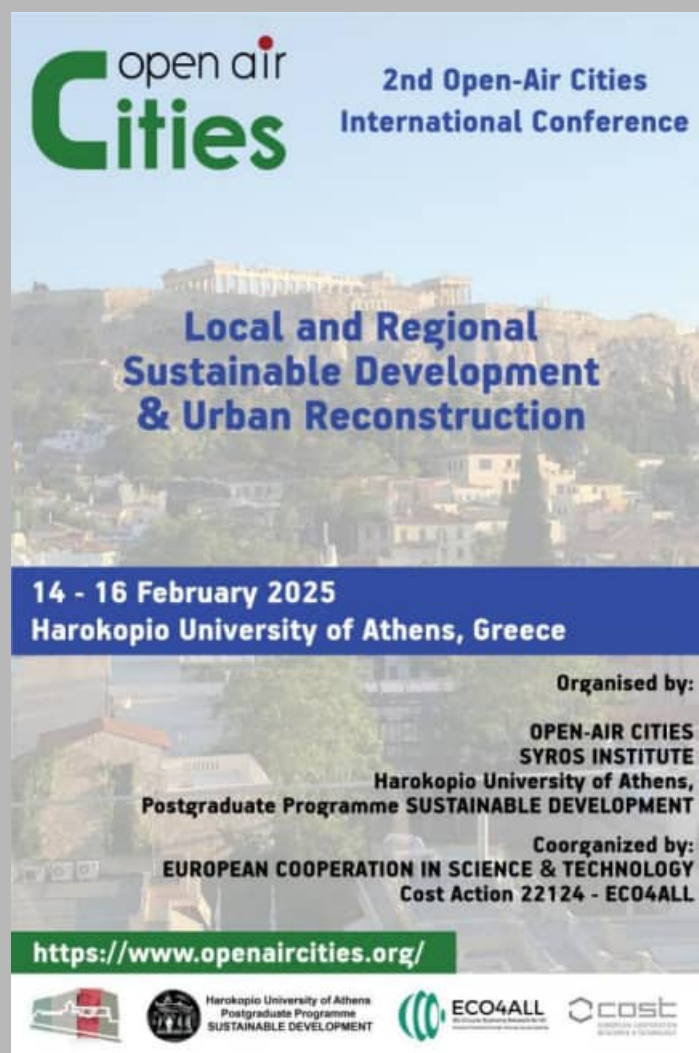


# 2<sup>nd</sup> OPEN-AIR CITIES INTERNATIONAL CONFERENCE “LOCAL AND REGIONAL SUSTAINABLE DEVELOPMENT AND URBAN RECONSTRUCTION”

## Proceedings



open air  
**Cities**

Athens, 2025

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*2nd Open-Air Cities International Conference “Local & Regional Sustainable Development and Urban Reconstruction”, Harokopio University of Athens, February 14-16, 2025*

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## WELCOME INTRODUCTION

Dear Invited guests, Colleagues and Students,

On behalf of the Scientific and Organizing Committee, we welcome you to the 2nd OPEN-AIR CITIES International Conference, organized by Open-Air Cities, HAROKOPIO UNIVERSITY of Athens - Postgraduate Programme "Sustainable Development", SYROS INSTITUTE and in co-organization with the EUROPEAN COOPERATION IN SCIENCE & TECHNOLOGY, Cost Action ECO4ALL.

This conference aims to present and disseminate research results related to the Sustainable Development of cities and regions at a global level.

The main subject is the presentation of relevant research in the field of Sustainable Development.

The conference is organized and structured on the four main pillars of Sustainable Development, which in fact are also the main pillars of Urban and Regional Development: Environment, Economy, Society and Culture. Each of these pillars includes its subcategories, which are detailed through the thematic sections related to the 17 Global Goals of Sustainable Development.

The conference brings together many distinguished researchers of Local and Regional Sustainable Development and Urban Reconstruction from many countries all over the world. Participants have the opportunity to present new research, exchange information, and discuss current issues.

The papers that will be presented at the conference have the possibility to be published in the international journal *Sustainable Development, Culture, Traditions Journal* ([www.sdct-journal.com](http://www.sdct-journal.com)) (ISSN: 2241-4010), after their final submission to the journal.

I would like to warmly thank the Ambassador of the Republic of Austria, Mrs. Vogl Gerda, who has done us the honour of visiting Harokopio University and welcoming this conference.

I would also like to extend particular thanks to the conference Keynote speakers: Joseph Stefanou, Konstantinos Moraitis, Olesea Plotnic, George Kremlis, Josep-Maria Arauzo-Carod, Georgios Panetsos, Kalliopi Radoglou, Minas Angelidis, Konstantinos Lalenis, Constantina Kottaridi, Alcestis Rodi, Aspa Gospidini and Luca Salvati.

Also, I would like to thank all the participants, as well as all the colleagues who have prepared the very interesting sessions you will attend at the conference.

I sincerely hope that all participants gain valuable scientific knowledge and find the 2nd OPEN-AIR CITIES International Conference an enjoyable and fulfilling experience.



### **Chair of the Organizing & Scientific Committees**

#### **Roido Mitoula**

*Dean, School of Environment, Geography and Applied Economics,  
HAROKOPIO UNIVERSITY OF ATHENS*

*Professor, “Local and Regional Development - Urban  
Reconstruction”*

*Director, Postgraduate Programme "Sustainable Development"*

*Department of Economics and Sustainable Development*

*Member of Syros Institute*

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| AN IMPORTANT URBAN RESEARCH PROPOSAL:ADULT EDUCATION FOR SUSTAINABILITY IN THE CONTEMPORARY URBAN LANDSCAPE: THE MEANING OF LIFELONG ACTION THROUGH SUSTAINABLE URBAN COMMUNITIES (K02141)<br><b>Vallianatou-Voutsina Eleni</b>                     | <b>462</b> |
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| APPLY THE PRINCIPLES OF CIRCULAR ECONOMY AND INDUSTRIAL SYMBIOSIS ON THE PRODUCTION SECTORS OF CYPRUS: THE BENEFITS FOR CONSUMERS( <a href="#">K02035</a> )<br><b>Kyriakidis Andreas, Michopoulos Apostolos</b>                                                                           | <b>553</b> |
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| DECODING EUROPE’S ‘RENOVATION WAVE’ ENERGY STRATEGY: REAL ESTATE SHIFTS FOR SUSTAINABLE CITIES ( <a href="#">K02055</a> )<br><b>Vardopoulos Ioannis, Poli Maria</b>                                                                                                                       | <b>611</b> |
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| CONSUMER PERCEPTIONS TOWARD THE USE OF BIOMETHANE - SURVEY RESULTS FROM 11 EUROPEAN COUNTRIES ( <a href="#">K02130</a> )<br><b>Karytsas Spyridon, Christou Myrsini</b>                                                                                                                    | <b>614</b> |
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| COGNITIVE BACKGROUND OF THE RELATIONSHIP BETWEEN AUTONOMOUS VEHICLES AND SUSTAINABLE MOBILITY: A CASE STUDY OF GREEK DRIVERS (K02059)<br><b>Kanellopoulos Panagiotis</b>                                                                     | <b>632</b> |
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| CULTURAL ENTREPRENEURSHIP AND SUSTAINABLE DEVELOPMENT IN LEMNOS (K02094)<br><b>Maniou Fotini</b>                                                                                                                                             | <b>661</b> |
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| RELIGIOUS FESTIVALS AND CULTURAL ENTREPRENEURSHIP IN THE MONASTERIES OF LESVOS FROM THE TIME OF THE TRAVELLERS TO THE PRESENT DAY (K02175)<br><b>Trikalitis Kostas, Maniou Fotini, Tsatalmpasoglou Anna-Irini, Manola Maria</b>              | <b>715</b> |
| Pre-organised Special Session:<br><b>“Sustainable Development, Social Sustainability and Social Policy: trends, transformations and rising challenges”</b> Organised and chaired by <b>Prof Nikos Papadakis &amp; Dr Stelios Tzagkarakis</b> | <b>716</b> |
| MEGATRENDS, THE NEW EUROPEAN STRATEGY ON SUSTAINABLE DEVELOPMENT AND THE ROLE OF EDUCATION, EMPLOYMENT AND RESKILLING IN SOCIAL SUSTAINABILITY (K02028)<br><b>Papadakis Nikos, Drakaki Maria</b>                                             | <b>718</b> |
| THE MIGRATION-REFUGEE CRISIS AS AN ‘ASYMMETRICAL THREAT’ IN THE MEDITERRANEAN REGION: FIELD RESEARCH (K02047)<br><b>Vlachadi Maria, Tsoumpekas Dimitrios</b>                                                                                 | <b>732</b> |
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| FOSTERING TOURISM WHILE NEUTRALIZING CULTURAL HERITAGE. THE PARADOXAL URBAN DEVELOPMENT OF TIRANE (ALBANIA). (K02193)<br><b>Fiano Francesca Romana, Vatnikaj Sidorela</b>                                                                | <b>863</b>  |
| SUSTAINABLE CULTURAL TOURISM IN THE GREEK ISLANDS. CASE STUDY: THE ISLAND OF SANTORINI (K02036)<br><b>Kriga Mimika (Dimitra)</b>                                                                                                         | <b>864</b>  |
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| CONTEMPORARY PHOTOGRAPHIC NARRATIVES AS AN EDUCATIONAL TOOL FOR THE DEVELOPMENT OF RELIGIOUS TOURISM IN GREEK URBAN AND REGIONAL AREAS (K02062)<br><b>Tsilimpokou Vasiliki, Vlassas Vasileios, KoronaiouAikaterini, VlassasGrigorios</b> | <b>895</b>  |
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| <p style="text-align: center;">Pre-organised Special Session:<br/>“Sustainable urban development”<br/>Organised and chaired by <b>Prof Rodi Alcestis &amp; Chatzidimitriou Angeliki</b></p>                                              | <b>936</b>  |
| INDUSTRIAL DOMAINS AS FUTURE’S RUINS: CHALLENGES AND STRATEGIES FOR SUSTAINABLE TRANSFORMATION(K02232)<br><b>Pikramenou Ourania</b>                                                                                                      | <b>937</b>  |
| THE 'GREEN' DIMENSION OF THE 15-MINUTE CITY. THE CASE STUDY OF ATHENS MUNICIPALITY, GREECE. (K02236)<br><b>Geronta Eirini Chrysovalanto</b>                                                                                              | <b>946</b>  |
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| READINGS OF THE NATURAL AND BUILT LANDSCAPE OF LAKE TRICHONIDA - A GUIDE TO DESIGN INTERVENTIONS BASED ON POINTS OF INTERFACE (Thesis project) (K02263)<br><b>Bovolou Eirini</b>                                                         | <b>1016</b> |
| A LITERATURE REVIEW ON THE INTRODUCTION AND FUTURE DOMINANCE OF THE AUTONOMOUS VEHICLES IN THE CITY WITH THE AIM OF PREPARING THE CITY FOR THE FUTURE (K02265)<br><b>Petri G. Ioanna, Rodi Alcestis</b>                                  | <b>1017</b> |

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| LIVING TOGETHER: AN EXPLORATION OF CO-LIVING FROM THE NEOLITHIC ERA TO THE 21 <sup>ST</sup> CENTURY (K02264)<br><b>Koutsogiannopoulou Angeliki Panagiota</b>                                                                                       | <b>1050</b> |
| <b>Session:</b><br><b>“Smart Cities and Sustainable Development”</b>                                                                                                                                                                               | <b>1069</b> |
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| A REVIEW OF SMART CITIES’ TECHNOLOGIES IN THE GOVERNANCE AND THE EVERYDAY LIFE OF CITIZENS IN GREEK CITIES (K02079)<br><b>Zompos Kostas, Chasiotis Angelos, PiromalisDimitris</b>                                                                  | <b>1086</b> |
| VIRTUAL WORLDS AND SUSTAINABLE ARCHITECTURE: NEW PATHWAYS TO SUSTAINABILITY IN THE ERA OF THE INDUSTRY 4.0 (K02101)<br><b>Kalemis Alexandros</b>                                                                                                   | <b>1088</b> |
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| CO-CREATING PLACE IDENTITY: PARTICIPATORY WORKSHOPS FOR PLACE BRANDING ALIGNED WITH LOCAL VALUES (K02135)<br><b>Apostolou Angelina, Birou - Athanasiou Vasiliki, Chatzigiannidou Alkisti, Katsavounidou Garyfallia, Kourti Paraskevi</b>           | <b>1126</b> |
| CULTURE AND SUSTAINABLE DEVELOPMENT OF CITIES: THE PHYSIOGNOMY OF THE CITY OF LAGKADAS (K02095)<br><b>Athanasaki Marina</b>                                                                                                                        | <b>1147</b> |
| THE FORMATION OF THE PHYSIOGNOMY OF THE ISLAND OF ZAKYNTHOS - THE OPINION OF RESIDENTS AND VISITORS (K02061)<br><b>Papadopoulos Joseph</b>                                                                                                         | <b>1148</b> |
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| AN ONLINE PLATFORM FOR ENABLING OPEN DATA COLLECTION, STORAGE, ANALYSIS AND CLASSIFICATION OF WATER MANAGEMENT DATA FOR THE ATTICA REGION IN GREECE (K02045)<br><b>Antoniadis Ioannis, Drakou Evangelia, Tsadimas Anargyros, Kousiouris George</b> | <b>1162</b> |

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| THE ROLE OF NEW TECHNOLOGY INTO FIGHTING AGAINST POVERTY AND SOCIAL ALIENATION. STUDYING THE INNOVATIVE DIGITAL PLATFORM USE WITHIN THE REGION OF CRETE ( <a href="#">K02097</a> )<br><b>Spyridaki Aikaterini, Papadakaki Maria, Vassilakis Kostas, Markakis George</b>                            | <b>1200</b> |
| THE DESIGN AND DEVELOPMENT OF A MOBILE APPLICATION FOR SUSTAINABLE INTERACTION WITH CULTURAL HERITAGE: THE ‘THESSALONIKI REIMAGINED’ PROJECT ( <a href="#">K02139</a> )<br><b>Dialehti Anthi</b>                                                                                                   | <b>1212</b> |
| RECONNECTING MYSTRAS: LINKING ARTIFACTS TO HISTORY THROUGH DIGITAL NARRATIVES ( <a href="#">K02235</a> )<br><b>Panagiotidis V. Vayia, Georgakopoulou Garyfalia</b>                                                                                                                                 | <b>1213</b> |
| CREATION OF A DEVELOPMENT RIGHTS MANAGEMENT MECHANISM USING BLOCKCHAIN TECHNOLOGY ( <a href="#">K02194</a> )<br><b>Christodoulou Dimitrios</b>                                                                                                                                                     | <b>1214</b> |
| INFORMATION LITERACY FOR CULTIVATING SUSTAINABLE MINDSET ( <a href="#">K02068</a> )<br><b>Katsira Georgia, Koulouris Alexandros, Vraimaki Eftichia, Efthymiou Foteini</b>                                                                                                                          | <b>1232</b> |
| <u>Session:</u><br><b>“Urban Environment and Sustainability”</b>                                                                                                                                                                                                                                   | <b>1245</b> |
| ASSESSMENT OF THE EFFECT OF GREEN ROOFS ON URBAN STORMWATER MANAGEMENT IN THESSALONIKI, GREECE ( <a href="#">K02110</a> )<br><b>Almazidou-Kairi Ioanna-Viktoria, Salasidou Elissavet, Kapouniari Maria, Zafeirakou Antigoni</b>                                                                    | <b>1246</b> |
| ACHIEVING URBAN SUSTAINABILITY THROUGH CIRCULARITY: THEORIES AND PRACTICES ( <a href="#">K02075</a> )<br><b>Stogianovits Matei</b>                                                                                                                                                                 | <b>1247</b> |
| Km Vert (Green Kilometer project)SYSTEM FOR URBAN REGENERATION ( <a href="#">K02171</a> )<br><b>Marcuccetti Andrea</b>                                                                                                                                                                             | <b>1248</b> |
| THE MULTIFUNCTIONAL ROLE OF BOTANICAL GARDENS FOR THE SUSTAINABLE DEVELOPMENT OF CITIES: AN URBAN RENEWAL STUDY WITH THE CREATION OF AN ARBORETUM AT THE UNIVERSITY OF THESSALY IN KARDITSA, GREECE ( <a href="#">K02137</a> )<br><b>Eleftheriou Vasilis, Samaras Dimitrios, Skarvelis Michail</b> | <b>1259</b> |
| <u>Session:</u><br><b>“Industry, Services and Sustainability”</b>                                                                                                                                                                                                                                  | <b>1261</b> |
| INTEGRATING SUPPLY CHAIN PRACTICES TO MITIGATE CIRCULAR ECONOMY RISKS: A QUALITATIVE STUDY OF THE GREEK FURNITURE SECTOR ( <a href="#">K02066</a> )<br><b>Ntio Despoina, Adamopoulos Antonios, Kotsas Stamatios</b>                                                                                | <b>1262</b> |
| FROM QUANTITATIVE TO QUALITATIVE SERVICES: HOW TO PROMOTE INTEGRATED PLANNING FOR THE REVISION OF THE SERVICE PLAN OF MANTUA, MUNICIPALITY IN ITALY ( <a href="#">K02179</a> )<br><b>Borini Martina</b>                                                                                            | <b>1271</b> |

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| SUSTAINABLE DEVELOPMENT AND THE GREEK PHARMACEUTICAL INDUSTRY (K02117)<br><b>Charitou Aikaterina</b>                                                                                                                                                                                  | <b>1293</b> |
| INDUSTRIAL SYMBIOSIS - SITUATION IN MAURITIUS (K02138)<br><b>Erceg Aleksandar, Sannegadu Rajesh</b>                                                                                                                                                                                   | <b>1308</b> |
| <u>Session:</u><br><b>“Urban and Regional Sustainable Development”</b>                                                                                                                                                                                                                | <b>1326</b> |
| COGNITIVE URBAN MAPS AS A BINDING ELEMENT OF LOCAL IDENTITY(K02092)<br><b>Kalergis Dimitris</b>                                                                                                                                                                                       | <b>1328</b> |
| ISSUES OF DEATH AND ECOLOGY: RECONSIDERING THE ROLE OF FUTURE CEMETERIES IN THE CITY(K02099)<br><b>Nikolaïdi Galini, Lountzis Georgios Dionysios</b>                                                                                                                                  | <b>1350</b> |
| WITH THE GAZE OF PLACE-MULTIFUNCTIONAL COMPLEX IN DORIDA (K02076)<br><b>Apostolatos Eleni</b>                                                                                                                                                                                         | <b>1351</b> |
| MOVING FROM LOCALITY TO LOCABILITY TOWARDS SUSTAINABLE PLACE BRANDING (K02172)<br><b>Briana Maria, Malindretos George</b>                                                                                                                                                             | <b>1365</b> |
| ANCIENT HARBOR OF LECHAION: REDEFINING THE PLACE(K02096)<br><b>Nikolaou Dimitra, SakkiAthina, Skoupa Anastasia-Alexandra</b>                                                                                                                                                          | <b>1366</b> |
| A SPATIAL ANALYSIS OF URBAN POVERTY:THE CASE OF KUSTEPE NEIGHBORHOOD (K02049)<br><b>Gözde Arzu Sarıcan, Elifsu Şahin, N.Hülya Berkmen</b>                                                                                                                                             | <b>1367</b> |
| <u>Session:</u><br><b>“Tourism, Culture and Sustainable Development of Places”</b>                                                                                                                                                                                                    | <b>1368</b> |
| SUSTAINABILITY AND CULTURAL HERITAGE: AXIOM OR OXYMORON?(K02180)<br><b>Imbesi Paola Nicoletta</b>                                                                                                                                                                                     | <b>1369</b> |
| THE EUROPEAN CITIES:CULTURAL CHANGE FOR SUSTAINABLE CITY SPACES (K02152)<br><b>Mickov Biljana</b>                                                                                                                                                                                     | <b>1382</b> |
| THE IMPACT OF HERITAGE-LED URBAN REGENERATION ON DESTINATION IDENTITY AND DESTINATION MARKETING; STAKEHOLDERS’ PERSPECTIVE; THE CASE OF THE TOBACCO WAREHOUSE IN KAVALA. (K02030)<br><b>Fragkoudi Vasiliki (Vicky), Gkritzali Alkmini, Manolitzas Panagiotis, Sarantakou Efthymia</b> | <b>1383</b> |
| ASSESSING THE FEASIBILITY OF PARTICIPATORY GOVERNANCE IN SUSTAINABLE TOURISM: CASE STUDY, SYROS (K02046)<br><b>Tsimpoulis Georgios</b>                                                                                                                                                | <b>1384</b> |
| THE ECONOMIC, SOCIAL AND ENVIRONMENTAL IMPACT OF SPORTS TO TOURISM IN THE CASE OF GREECE (K02178)<br><b>Panagiotopoulos Panagiotis</b>                                                                                                                                                | <b>1400</b> |
| DEVELOPMENT OF ALTERNATIVE FORMS OF TOURISM IN THE ISLAND REGION OF THE MUNICIPALITY OF WEST SAMOS (K02134)<br><b>Lepenioti Despoina-Dimitra</b>                                                                                                                                      | <b>1416</b> |
| THE FORMATION OF THE PHYSIOGNOMY OF THE CITY OF NAFPAKTOS (K02266)<br><b>Oikonomou Konstantina</b>                                                                                                                                                                                    | <b>1417</b> |
| <u>Pre-organised Special Session:</u><br><b>“Cities Physiognomy”</b><br>Organised and chaired by <b>Joseph Stefanou &amp; Roido Mitoula</b>                                                                                                                                           | <b>1418</b> |

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| THE FORMATION OF THE PHYSIOGNOMY OF THE ISLAND OF HERAKLIO. THE OPINION OF RESIDENTS AND VISITORS. (K02040)<br><b>Michelaki Eleftheria</b>                                                                               | <b>1419</b> |
| THE FORMATION OF THE PHYSIOGNOMY OF THE CITY OF IOANNINA - THE OPINION OF RESIDENTS AND VISITORS (K02098)<br><b>Spachos Triantafyllos</b>                                                                                | <b>1435</b> |
| THE FORMATION OF THE PHYSIOGNOMY OF THE CITY OF MONEMVASIA - THE OPINION OF RESIDENTS AND VISITORS (K02111)<br><b>Alpa Natalia-Maria</b>                                                                                 | <b>1436</b> |
| THE FORMATION OF THE PHYSIOGNOMY OF THE CITY OF VOLOS - THE OPINION OF RESIDENTS AND VISITORS (K02127)<br><b>Vasilakou Eftychia</b>                                                                                      | <b>1442</b> |
| ENVIRONMENTAL PROFILE A REGION KARDITSA (K02122)<br><b>Velagia Maria</b>                                                                                                                                                 | <b>1469</b> |
| <u>Session:</u><br><b>“Entrepreneurship and Local Sustainability- ESG Criteria”</b>                                                                                                                                      | <b>1470</b> |
| THE APPLICATION AND EFFECTIVENESS OF ESG CRITERIA IN GREEK COMPANIES (K02090)<br><b>Kani Anastasia-Theodora, Karametou Panagiota, Mitoula Roido, Economou Agisilaos</b>                                                  | <b>1471</b> |
| THE EFFECT OF ESG CRITERIA ON CONSUMER PREFERENCES REGARDING THE CHOICE OF A COMPANY’S PRODUCTS AND SERVICES (K02108)<br><b>Christofilis Konstantinos, Karametou Panagiota, Mitoula Roido, Sdrali Despina</b>            | <b>1472</b> |
| SUSTAINABLE DEVELOPMENT AND ENTREPRENEURSHIP IN MOUNTAIN COMMUNITIES. METSOVO CASE STUDY (K02143)<br><b>Karagiannis George</b>                                                                                           | <b>1487</b> |
| <u>Session:</u><br><b>“Urban Regeneration and Environment”</b>                                                                                                                                                           | <b>1488</b> |
| THE IMPACT OF ENVIRONMENTAL EDUCATION ON SUSTAINABLE DEVELOPMENT, ENVIRONMENTAL CONSCIOUSNESS AND PRO-ENVIRONMENTAL BEHAVIOUR (K02038)<br><b>Nastos Georgios, Mitoula Roido, Theodoropoulou Eleni, Astara Olga-Eleni</b> | <b>1489</b> |
| THE ‘ELLINIKON’ RENOVATION PROJECT: BALANCING ECONOMIC DEVELOPMENT AND SOCIAL EQUITY IN ATHENS (K02118)<br><b>Karametou Panagiota, Mitoula Roido, Papavasileiou Angelos, Tsimpoulis Georgios</b>                         | <b>1490</b> |
| THE USE OF NEW TECHNOLOGIES IN THE PRIMARY PRODUCTION SECTOR (K02149)<br><b>Petridis Dimitris, Mitoula Roido, Kalantonis Petros, Astara Olga-Eleni</b>                                                                   | <b>1507</b> |
| SUSTAINABLE DEVELOPMENT, HUMAN HEALTH AND QUALITY OF LIFE - CASE STUDY: REGIONAL UNIT OF PIRAEUS, GREECE (K02081)<br><b>Maria Derventi, Roido Mitoula, Eleni Theodoropoulou, Vilelmini Karagianni</b>                    | <b>1508</b> |
| CONTRIBUTION OF URBAN REGENERATION TO SUSTAINABLE DEVELOPMENT: THE CASE OF PIRAEUS (K02085)<br><b>Tsiare Kolliopoulou Thaleia Eleni, Mitoula Roido, Economou Agisilaos, Karametou Panagiota</b>                          | <b>1509</b> |
| IDENTIFICATION OF BOUNDARIES OF MEASUREMENTS FOR CITY ENVIRONMENTAL QUALITY (K02024)<br><b>Hasni Gayathma Gunasekara, K. K. K. Sylva, T. D. S. V. Dias</b>                                                               | <b>1524</b> |
| FROM WASTE MANAGEMENT TO CIRCULAR ECONOMY? THE ROLE OF ENVIRONMENTAL CONFLICTS IN POLICY MAKING IN ATTICA REGION (K02174)<br><b>Kolokouris Orestes</b>                                                                   | <b>1525</b> |



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| THE HUMAN SIDE OF SUSTAINABILITY: THE ROLE OF LEADERSHIP IN EMPLOYEE WELLBEING ( <a href="#">K02091</a> )<br><b>Dologlou Maria, Mitoula Roido</b>                                                                                                         | <b>1526</b> |
| Pre-organised Special Session:<br><b>“ECO4ALL FOR CONSUMER PROTECTION THROUGH CIRCULAR ECONOMY STRATEGIES - THE CONTRIBUTION TO SUSTAINABLE DEVELOPMENT”</b> Organised by <b>Prof Plotnic Olesea</b><br>(COST ACTION 22124 ECO4ALL)                       | <b>1531</b> |
| CIRCULAR ECONOMY AND SUSTAINABLE CONSUMPTION AS LEVERAGE FOR GREEN GROWTH AND CONSUMER PROTECTION ( <a href="#">K02150</a> )<br><b>Radukic Snezana, Stankovic Zorana, Sakıcı Şehnaz, Yaprak Burak, Avdullahi Ajtene, Dionizi Brikene, Espinosa Nieves</b> | <b>1532</b> |
| CIRCULAR ECONOMY: CONNECTING INDUSTRY WITH SOCIETY ( <a href="#">K02200</a> )<br><b>Gama Nuno</b>                                                                                                                                                         | <b>1548</b> |
| OVERCOMING THE BARRIERS TO CIRCULAR ECONOMY PRACTICES IN DIFFERENT REGIONS: THE CASE OF TURKEY ( <a href="#">K02202</a> )<br><b>Karabulut Yasemin</b>                                                                                                     | <b>1549</b> |
| FOSTERING CIRCULAR ECONOMY PRACTICES IN ALBANIAN PUBLIC UNIVERSITIES: A PATHWAY TO SUSTAINABLE DEVELOPMENT ( <a href="#">K02204</a> )<br><b>Idrizi Altin</b>                                                                                              | <b>1550</b> |
| ANALYSIS OF POLICY FRAMEWORKS RELATED TO CIRCULAR ECONOMY IMPACT IN AGRICULTURE, ALBANIAN CASE ( <a href="#">K02206</a> )<br><b>Gecaj Merita</b>                                                                                                          | <b>1551</b> |
| THE ROLE OF RENEWABLE ENERGY IN SHAPING INCOME (IN)EQUALITY DYNAMICS IN SOUTHEAST EUROPEAN COUNTRIES ( <a href="#">K02207</a> )<br><b>Kalaj Ermira</b>                                                                                                    | <b>1557</b> |
| AN EXAMINATION OF ZERO WASTE MANAGEMENT IN UNIVERSITIES IN THE CONTEXT OF CIRCULAR ECONOMY: A CASE STUDY OF DUZCE UNIVERSITY ( <a href="#">K02208</a> )<br><b>Gultekin Pinar</b>                                                                          | <b>1558</b> |
| BIBLIOMETRIC ANALYSIS OF ACADEMIC STUDIES PUBLISHED ON CIRCULAR ECONOMY IN TURKEY ( <a href="#">K02209</a> )<br><b>Gültekin Yaşar Selman</b>                                                                                                              | <b>1559</b> |
| INTEGRATING CIRCULAR ECONOMY INTO SUSTAINABLE DEVELOPMENT GOALS: INSIGHTS FROM LIFE CYCLE IMPACT ASSESSMENT ( <a href="#">K02211</a> )<br><b>Rajic Milena</b>                                                                                             | <b>1560</b> |
| SMART CITIES AS DRIVERS OF TWIN TRANSITION - EVIDENCE FROM THE REPUBLIC OF SERBIA( <a href="#">K02212</a> )<br><b>Simonida Vukadinovic, Jelena Jesic, Jovana Kisin</b>                                                                                    | <b>1561</b> |
| FROM POLICY TO PRACTICE: EXAMINING THE AGENCY-DRIVEN DYNAMICS OF TURKEY’S ZERO WASTE MOVEMENT AND ITS IMPACT ON RECYCLING ( <a href="#">K02213</a> )<br><b>Ates Seyithan</b>                                                                              | <b>1562</b> |
| WASTE MANAGEMENT PRACTICES IN TURKEY PAST AND PRESENT ( <a href="#">K02220</a> )<br><b>Kafadar Muhammed Halid</b>                                                                                                                                         | <b>1563</b> |
| CIRCULAR ECONOMY APPLICATIONS WITHIN THE FRAMEWORK OF SUSTAINABILITY IN TURKEY ( <a href="#">K02221</a> )<br><b>Acma Bulent</b>                                                                                                                           | <b>1564</b> |
| ENHANCING SUSTAINABILITY WITH CIRCULAR ECONOMY PRACTICES: MULTI-CRITERIA SOLUTIONS ( <a href="#">K02222</a> )<br><b>João Zambujal-Oliveira</b>                                                                                                            | <b>1565</b> |

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| THE ROLE OF EDUCATION IN SUSTAINABLE CONSUMPTION AWARENESS AMONG ALBANIAN STUDENTS ( <a href="#">K02223</a> )<br><b>Sula Olliana</b>                                                                                                                        | <b>1566</b> |
| FOSTERING CROSS-BORDER COOPERATION BETWEEN NORTH MACEDONIA AND GREECE FOR CIRCULAR ECONOMY SUCCESS: A MODEL FOR REGIONAL SUSTAINABILITY ( <a href="#">K02233</a> )<br><b>Bojkovska Katerina, Stojkovski Viktorija, Pelivanoska-Dameska Daniela</b>          | <b>1567</b> |
| IMPLEMENTATION OF THE GLOBAL GATEWAY STRATEGY THROUGH THE NEW EU CIRCULAR ECONOMY RESOURCE CENTRE ( <a href="#">K02102</a> )<br><b>Khachikyan Sos, Sakici Şehnaz, Cunha Carlos, Yaprak Burak, Rajic Milena</b>                                              | <b>1568</b> |
| CIRCULAR ECONOMY STRATEGIES FOR SUSTAINABLE RESOURCE MANAGEMENT IN THE CONSTRUCTION INDUSTRY ( <a href="#">K02198</a> )<br><b>Petrovski Aleksandar</b>                                                                                                      | <b>1581</b> |
| MANAGING AGRICULTURAL LAND AND LANDSCAPE IN THE ISLANDS: CHALLENGES AND STRATEGIES ( <a href="#">K02042</a> )<br><b>Vlahos George, Pavlis Evangelos</b>                                                                                                     | <b>1594</b> |
| CARBON FARMING IN FORESTRY AND CARBON STORAGE IN WOOD PRODUCTS. THE NEW CERTIFICATION FRAMEWORK AND THE POTENTIALS FOR THE RELATED MARKETS ( <a href="#">K02252</a> )<br><b>Trigkas Marios, Charitos Evangelos, Karagouni Glykeria, Karageorgos Anthony</b> | <b>1603</b> |
| <b>CITATION GUIDELINES</b>                                                                                                                                                                                                                                  | <b>1615</b> |

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## PROCEEDINGS

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## PROCEEDINGS

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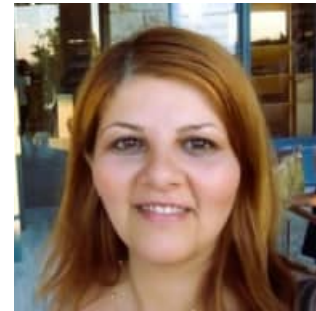
## PROCEEDINGS

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## CONCISE CONFERENCE PROGRAMME

### Day 1 - Friday 14/02/2025

|             |                                                                                                                                                                                                                                                                                                                                                                   |
|-------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 90:00-10:00 | Registration (Harokopio University)<br>( <a href="#">main building</a> )                                                                                                                                                                                                                                                                                          |
| 10.00-10.30 | OPENING CEREMONY<br>( <a href="#">Amphitheater: Georgios Karabatzos</a> ) ( <a href="#">main building</a> )                                                                                                                                                                                                                                                       |
| 10.30-13.00 | Keynote Speeches<br>( <a href="#">Amphitheater: Georgios Karabatzos</a> ) ( <a href="#">main building</a> )                                                                                                                                                                                                                                                       |
| 13.00-14.30 | Conference Lunch - Finger Food                                                                                                                                                                                                                                                                                                                                    |
| 14.30-17.30 | Keynote Speeches<br>( <a href="#">Amphitheater: Georgios Karabatzos</a> ) ( <a href="#">main building</a> )                                                                                                                                                                                                                                                       |
| 17.30-18.00 | Coffee Break                                                                                                                                                                                                                                                                                                                                                      |
| 18.00-20.00 | <b>Session 2:</b> “Forestry and forest-based wood products: Discussing their role for sustainability and climate neutrality at local, regional and global scale” Organised by Department of Forestry, Wood Sciences and Desing, Chaired by <i>Prof Georgios Ntalos</i><br>( <a href="#">Amphitheater: Georgios Karabatzos</a> ) ( <a href="#">main building</a> ) |
| 18.00-20.00 | <b>Session 3:</b> “Culture and sustainable urban development of the city”. Organised and chaired by <i>Antonis Papagiannidis</i> (Greek Language)<br>( <a href="#">Senate Hall</a> ) ( <a href="#">main building</a> )                                                                                                                                            |
| 16.30-20.00 | <b>Session 4:</b> “Cultural Sustainability in Praxis: Digital Transformation and Green Innovation”, Organised and chaired by <i>Dr Bokolas Vassilis</i> and <i>Prof Colantoni Andrea</i><br>( <a href="#">Ceremony Hall</a> ) ( <a href="#">New Library Building</a> )                                                                                            |
| 18.00-20.00 | <b>Session 5:</b> “Cultural Heritage and Sustainable Development of Places and Cities” Chaired by <i>Prof Polychronopoulos Dimitris</i><br>( <a href="#">Room A1</a> ) ( <a href="#">main building</a> )                                                                                                                                                          |
| 18.00-20.00 | <b>Session 6:</b> “Sustainable Urban Public Space” Chaired by <i>Prof Angelidou Margarita</i><br>( <a href="#">Room A2</a> ) ( <a href="#">main building</a> )                                                                                                                                                                                                    |
| 18.00-20.00 | <b>Session 7:</b> “Urban Regeneration”, Chaired by <i>Prof Lava Riva</i><br>( <a href="#">Room A5</a> ) ( <a href="#">main building</a> )                                                                                                                                                                                                                         |
| 18.00-20.00 | <b>Session 8:</b> “Circular Economy and Sustainable Development” Chaired by <i>Prof Dzintra Atstāja</i><br>( <a href="#">Room A6</a> ) ( <a href="#">main building</a> )                                                                                                                                                                                          |

### Day 2 - Saturday 15/02/2025

|             |                                                                                                                                                                                                                                        |
|-------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 09.00-11.00 | <b>Session 9:</b> “Natural Disasters, Resilience and Sustainable Development of Places and Cities”, Chaired by <i>Dr Economou Agisilaos</i><br>( <a href="#">Amphitheater: Georgios Karabatzos</a> ) ( <a href="#">main building</a> ) |
| 11.00-11.30 | Coffee Break                                                                                                                                                                                                                           |

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| 11.30-12.00 | <b>Keynote Speech</b><br>(Amphitheater: Georgios Karabatzos) (main building)                                                                                                                                                                                     |
| 12.00-14.00 | <b>Session 10:</b> “Landscape and Urban Sustainability: discussing the natural and socio-cultural factors, in a positive or negative mood”, Organised and chaired by <i>Prof Konstantinos Moraitis</i><br>(Amphitheater: Georgios Karabatzos) (main building)    |
| 14.00-15.00 | Conference Lunch - Finger Food                                                                                                                                                                                                                                   |
| 09.00-12.45 | <b>Session 11:</b> “ECO4ALL FOR CONSUMER PROTECTION THROUGH CIRCULAR ECONOMY STRATEGIES - THE CONTRIBUTION TO SUSTAINABLE DEVELOPMENT” Organised and chaired by <i>Prof Plotnic Olesea</i> (COST ACTION 22124 ECO4ALL)<br>(Ceremony Hall) (New Library Building) |
| 11.00-11.30 | Coffee Break                                                                                                                                                                                                                                                     |
| 13.00-14.15 | <b>Session 12:</b> “Climate Change”, Chaired by <i>Dr Chatzigrigoriou Pavlos</i><br>(Ceremony Hall) (New Library Building)                                                                                                                                       |
| 14.15-15.00 | Conference Lunch - Finger Food                                                                                                                                                                                                                                   |
| 09.00-11.00 | <b>Session 13:</b> “Energy Management and Sustainable Mobility”<br>Chaired by <i>Prof Aspa Gospodini</i><br>(Room A1) (main building)                                                                                                                            |
| 11.00-11.30 | Coffee Break                                                                                                                                                                                                                                                     |
| 11.30-12.00 | <b>Session 14:</b> “Cultural Routes and Sustainable Development”<br>Organised and chaired by <i>Assoc Prof Maria Manola &amp; Argyros Leonidas</i><br>(Room A1) (main building)                                                                                  |
| 13.15-14.00 | <b>Session 15:</b> “Sustainable Development, Social Sustainability and Social Policy: trends, transformations and rising challenges” Organised and chaired by <i>Prof Nikos Papadakis &amp; Dr Stelios Tzagkarakis</i><br>(Room A1) (main building)              |
| 14.00-15.00 | Conference Lunch - Finger Food                                                                                                                                                                                                                                   |
| 09.00-12.30 | <b>Session 16:</b> “Education and Sustainable Development”<br>Chaired by <i>Prof Peraboni Carlo</i><br>(Room A2) (main building)                                                                                                                                 |
| 11.00-11.30 | Coffee Break                                                                                                                                                                                                                                                     |
| 12.30-14.00 | <b>Session 17:</b> “Alternative Tourism and Sustainable Development”<br>Chaired by <i>Dr Vardopoulos Ioannis</i><br>(Room A2) (main building)                                                                                                                    |
| 14.00-15.00 | Conference Lunch - Finger Food                                                                                                                                                                                                                                   |
| 09.00-11.00 | <b>Session 18:</b> “Sustainable urban development”<br>Organised and chaired by <i>Prof Rodi Alcestis</i><br>(Room A4) (main building)                                                                                                                            |
| 11.00-11.30 | Coffee Break                                                                                                                                                                                                                                                     |
| 11.30-14.00 | <b>Session 19:</b> “Smart Cities and Sustainable Development”<br>Chaired by <i>Assoc Prof Konstantinidou Elena</i><br>(Room A4) (main building)                                                                                                                  |
| 09.00-09.30 | <b>Keynote Speech</b><br>(Room A5) (main building)                                                                                                                                                                                                               |
| 09.30-11.00 | <b>Session 20:</b> “The Physiognomy of cities”, Chaired by <i>Prof Joseph Stefanou</i><br>(Room A5) (main building)                                                                                                                                              |

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|-------------|----------------------------------------------------------------------------------------------------------------------------------------------------------|
| 11.00-11.30 | Coffee Break                                                                                                                                             |
| 11.30-14.00 | <b>Session 21:</b> “Digital Cities and Sustainable Development”<br>Chaired by <i>Assoc Prof Panetsos Georgios</i><br>(Room A5) (main building)           |
| 14.00-15.00 | Conference Lunch - Finger Food                                                                                                                           |
| 09.00-10.00 | <b>Session 22:</b> “Urban Environment and Sustainability”<br>Organised and chaired by <i>Prof Skarvelis Michail</i><br>(Room A6) (main building)         |
| 10.00-11.00 | <b>Session 23:</b> “Industry, Services and Sustainability”<br>Organised and chaired by <i>Prof Arauzo-Carod Josep-Maria</i><br>(Room A6) (main building) |
| 11.00-11.30 | Coffee Break                                                                                                                                             |
| 11.30-14.00 | <b>Session 24:</b> “Urban and Regional Sustainable Development”<br>Organised and chaired by <i>Prof Nikolaou Dimitra</i><br>(Room A6) (main building)    |
| 14.00-15.00 | Conference Lunch - Finger Food                                                                                                                           |

### Day 3 - Sunday 16/02/2025

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|-------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 09.00-10.30 | <b>Session 25:</b> “Tourism, Culture and Sustainable Development of Places” Chaired by <i>Olga-Eleni Astara</i> (online) <a href="https://meet.google.com/adr-trzz-gvv">https://meet.google.com/adr-trzz-gvv</a>                                                                                                                                |
| 10.30-12.00 | <b>Session 26:</b> “Cities Physiognomy”<br>Organised and chaired by <i>Joseph Stefanou &amp; Roido Mitoula</i> (online)<br><a href="https://meet.google.com/fqw-hmbv-pqp">https://meet.google.com/fqw-hmbv-pqp</a>                                                                                                                              |
| 12.00-13.00 | <b>Session 27:</b> “Entrepreneurship and Local Sustainability- ESG Criteria”<br>Chaired by <i>Panagiota Karametou</i> (online) <a href="https://meet.google.com/fqa-rcmd-adi">https://meet.google.com/fqa-rcmd-adi</a>                                                                                                                          |
| 13.00-14.45 | <b>Session 28:</b> “Urban Regeneration and Environment”,<br>Chaired by <i>Dr Papavasileiou Angelos</i> (online)<br><a href="https://meet.google.com/axo-bpym-zky">https://meet.google.com/axo-bpym-zky</a>                                                                                                                                      |
| 14.00-19.00 | <b>Session 29:</b> “ECO4ALL FOR CONSUMER PROTECTION THROUGH CIRCULAR ECONOMY STRATEGIES - THE CONTRIBUTION TO SUSTAINABLE DEVELOPMENT” Organised by <i>Prof Plotnic Olesia</i> (COST ACTION 22124 ECO4ALL) and chaired by <i>Mihaela Tofan</i> (online) <a href="https://meet.google.com/dbk-yiey-dnw">https://meet.google.com/dbk-yiey-dnw</a> |

Closing of the Conference

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## KEYNOTE SPEAKERS



**Moraitis Konstantinos**

*Professor, National Technical University of Athens*

**“Eros and the City: Make the Cultural Urban-Scale Flourish!”**



**Plotnic Olesea**

*Professor, Moldova State University*

**“Advancing Consumer Protection through the Circular Economy: Strategic Imperatives of Reduction, Reuse, and Repair”**

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**Arauzo-Carod Josep-Maria**

*Professor, Rovira i Virgili University (URV)*

**“What determines drivers and barriers of the implementation of Circular Economy measures at regional level?”**



**Gospodini Anastasia-Aspasia**

*Professor, University of Thessaly*

**“Building new places of creative economies; Renewal and re-use abandoned buildings as coworking buildings in Athens’ central districts”**

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**Panetsos A. Georhios**

Professor, University of Patras

**“Sustainable Architectural Creations in Historic Cities”**



**Salvati Luca**

*Professor, Sapienza University of Rome*

**“Demographic transitions, local economies and Metropolitan systems in-between sustainability and resilience”**

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**Kremlis George**

*Honorary Director of the European Commission*

*Member of the Board of Directors of the European Public Law Organisation and Director of its Circular economy and Climate Institute, as well as Ambassador of the EPLO to Bulgaria*

*Chair of the Bureau of the Espoo Convention & the SEA Protocol and of their MOPs*

**“Circular Economy as a driver of energy transition and carbon neutrality”**



**Rodi Alcestis**

*Associate Professor, University of Patras*

**“Origin and Future of the X-Minute City”**



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**Lalenis Konstantinos**

*Professor, University of Thessaly*

**“Democratic Theory, Urban Planning Ideology and Public Participation in the Era of Artificial Intelligence”**



**Radoglou Kalliopi**

*Professor, Democritus University of Thrace*

**“Urban and peri-urban forests. Their contribution to sustainable development”**

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**Angelidis Minas**

*Professor, National Technical University of Athens*

**“City overtourism versus economic, social and environmental sustainability”**



**Konstantinidou Elena**

*Associate Professor, National Technical University of Athens*

**“Architectural Composition and Cities Architectural Heritage”**

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**Constantina Kottaridi**

*Professor, University of Piraeus*

**“Circular Economy as a pillar for regional development”**



**Joseph Stefanou**

*Em. Professor, National Technical University of Athens*

**“Sustainable City Development”**

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## CONFERENCE SCHEDULE

### DAY 1 - Friday 14/02/2025

09:00-10:00 **Registration** (Harokopio University) (main building)  
10.00-10.30 Welcome introduction by **Prof. Roido Mitoula**, Dean, School of Environment, Geography and Applied Economics, Harokopio University of Athens, Head of Postgraduate Program “Sustainable Development”, Chair of the Organising & Scientific Committee

**Prof Dedoussis George**, Rector of Harokopio University of Athens  
**Vogl Gerda**, Ambassador of the Republic of Austria

**Prof Plotnic Olesea**, Head fo COST ACTION 22124 ECO4ALL  
**Dr Hatzigrigoriou Pavlos**, Head of Syros Institute  
**Assoc Prof Costarelli Vassiliki**, Head of the Deparrtment of Economics & Sustainable Development  
**Damatis Nikolaos**, EAEABIOM, General Secretary of the Board of Directors  
**Gialypsos Dimitris**, WATereco Irrigation and Water Supply

|                   | Keynote Speeches                                                                                                                                                                                       |
|-------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1.<br>10.30-17.30 | Chaired by Prof Sardanou Eleni & Prof Malindretos Georgios<br>(Amphitheater: Georgios Karabatzos) (main building)                                                                                      |
| 10:30-11:00       | EROS AND THE CITY: MAKE THE CULTURAL URBAN-SCAPE FLOURISH! (K02144)<br><b>Moraitis Konstantinos</b> , Professor Emeritus, National Technical University of Athens                                      |
| 11:00-11:30       | ADVANCING CONSUMER PROTECTION THROUGH THE CIRCULAR ECONOMY: STRATEGIC IMPERATIVES OF REDUCTION, REUSE, AND REPAIR (K02027)<br><b>Plotnic Olesea</b> , Professor, Moldova State University              |
| 11:30-12:00       | CIRCULAR ECONOMY AS A DRIVER OF ENERGY TRANSITION AND CARBON NEUTRALITY (K02082)<br><b>Kremlis George</b> , European Public Law Organisation and Director of its Circular economy and Climate Institut |
| 12:00-12:30       | WHAT DETERMINES DRIVERS AND BARRIERS OF THE IMPLEMENTATION OF CIRCULAR ECONOMY MEASURES AT REGIONAL LEVEL? (K02029)<br><b>Arauzo-Carod Josep-Maria</b> , Professor, Universitat Rovira i Virgili       |
| 12:30-13:00       | SUSTAINABLE ARCHITECTURAL CREATIONS IN HISTORIC CITIES (K02244)<br><b>Panetsos A. Georgios</b> , Professor, University of Patras                                                                       |
| 13.00-14.00       | Conference Lunch - Finger Food                                                                                                                                                                         |
|                   | Chaired by Prof Abeliotis Konstantinos & Assist Prof Kostakis Ioannis<br>(Amphitheater: Georgios Karabatzos) (main building)                                                                           |

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|-------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 14.00-14.30       | URBAN AND PERI-URBAN FORESTS, THEIR CONTRIBUTION TO SUSTAINABLE DEVELOPMENT ( <a href="#">K02032</a> )<br><b>Radoglou Kalliopi</b> , Professor, University of Thrace                                                                                                                                                                                                                 |
| 14:30-15:00       | CITY OVERTOURISM VERSUS ECONOMIC, SOCIAL AND ENVIRONMENTAL SUSTAINABILITY ( <a href="#">K02073</a> )<br><b>Angelidis Minas</b> , Professor Emeritus, National Technical University of Athens                                                                                                                                                                                         |
| 15:00-15:30       | DEMOCRATIC THEORY, URBAN PLANNING IDEOLOGY AND PUBLIC PARTICIPATION IN THE ERA OF ARTIFICIAL INTELLIGENCE ( <a href="#">K02026</a> )<br><b>Lalenis Konstantinos</b> , Professor, University of Thessaly                                                                                                                                                                              |
| 15:30-16:00       | CULTURAL HERITAGE AND SUSTAINABILITY: AN INTIMATE RELATIONSHIP ( <a href="#">K02089</a> )<br><b>Konstantinidou Elena</b> , Associate Professor, National Technical University of Athens                                                                                                                                                                                              |
| 16:00-16:30       | CLIMATE NEUTRAL CITIES AND CITIZENS' WELFARE ( <a href="#">K02176</a> )<br><b>Kottaridi Constantina</b> , Professor, University of Piraeus                                                                                                                                                                                                                                           |
| 16:30-17:00       | ENABLING ACCESSIBILITY, DISABLING DISABILITY ( <a href="#">K02247</a> )<br><b>Rodi Alcestis</b> , Professor, University of Patras                                                                                                                                                                                                                                                    |
| 17:00-17:30       | BUILDING NEW PLACES OF CREATIVE ECONOMIES; RENEWAL AND RE-USE OF ABANDONED BUILDINGS AS COWORKING BUILDINGS IN ATHENS' CENTRAL DISTRICTS ( <a href="#">K02243</a> )<br><b>Gospodini Aspa</b> , Professor, University of Thessaly                                                                                                                                                     |
| 17.30-18.00       | Coffee Break                                                                                                                                                                                                                                                                                                                                                                         |
| 2.<br>18.00-20.00 | Pre-organised Special Session: “ <b>Forestry and forest-based wood products: Discussing their role for sustainability and climate neutrality at local, regional and global scale</b> ” Organised by Department of Forestry, Wood Sciences and Design. Chaired by <b>Prof Georgios Ntalos</b> ( <a href="#">Amphitheater: Georgios Karabatzos</a> ) ( <a href="#">main building</a> ) |
| 18.00-18.15       | EUROPEAN PROGRAMS AND GREECE'S FOREST BIO-ECONOMY: REVIEW AND RESEARCH GAP IDENTIFICATION ( <a href="#">K02251</a> )<br><b>Veneti Angeliki</b> , <b>Karagouni Glykeria</b>                                                                                                                                                                                                           |
| 18.15-18.30       | CARBON FARMING IN FORESTRY AND CARBON STORAGE IN WOOD PRODUCTS. THE NEW CERTIFICATION FRAMEWORK AND THE POTENTIALS FOR THE RELATED MARKETS ( <a href="#">K02252</a> )<br><b>Trigkas Marios</b> , <b>Charitos Evangelos</b> , <b>Karagouni Glykeria</b> , <b>Karageorgos Anthony</b>                                                                                                  |
| 18.30-18.45       | THE USE OF SUSTAINABLE WOOD-BASED CONSTRUCTION MATERIALS TOWARDS REDUCING ENERGY INPUT ( <a href="#">K02253</a> )<br><b>Ninikas Konstantinos</b> , <b>Ntalos Georgios</b> , <b>Koutsianitis Dimitrios</b> , <b>Mitani Andromachi</b> , <b>Alexaki Pinelopi</b>                                                                                                                       |
| 18.45-19.00       | AI IN SMART FOREST MANAGEMENT: FROM DMRV SERVICES TO INTELLIGENT BIOMASS MANAGEMENT ( <a href="#">K02254</a> )<br><b>Lallas Efthymios</b> , <b>Karageorgos Anthony</b> , <b>Mountzouris George</b> , <b>Chrysikou Vasiliki</b>                                                                                                                                                       |
| 19.00-19.15       | CAN FORESTS HELP CRYPTOCURRENCIES BECOME SUSTAINABLE? A THEORETICAL APPROACH FOR RELATIVE STRATEGIES ( <a href="#">K02255</a> )<br><b>Trigkas Marios</b> , <b>Charitos Evangelos</b>                                                                                                                                                                                                 |

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| 19.15-19.30 | EVALUATION OF THE POTENTIAL SUPPLY OF AGRICULTURAL AND FOREST RESIDUES FOR BIOENERGY PRODUCTION IN GREECE (K02256)<br><b>Mitani Andromachi, Ntalos Georgios, Koutsianitis Dimitrios, Ninikas Konstantinos, Alexaki Pinelopi</b> |
| 19.30-19.45 | INVESTIGATING THE RELATIONSHIP AMONG ROAD NETWORK ALTITUDE ZONES AND LAND USE: EVIDENCE FROM THE REGIONS OF GREECE (K02257)<br><b>Stamatiou Christos, Matsouka Maria, Papageorgiou Grigorios</b>                                |
| 19.45-20.00 | A COMPREHENSIVE APPRAISAL OF LANDSLIDE PREVENTIVE MEASURES ON ROAD SLOPES (K02258)<br><b>Papageorgiou Grigorios</b>                                                                                                             |

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| 3.<br>18.00-20.00 | Pre-organised Round Table: “ <b>Culture and sustainable urban development of the city</b> ”. Organised and chaired by <b>Antonis Papagiannidis</b> (Greek Language) (Senate Hall) (main building)                                                       |
| 18.00-18.15       | ATHENS: A CITY WITHOUT AN "URBAN" CULTURE (K02155)<br><b>Maravegias Napoleon</b>                                                                                                                                                                        |
| 18.15-18.30       | THE CONCEPT OF "SYSPONDIA" (K02156)<br><b>Chryssochoou N. Dimitris</b>                                                                                                                                                                                  |
| 18.30-18.45       | THE PROTECTION OF THE PHYSIOGNOMY OF CITIES AND GREEN PUBLIC PROCUREMENTS (K02248)<br><b>Karnavos Dimitris</b>                                                                                                                                          |
| 18.45-19.00       | HEALTHY CITY (K02167)<br><b>Pelegrinis Theodosios</b>                                                                                                                                                                                                   |
| 19.00-19.15       | CULTURAL HERITAGE AND SUSTAINABLE URBAN TRANSFORMATION: A CONTINUUM FROM ANTIQUITY TO MODERNITY (K02241)<br><b>Konstantatos Ioannis</b>                                                                                                                 |
| 19.15-19.30       | THE ENVIRONMENT OF CITIES (K02250)<br><b>Galanopoulou Eleonora</b>                                                                                                                                                                                      |
| 19.30-20.00       | Discussion                                                                                                                                                                                                                                              |
| 4.<br>16.30-20.00 | Pre-organised Special Session: “ <b>Cultural Sustainability in Praxis: Digital Transformation and Green Innovation</b> ”<br>Organised and chaired by <b>Dr Bokolas Vassilis</b> and <b>Prof Colantoni Andrea</b> (Ceremony Hall) (New Library Building) |
| 16.45-17.00       | CREATIVE INDUSTRIES AND DIGITAL TRANSFORMATION OF TOURISM: ONLINE GAMES AS 'THIRD SPACES' OF COMMUNICATION AND INTERACTION (K02230)<br><b>Bokolas Vassilis, Papadaki Eirini</b>                                                                         |
| 17.00-17.15       | BRIDGING THE GENDER DIGITAL DIVIDE: STRATEGIES FOR INCLUSIVE TECHNOLOGY ADOPTION IN MARGINALIZED COMMUNITIES IN UGANDA (K02199)<br><b>Nagasha Judith Irene</b>                                                                                          |
| 17.15-17.30       | THE ROLE OF UNIVERSITY - INDUSTRY R&D COLLABORATIONS: DRIVING TO INNOVATION AND SUSTAINABILITY IN DEVELOPING COUNTRIES (GOVERNANCE AND GROWTH MODEL) (K02170)<br><b>Nuka Dardane, Troshani Ines, Mijo Ketrina</b>                                       |

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|-------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 17.30-18.00 | Coffee Break                                                                                                                                                                                                                                                |
| 18.00-18.15 | ANALYZING HEALTH-RELATED QUALITY OF LIFE AND PROFESSIONAL QUALITY OF LIFE AMONG MIGRANT POPULATIONS IN URBAN SETTINGS: A SYSTEMATIC REVIEW ( <a href="#">K02239</a> )<br><b>Fouskas Theodoros, Vassilakou Tonia, Merakou Kyriakoula, Koulterakis George</b> |
| 18.15-18.30 | GREEN ROOFS CONCEPT REVIEW: STRATEGIC COMMUNICATIONS FOR TECHNICAL AND ENVIRONMENTAL SUSTAINABILITY ( <a href="#">K02238</a> )<br><b>Colantoni Andrea, Nosova Bogdana, Skarpelos Yannis</b>                                                                 |
| 18.30-18.45 | DIGITAL SKILLS AND PROFESSIONAL DEVELOPMENT: BUILDING BRIDGES BETWEEN ACADEMIC EDUCATION AND DIGITAL LABOR MARKET ( <a href="#">K02242</a> )<br><b>Skarpelos Yannis, Kaperonis Stavros, Carbone Luisa, Ntrouva Efi</b>                                      |
| 18.45-19.00 | DIGITAL LITERACY AND COMBATING MISINFORMATION AS CRITERIA FOR THE SUSTAINABILITY OF PUBLIC HEALTH ( <a href="#">K02173</a> )<br><b>Saridi Maria, Tsintari Elena</b>                                                                                         |
| 19.00-19.15 | CULTURAL TOURISM AND LOCAL SUSTAINABLE DEVELOPMENT: THE CASE OF THE DIGITAL GAMES IN THE MUSEUMS ( <a href="#">K02196</a> )<br><b>Bokolas Vassilis, Skyrianou Martha</b>                                                                                    |
| 19.15-19.30 | CHALLENGES OF INTERNATIONALIZATION PROCESS OF UNIVERSITIES IN ALBANIA ( <a href="#">K02261</a> )<br><b>Skendaj Elton</b>                                                                                                                                    |
| 19.30-19.45 | DIGITAL GAMES AND SUPPORT FOR CHILDREN WITH LEARNING DIFFICULTIES: RESEARCH AND PEDAGOGICAL APPLICATIONS ( <a href="#">K02197</a> )<br><b>Bokolas Vassilis, Zotou Danai</b>                                                                                 |
| 19.45-20.00 | DIGITAL ENTREPRENEURSHIP AND SUSTAINABLE DEVELOPMENT: THE DISTANCE LEARNING OF GREEK AS A FOREIGN LANGUAGE EXAMPLE ( <a href="#">K02169</a> )<br><b>Karageorgou Irene</b>                                                                                   |

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| 5.<br>18.00-20.00 | Session: “ <b>Cultural Heritage and Sustainable Development of Places and Cities</b> ”<br>Chaired by <b>Prof Polychronopoulos Dimitris</b> ( <a href="#">Room A1</a> ) ( <a href="#">main building</a> )                       |
| 18.00-18.15       | CULTURAL HERITAGE AND URBAN RESILIENCE: REVIVING TOBACCO WAREHOUSES IN NORTHERN GREECE ( <a href="#">K02148</a> )<br><b>Grigoriadou Maria, Polychronopoulos Dimitris, Kapandriti Anastasia</b>                                 |
| 18.15-18.30       | HISTORICAL MEMORY AND SUSTAINABLE DEVELOPMENT WITHIN AN URBAN CULTURAL LANDSCAPE. THE CASE OF THE OLD MUNICIPAL HOSPITAL OF THE UPPER TOWN OF PATRAS (OLD PATRAS). ( <a href="#">K02034</a> )<br><b>Lykourgiotis Angelos</b>   |
| 18.30-18.45       | MATERIAL AND IMMATERIAL CULTURE AND SUSTAINABLE DEVELOPMENT (HISTORIC CITIES, MONUMENTS, CUSTOMS). THE CASE STUDY OF THE MINOR ASIA REFUGEES IN AITOLIA-AKARNANIA, GREECE ( <a href="#">K02048</a> )<br><b>Tsoka Evangelia</b> |



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| 18.45-19.00 | THE <b>UNDERWATER CULTURAL</b> HERITAGE AS MANAGEMENT FACTOR OF THE MEDITERRANEAN LANDSCAPE (K02064)<br><b>Konaxis Ioannis</b>                                                            |
| 19.00-19.15 | WORLD HERITAGE MONUMENTS AND THE CITY: SOME PRELIMINARY REMARKS ON THE MANAGEMENT OF THE MONUMENTS OF THESSALONIKI, GREECE (K02123)<br><b>Karadimou Agni</b>                              |
| 19.15-19.30 | THE LEGACY OF HIPPOCRATES IN THE MODERN WORLD AIMING AT WELL-BEING AND SUSTAINABILITY. THE CASE OF KOS. (K02186)<br><b>Karayanni Anda</b>                                                 |
| 19.30-19.45 | OPTIMIZING DESTINATION MANAGEMENT: THE ROLE OF BIMs IN PROMOTING CULTURAL HERITAGE AND SUSTAINABILITY (K02188)<br><b>Poulimenou Sofia Maria, Deliyannis Ioannis, Mazi Ioanna Afroditi</b> |
| 19.45-20.00 | REVIVING TRADITION: TOBACCO WAREHOUSES IN KAVALA AS PILLARS OF SUSTAINABLE GROWTH (K02120)<br><b>Grigoriadou Maria - Alexandra, Kouveli Aikaterini</b>                                    |

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| 6.<br>18.00-20.00 | Session: “ <b>Sustainable Urban Public Space</b> ”<br>Chaired by <b>Prof Angelidou Margarita</b><br>(Room A2) (main building)                                                                                                                                                       |
| 18.00-18.15       | TRANSFORMING URBAN SPACES FOR REMOTE WORK: POLICY IMPLICATIONS AND DESIGN STRATEGIES (K02087)<br><b>Angelidou Margarita, Pouzoukidou Georgia, Roma-Athanasiadou Elli</b>                                                                                                            |
| 18.15-18.30       | REGENERATIVE AND CIRCULAR CITY DEVELOPMENT THROUGH DISTRIBUTED URBAN PRODUCTION AND THE MAKER MOVEMENT IN THESSALONIKI, GREECE (K02088)<br><b>Angelidou Margarita, Roma-Athanasiadou Elli, Premyanov Nikolay, Psaltoglou Artemis, Chatziioannou Nikolaos, Tsolakis C. Apostolos</b> |
| 18.30-18.45       | SERVICE DESIGN IN URBAN LIFE: PROPOSING A CO-DESIGN MODEL FOR INTERVENTIONS IN URBAN COMMONS (K02112)<br><b>Chairetakis Dimitrios</b>                                                                                                                                               |
| 18.45-19.00       | URBAN OBSERVATORIES. GAZING AT THE CITY. SNAPSHOTS AND ALLEGORICAL INTERPRETATIONS OF THE URBAN LANDSCAPE OF ATHENS (K02116)<br><b>Moira Maria, Makris Dimitrios, Michalopoulou Katerina</b>                                                                                        |
| 19.00-19.15       | STRATEGIC STAKEHOLDER ENGAGEMENT FOR LONG-TERM SUSTAINABILITY OF URBAN DEVELOPMENT PROJECTS (K02147)<br><b>Zacharis Theo</b>                                                                                                                                                        |
| 19.15-19.30       | EXPLORING PUBLIC PERCEPTIONS OF THE PARIS 2024 OLYMPICS' SUSTAINABILITY STRATEGY: A CONTENT ANALYSIS OF COMMENTS ON YOUTUBE VIDEOS (K02071)<br><b>Kübra Büyük Öksüz</b>                                                                                                             |

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| 19.30-19.45 | A SENSITIVE APPROACH TO THE HISTORIC URBAN LANDSCAPE. THE INTERWAR APARTMENT BUILDINGS OF THE LINEAR OPEN SPACE OF FOKIONOS NEGRI IN ATHENS, GREECE ( <a href="#">K02132</a> )<br><b>Eleftheraki Georgina</b> |
| 19.45-20.00 | Discussion                                                                                                                                                                                                    |

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| 7.<br>18.00-20.00 | Session: “ <b>Urban Regeneration</b> ”, Chaired by <b>Prof Lava Riva</b> ( <a href="#">Room A5</a> ) ( <a href="#">main building</a> )                                                                                                |
| 18.00-18.15       | THE EXTERNALITIES OF CONTEMPORARY ARCHITECTURE IN TERMS OF SUSTAINABILITY ( <a href="#">K02124</a> )<br><b>Vernadou Emmanouela-Pagona, Lava Riva</b>                                                                                  |
| 18.15-18.30       | REDESIGNING A PUBLIC SQUARE FOR MANIFESTATIONS: A SERBIAN EXAMPLE OF SOMBOR SQUARE ( <a href="#">K02125</a> )<br><b>Mitrović Nikola, Mitrović Djordje, Antonić Branislav, Grujičić Aleksandar</b>                                     |
| 18.30-18.45       | GAZI - PSALLIDI: EXPLORING DIFFERENCES BETWEEN TRADITIONAL MAP MAKING AND CONTEMPORARY MAPPING PRACTICES UPON TWO ATHENIAN NEIGHBOURHOODS ( <a href="#">K02195</a> )<br><b>Tsakiri Efrossyni, Vrasida Maria, Vasilara Archontoula</b> |
| 18.45-19.00       | CINEMA AS A PLANNING “TOOL” FOR A SUSTAINABLE, CHILD-FRIENDLY AND THEREFORE WORTH LIVING CITY ( <a href="#">K02070</a> )<br><b>Chatzifragkios Makrydakios Konstantinos</b>                                                            |
| 19.00-19.15       | CITY-CENTERED VALUES ( <a href="#">K02072</a> )<br><b>Maniatis Antonios, Adamopoulos Antonios</b>                                                                                                                                     |
| 19.15-19.30       | THE ELLINIKON: A CASE STUDY OF SUSTAINABLE URBAN REGENERATION AND DEVELOPMENT ( <a href="#">K02086</a> )<br><b>Rachiotis Theodoros, Poulaki Panoraia</b>                                                                              |
| 19.30-19.45       | FROM AUTOTROPH SYSTEMS TO CITIES. RETHINKING TERRITORIAL METABOLISM TOWARDS URBAN SUSTAINABILITY ( <a href="#">K02185</a> )<br><b>Apostolou Malvina</b>                                                                               |
| 19.45-20.00       | GOVERNANCE AND SUSTAINABILITY OF SPECIAL URBAN PLANS IN THESSALONIKI: PUBLIC PARTICIPATION AND URBAN TRANSFORMATION ( <a href="#">K02192</a> )<br><b>Theodorakopoulou Vasiliki</b>                                                    |

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| 8.<br>18.00-20.00 | Session: “ <b>Circular Economy and Sustainable Development</b> ”<br>Chaired by <b>Prof Dzintra Atstāja</b> ( <a href="#">Room A6</a> ) ( <a href="#">main building</a> )                                             |
| 18.00-18.15       | THE CIRCULAR ECONOMY - A RESPONSE TO CLIMATE CHANGE ( <a href="#">K02031</a> )<br><b>Dzintra Atstāja</b>                                                                                                             |
| 18.15-18.30       | INTEGRATING CIRCULAR ECONOMY INTO SUSTAINABLE DEVELOPMENT GOALS: INSIGHTS FROM LIFE CYCLE IMPACT ASSESSMENT ( <a href="#">K02119</a> )<br><b>Rajic Milena, Stanković Zorana, Milosavljević Peđa, Jovanović Vesna</b> |

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| 18.30-18.45 | STAKEHOLDER PERCEPTIONS ON BARRIERS AND DRIVERS FOR THE ENHANCEMENT OF CIRCULAR ECONOMY IN THE CONSTRUCTION SECTOR ( <a href="#">K02128</a> )<br><b>Oikonomou I. Theoni, Karytsas Spyridon, Karytsas Constantine, Theodoropoulou Eleni</b> |
| 18.45-19.00 | CIRCULARITY IN THE BUILT ENVIRONMENT: INSIGHTS FROM ALBANIA ( <a href="#">K02145</a> )<br><b>Keçi Julinda, Imeraj Erinda</b>                                                                                                               |
| 19.00-19.15 | EDUCATING FOR A CIRCULAR ECONOMY: POLICY AND PRACTICE IN WESTERN BALKAN HIGHER EDUCATION ( <a href="#">K02146</a> )<br><b>Keçi Julinda, Vila Jubjana</b>                                                                                   |
| 19.15-19.30 | TOWARD A REGENERATIVE FUTURE: CIRCULAR ECONOMY, ECOSYSTEM CONSERVATION, AND THE CO-EVOLUTION OF SOCIAL-ECOLOGICAL SYSTEMS. ( <a href="#">K02260</a> )<br><b>Charitonidou Marianna</b>                                                      |
| 19.30-20.00 | Discussion                                                                                                                                                                                                                                 |

## DAY 2 - Saturday 15/02/2025

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| 9.<br>09.00-11.00 | Session: “ <b>Natural Disasters, Resilience and Sustainable Development of Places and Cities</b> ”, Chaired by <b>Dr Economou Agisilaos</b> ( <a href="#">Amphitheater: Georgios Karabatzos</a> ) ( <a href="#">main building</a> )                                             |
| 09.00-09.15       | BUILDING SUSTAINABLE SOCIAL RESILIENCE FOLLOWS A MORE HOLISTIC APPROACH ( <a href="#">K02054</a> )<br><b>Poli Maria, Malagas Konstantinos, Manola Maria</b>                                                                                                                     |
| 09.15-09.30       | THE USE OF UNMANNED SYSTEMS AND SWARM TECHNOLOGY IN CRITICAL SITUATION MANAGEMENT IN URBAN AREAS ( <a href="#">K02126</a> )<br><b>Papachristos Dimitrios, Lilas Thodoros, Nikitakos Nikitas</b>                                                                                 |
| 09.30-09.45       | QUANTIFICATION OF URBAN AND COMMUNITY RESILIENCE ( <a href="#">K02033</a> )<br><b>Makris N., Chatzikyriakidis G.</b>                                                                                                                                                            |
| 09.45-10.00       | “TURN AROUND, DON’T DROWN”; LESSONS LEARNT FROM THE 2023 FLOOD IN MAGNESIA, GREECE ( <a href="#">K02182</a> )<br><b>Kyriakidis Charalampos, Athanasia Konstantina Despoina, Dionysopoulou Anna, Plaka Gabriela, Sidiras Vasileios, Xirogiannis Maria, Bakogiannis Efthimios</b> |
| 10.00-10.15       | SUSTAINABLE DEVELOPMENT OF HISTORIC CITIES: FLOOD MANAGEMENT STRATEGIES AND RESILIENCE ( <a href="#">K02191</a> )<br><b>Dreliosi Georgia Christina, Karamanou Aspasia</b>                                                                                                       |
| 10.15-10.30       | THE PROTECTION AND MANAGEMENT OF <b>COASTAL AREAS</b> IN GREECE. EVALUATION OF RECENT LEGAL FRAMEWORK (L. 5092/2024) ( <a href="#">K02105</a> )<br><b>Zygouri Foteini, Lalenis Konstantinos</b>                                                                                 |

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| 10.30-10.45 | THE AXIOS DELTAIC TERRITORY: ESTABLISHING RESILIENCE IN A GRADIENT OF WETNESS (K02109)<br><b>Kasselouri Elena</b>                                                                                                        |
| 10.45-11.00 | A REVIEW OF SMART SOLUTIONS FOR SUSTAINABLE WATER MANAGEMENT WITHIN URBAN AREAS WHILE TACKLING WATER SCARCITY IN GREEK CITIES (K02121)<br><b>Chasiotis Angelos, Gialama Sofia, Piromalis Dimitris, Nastos Panagiotis</b> |
| 11.00-11.30 | Coffee Break                                                                                                                                                                                                             |

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| 10          | <b>Keynote Speech</b><br>(Amphitheater: Georgios Karabatzos) (main building)                                                                                                        |
| 11.30-12.00 | DEMOGRAPHIC TRANSITIONS, LOCAL ECONOMIES AND METROPOLITAN SYSTEMS IN-BETWEEN SUSTAINABILITY AND RESILIENCE (K02246)<br><b>Salvati Luca</b> , Professor, Sapienza University of Rome |

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| 10.<br>12.00-14.00 | Pre-organised Special Session: “ <b>Landscape and Urban Sustainability: discussing the natural and socio-cultural factors, in a positive or negative mood</b> ”<br>Organised and chaired by <b>Prof Konstantinos Moraitis</b><br>(Amphitheater: Georgios Karabatzos) (main building) |
| 12.00-12.15        | OPEN-AIR CITIES: COMMON APPROACHES FOR BUILDING, LANDSCAPE AND URBAN-SCAPE DESIGN - THE CONCEPT OF DESIGN SCHEMATIZATION (K02025)<br><b>Moraitis Konstantinos</b>                                                                                                                    |
| 12.15-12.30        | THE LIMINAL SPACE OF THE GREEN CITY (K02093)<br><b>Retsos Georgios</b>                                                                                                                                                                                                               |
| 12.30-12.45        | LANDSCAPE AND URBAN SUSTAINABILITY. CULTURAL ROUTES FOR CULTURAL TRAVELLERS: A POSITIVE APPROACH - CASE STUDY (K02115)<br><b>Katraouzou Dimitra</b>                                                                                                                                  |
| 12.45-13.00        | SUPPORTING ARCHITECTURAL EDUCATION THROUGH PARTICIPATORY LANDSCAPE MAPPING USING CROWDSOURCING AND GIS (K02131)<br><b>Ioannidis Romanos, Mamassis Nikos, Moraitis Konstantinos</b>                                                                                                   |
| 13.00-13.15        | TRIKALA CITY CENTER (K02136)<br><b>Apostolidis Konstantinos, Karachalios Thanassis, Karachalios Sotiris, Belemezi Louzia-Maria, Moraitis Konstantinos, Helidoni Katerina</b>                                                                                                         |
| 13.15-13.30        | AN IMPORTANT URBAN RESEARCH PROPOSAL: ADULT EDUCATION FOR SUSTAINABILITY IN THE CONTEMPORARY URBAN LANDSCAPE: THE MEANING OF LIFELONG ACTION THROUGH SUSTAINABLE URBAN COMMUNITIES (K02141)<br><b>Vallianatou-Voutsina Eleni</b>                                                     |
| 13.30-13.45        | URBAN PLANNING IN A PROCESS RE- CONSIDERATION AND RE- EXAMINATION. A CASE STUDY THE MUNICIPALITY OF LARISSA, THESSALY, GREECE (K02142)<br><b>Markatou Maria</b>                                                                                                                      |

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| 13.45-14.00        | RE- PLANNING AND RE- DESIGNING THE LARISSA’ S LANDSCAPE INCORPORATING PARAMETERS OF NATURAL AND SOCIO- CULTURAL SUSTAINABILITY (K02151)<br><b>Markatou Maria, Moraitis Konstantinos</b>                                                                                            |
| 14.00-15.00        | Conference Lunch - Finger Food                                                                                                                                                                                                                                                     |
| 11.<br>09.00-12.45 | Pre-organised Special Session: “ <b>ECO4ALL FOR CONSUMER PROTECTION THROUGH CIRCULAR ECONOMY STRATEGIES - THE CONTRIBUTION TO SUSTAINABLE DEVELOPMENT</b> ” Organised and chaired by <b>Prof Plotnic Olesea</b> (COST ACTION 22124 ECO4ALL) (Ceremony Hall) (New Library Building) |
| 09.00-09.15        | CIRCULAR ECONOMY AS A STRATEGIC IMPERATIVE FOR FOSTERING SUSTAINABILITY AND CONSUMER ENGAGEMENT (K02140)<br><b>Milošević Isidora, Plotnic Olesea, Stanković Zorana, Tick Andrea, Buzdugan Andriana</b>                                                                             |
| 09.15-09.30        | NORDIC CROSS-BORDER COOPERATION FOR CIRCULAR ECONOMY SUCCESS (K02210)<br><b>Goncharuk Anatoliy</b>                                                                                                                                                                                 |
| 09.30-09.45        | SUSTAINABILITY AND COMPETITION POLICY - VIA CONSUMER PROTECTION (K02214)<br><b>Mirza Radu</b>                                                                                                                                                                                      |
| 09.45-10.00        | THE ROLE OF CIRCULAR ECONOMY IN SUSTAINABLE DEVELOPMENTS GOALS IN ALBANIA (K02215)<br><b>Hysaj Albina</b>                                                                                                                                                                          |
| 10.00-10.15        | ADVANCING CLIMATE NEUTRALITY THROUGH CIRCULAR ECONOMY SANDBOXES: A FRAMEWORK FOR INNOVATION AND REGULATION (K02217)<br><b>Zamfir Natalia, Lisnic Iurie</b>                                                                                                                         |
| 10.15-10.30        | EMPOWERING CONSUMERS FOR CIRCULAR FOOD SYSTEMS: INSIGHTS FROM HUNGARIAN RESEARCH ON SUSTAINABILITY AND CONSUMPTION PATTERNS (K02218)<br><b>Csizmadý Adrienne</b>                                                                                                                   |
| 10.30-10.45        | SUSTAINABILITY, CIRCULAR ECONOMY AND CREATIVE COMPUTING (K02219)<br><b>Cunha Carlos</b>                                                                                                                                                                                            |
| 10.45-11.00        | LEGAL ANALYSIS OF CONSUMER RIGHTS TO PRODUCT REPAIR UNDER THE EU DIRECTIVE ON REDUCING, REUSING AND REPAIRING (K02224)<br><b>Dumančić Kosjenka</b>                                                                                                                                 |
| 11.00-11.30        | Coffee Break                                                                                                                                                                                                                                                                       |
| 11.30-11.45        | ENHANCING CIRCULAR ECONOMY THROUGH NATURE-BASED SOLUTIONS IN HIGHER EDUCATION (K02225)<br><b>Manou Dimitra</b>                                                                                                                                                                     |
| 11.45-12.00        | ESG REPORTING IN ACCORDANCE WITH THE NEW CSRD DIRECTIVE - ARE WE READY FOR A PARADIGM CHANGE IN CORPORATE MANAGEMENT AND BUSINESS? (K02226)<br><b>Simunovic Lidija, Mikrut Martina Nađsombat, Getoš Krešimir</b>                                                                   |

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| 12.00-12.15 | THE EU’S PROBABILISTIC DEPENDENCY STRUCTURE TOWARDS THE GOAL OF A CIRCULAR ECONOMY (K02227)<br><b>Esma Nur Cinicioglu</b>                                                                      |
| 12.15-12.30 | A REVIEW OF GREENWASHING AND CIRCULAR INDUSTRIAL PRACTICES FROM CONSUMER’S PERSPECTIVE (K02231)<br><b>Stanković Zorana, Milošević Isidora</b>                                                  |
| 12.30-12.45 | APPLY THE PRINCIPLES OF CIRCULAR ECONOMY AND INDUSTRIAL SYMBIOSIS ON THE PRODUCTION SECTORS OF CYPRUS: THE BENEFITS FOR CONSUMERS (K02035)<br><b>Kyriakidis Andreas, Michopoulos Apostolos</b> |
| 12.45-13.00 | THE CONTRIBUTION OF LOCAL GOVERNMENT ORGANIZATIONS AND CITIZENS TO THE ACHIEVEMENT OF THE 12TH SDG IN GREECE (K02228)<br><b>Angelos Papavasileiou, Agisilaos Economou, Mitoula Roido</b>       |
| 13.00-13.15 | EU CIRCULAR ECONOMY NETWORK FOR ALL: CONSUMER PROTECTION THROUGH REDUCING, REUSING, REPAIRING (K02229)<br><b>Plotnic Olesea</b>                                                                |

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| 12.<br>13.00-14.15 | Session: “ <b>Climate Change</b> ”, Chaired by <b>Dr Chatzigrigoriou Pavlos</b> (Ceremony Hall) (New Library Building)                                                                                                             |
| 13.00-13.15        | A REVIEW OF CLIMATE RISK ASSESSMENT METHODS FOR WATER INFRASTRUCTURE IN GREECE (K02041)<br><b>Gialama Sofia, Chasiotis Angelos, Piromalis Dimitris, Nastos Panagiotis</b>                                                          |
| 13.15-13.30        | CLIMATE DATA-DRIVEN URBAN POLICIES: A NEW CHALLENGE FOR GREEK LOCAL AUTHORITIES (K02069)<br><b>Tarani Paraskevi, Bratsas Charalambos, Ioannidis Lazaros, Filippidis Panagiotis-Marios, Vouraki Marianna, Kountouras Efstratios</b> |
| 13.30-13.45        | HERitage MONitoring (HER-MON) FOS INCREASING RESILIENCE IN THE CLIMATE CHANGE ERA (K02187)<br><b>Chatzigrigoriou Pavlos, Chamalidou Alik, Mamalis Dimitrios, Charalampidis Ioannis, Diakodimitriou David</b>                       |
| 13.45-14.00        | KIFISSOS RIVER - A POSSIBLE DISASTER IN ATHENS (K02039)<br><b>Kampolis Dimitrios</b>                                                                                                                                               |
| 14.00-14.15        | SYSTEMIC, TRANSVERSAL, DYNAMIC: AN INTEGRATED APPROACH TO ACHIEVE SUSTAINABILITY IN A COMPLEX LANDSCAPE (K02183)<br><b>Angelillo Carmen</b>                                                                                        |
| 14.15-15.00        | Conference Lunch - Finger Food                                                                                                                                                                                                     |

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| 13.<br>09.00-11.00 | Session: <b>“Energy Management and Sustainable Mobility”</b><br>Chaired by <b>Prof Aspa Gospodini</b><br>(Room A1) (main building)                                                                                                                             |
| 09.00-09.15        | DECODING EUROPE’S ‘RENOVATION WAVE’ ENERGY STRATEGY: REAL ESTATE SHIFTS FOR SUSTAINABLE CITIES (K02055)<br><b>Vardopoulos Ioannis, Poli Maria</b>                                                                                                              |
| 09.15-09.30        | END-USER PERCEPTIONS TOWARD THE REQUIREMENTS OF INNOVATIVE THERMAL INSULATION MATERIALS<br><b>Spyridon Karytsas, Dimitrios Mendrinou, Constantine Karytsas, Carlos L. Rodríguez López, Roberto Rodríguez Álvaro, Irene Beleña Pozo, Amparo Roca de Togores</b> |
| 09.30-09.45        | CONSUMER PERCEPTIONS TOWARD THE USE OF BIOMETHANE - SURVEY RESULTS FROM 11 EUROPEAN COUNTRIES (K02130)<br><b>Karytsas Spyridon, Christou Myrsini</b>                                                                                                           |
| 09.45-10.00        | THE IMPACT OF ECONOMIC GROWTH AND ENERGY CONSUMPTION ON ENVIRONMENTAL QUALITY (K02067)<br><b>Karsiotis Panagiotis, Adamopoulos Antonios</b>                                                                                                                    |
| 10.00-10.15        | QUANTILE CONNECTEDNESS IN RENEWABLE ENERGY COMPANIES AND RELATED COMMODITIES DURING COVID-19 OUTBREAK (K02083)<br><b>Bikramaditya Ghosh, Hayfa Kazouz, Papadas Dimitrios</b>                                                                                   |
| 10.15-10.30        | URBAN ENERGY TRANSITION AND BUILDING INTEGRATED PHOTOVOLTAICS (K02104)<br><b>Karamanis Dimitrios, Skandalos Nikolaos, Dimitriou Tsampika</b>                                                                                                                   |
| 10.30-10.45        | COGNITIVE BACKGROUND OF THE RELATIONSHIP BETWEEN AUTONOMOUS VEHICLES AND SUSTAINABLE MOBILITY: A CASE STUDY OF GREEK DRIVERS (K02059)<br><b>Kanellopoulos Panagiotis</b>                                                                                       |
| 10.45-11.00        | ANALYZING ENERGY POVERTY IN SOUTHERN EUROPE: A DESCRIPTIVE ANALYSIS USING SUBJECTIVE INDICATORS (K02249)<br><b>Pastrapa Eleni, Angeletopoulou Paraskevi, Papadaki Stamatina, Mitoula Roido</b>                                                                 |
| 11.00-11.30        | Coffee Break                                                                                                                                                                                                                                                   |

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| 14.<br>11.30-12.00 | Pre-organised Special Session: <b>“Culture and Sustainable Development”</b><br>Organised and chaired by <b>Assoc Prof Maria Manola &amp; Argyros Leonidas</b><br>(Room A1) (main building) |
| 11.30-11.45        | MONASTERIES AS ELEMENTS OF CULTURE AND SUSTAINABLE DEVELOPMENT. FROM TRAVEL TEXTS TO ENTREPRENEURSHIP (K02080)<br><b>Tsatalmpasoglou Anna-Irini, Fotini Maniou, Manola Maria</b>           |
| 11.45-12.00        | CULTURAL ENTREPRENEURSHIP AND SUSTAINABLE DEVELOPMENT IN LEMNOS (K02094)<br><b>Maniou Fotini</b>                                                                                           |



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| 12.00-12.15 | DAFNI MONASTERY: PILLAR OF SUSTAINABLE DEVELOPMENT AND CULTURAL ENTREPRENEURSHIP. ARE THERE POSSIBILITIES? (K02133)<br><b>Manola Maria, Argyros Leonidas, Maniou Foteini, Poli Maria, Papadogoulas Georgios</b>                           |
| 12.15-12.30 | QUALITY ASSURANCE FOR PEOPLE WITH DISABILITIES AND ITS RELATIONSHIP WITH CULTURAL ENTREPRENEURSHIP: A CASE STUDY ON THE MUSEUM OF THE LESVOS PETRIFIED FOREST (K02153)<br><b>Vouglanis Taxiarchis, Papaioannou Olympia, Maniou Fotini</b> |
| 12.30-12.45 | ART IN EDUCATION AND LANGUAGE AS FUNDAMENTAL TOOLS OF CULTURE AND TOURISM (K02154)<br><b>Papadrosou Maria- Sofia, Papaioannou Olympia, Manola Maria</b>                                                                                   |
| 12.45-13.00 | THE ITALIAN MONUMENTS IN LEROS AS HISTORICAL RELICS OR LIVING PARTS OF MODERN ECONOMIC LIFE (K02168)<br><b>Koltsikoglou Georgios, Manola Maria, Kamaroudis Stavros, Spantidakis Ioannis</b>                                               |
| 13.00-13.15 | RELIGIOUS FESTIVALS AND CULTURAL ENTREPRENEURSHIP IN THE MONASTERIES OF LESVOS FROM THE TIME OF THE TRAVELLERS TO THE PRESENT DAY (K02175)<br><b>Trikalitis Kostas, Maniou Fotini, Tsatalmpasoglou Anna-Irini, Manola Maria</b>           |

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| 15.<br>13.15-14.00 | Pre-organised Special Session: <b>“Sustainable Development, Social Sustainability and Social Policy: trends, transformations and rising challenges”</b> Organised and chaired by <b>Prof Nikos Papadakis &amp; Dr Stelios Tzagkarakis</b> (Room A1) (main building) |
| 13.15-13.30        | MEGATRENDS, THE NEW EUROPEAN STRATEGY ON SUSTAINABLE DEVELOPMENT AND THE ROLE OF EDUCATION, EMPLOYMENT AND RESKILLING IN SOCIAL SUSTAINABILITY (K02028)<br><b>Papadakis Nikos, Drakaki Maria</b>                                                                    |
| 13.30-13.45        | THE MIGRATION-REFUGEE CRISIS AS AN ‘ASYMMETRICAL THREAT’ IN THE MEDITERRANEAN REGION: FIELD RESEARCH (K02047)<br><b>Vlachadi Maria, Tsoumpekas Dimitrios</b>                                                                                                        |
| 13.45-14.00        | SOCIAL SUSTAINABILITY AND SOCIAL VULNERABILITY IN FOCUS: THE CASE OF GREECE (K02077)<br><b>Tzagkarakis Stylianos Ioannis</b>                                                                                                                                        |
| 14.00-15.00        | Conference Lunch - Finger Food                                                                                                                                                                                                                                      |

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| 16.<br>09.00-12.30 | Session: <b>“Education and Sustainable Development”</b><br>Chaired by <b>Prof Peraboni Carlo</b> (Room A2) (main building)                                                                                                            |
| 09.00-09.15        | TOWARDS AN IMMERSIVE VR AND GAMIFICATED EDUCATIONAL MODEL FOR CONSTRUCTION COURSES. A VIEW ON THE BENEFITS AND DRAWBACKS (K02056)<br><b>Kanellopoulos Panagiotis, Kostopoulos Konstantinos, Katsaros Miltiadis, Antoniou Dimitris</b> |

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| 09.15-09.30 | A REVIEW OF VR AND GAMIFICATED EDUCATIONAL METHODOLOGY IN VIRTUAL CONSTRUCTION FROM NON TO FULL IMMERSION ( <a href="#">K02057</a> )<br><b>Kanellopoulos Panagiotis, Katsaros Miltiadis, Kostopoulos Konstantinos, Antoniou Dimitris</b>                                                             |
| 09.30-09.45 | SUSTAINABLE SCHOOL: ENHANCING ENVIRONMENTAL AWARENESS AND ENTREPRENEURSHIP THROUGH SCHOOL PROGRAMS AND VIRTUAL BUSINESSES. THE CASE STUDY OF THE UNIFIED SPECIAL VOCATIONAL HIGH SCHOOL OF AGIOS DIMITRIOS, ATTICA, GREECE ( <a href="#">K02065</a> )<br><b>Stouri Vasiliki, Zervas Konstantinos</b> |
| 09.45-10.00 | THE PHILOSOPHY OF ENVIRONMENTAL EDUCATION ( <a href="#">K02084</a> )<br><b>Christou Melpomeni, Vlachos Apostolos</b>                                                                                                                                                                                 |
| 10.00-10.15 | RETHINKING SCHOOL ARCHITECTURE: BRIDGING EDUCATIONAL SPACES AND THE URBAN FABRIC ( <a href="#">K02100</a> )<br><b>Filou Vasiliki, Grigoriadou Maria</b>                                                                                                                                              |
| 10.15-10.30 | THE ROLE OF MUNICIPAL OPEN FREE UNIVERSITY OF MUNICIPALITY OF NEW FILADELFIA-NEA CHALKIDONA: A SOCIAL FOOTPRINT AN ACCESS TO HIGH LEVEL EDUCATION ( <a href="#">K02113</a> )<br><b>Chronopoulou Georgia</b>                                                                                          |
| 10.30-10.45 | STUDENTS AS AGENTS OF CHANGE IN URBAN STUDIES OF PRIMARY EDUCATION IN THE CONTEXT OF THE NEW NATIONAL CURRICULUM: ‘ACTIONS FOR ACTIVE CITIZENSHIP’ ( <a href="#">K02177</a> )<br><b>Christodoulou Nikolaos, Rizaki Aikaterini, Ntoka Aglaia</b>                                                      |
| 10.45-11.00 | YOUR 2030 – A MULTIDISCIPLINARY EDUCATIONAL PROJECT TO PROMOTE THE THEMES OF SUSTAINABILITY ( <a href="#">K02184</a> )<br><b>Peraboni Carlo</b>                                                                                                                                                      |
| 11.00-11.30 | Coffee Break                                                                                                                                                                                                                                                                                         |
| 11.30-11.45 | BUILDING A SUSTAINABLE FUTURE: THE INTERPLAY OF QUALITY EDUCATION AND TEACHER WELL-BEING IN SUSTAINABLE DEVELOPMENT ( <a href="#">K02189</a> )<br><b>Anargyrou Aikaterini</b>                                                                                                                        |
| 11.45-12.00 | EVALUATION OF SUSTAINABLE DEVELOPMENT PROGRAMMES BY SECONDARY SCHOOL TEACHERS ( <a href="#">K02190</a> )<br><b>Loupas Efstathios, Martinis Aristotelis</b>                                                                                                                                           |
| 12.00-12.15 | BLENDED INTENSIVE PROGRAMS: BRIDGING THEORY AND PRACTICE OF ENVIRONMENTAL EDUCATION? ( <a href="#">K02234</a> )<br><b>Hordecki Bartosz, Sakson-Boulet Anna</b>                                                                                                                                       |
| 12.15-12.30 | EUROPEAN UNION AND SUSTAINABILITY: THE MODERN POLITICAL DIRECTIONS AND ITS INCORPORATION IN EDUCATION AND THE GREEK EDUCATIONAL SYSTEM ( <a href="#">K02050</a> )<br><b>Papadopoulou Kl. Vasiliki, Mitoula Roido, Sardianou Eleni, Kaldi Stavroula</b>                                               |

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| 17.<br>12.30-14.00 | Session: <b>“Alternative Tourism and Sustainable Development”</b><br>Chaired by <b>Dr Vardopoulos Ioannis</b><br>(Room A2) (main building)                                                                                                       |
| 12.30-12.45        | FOSTERING TOURISM WHILE NEUTRALIZING CULTURAL HERITAGE.<br>THE PARADOXAL URBAN DEVELOPMENT OF TIRANE (ALBANIA). (K02193)<br><b>Fiano Francesca Romana, Vatnikaj Sidorela</b>                                                                     |
| 12.45-13.00        | SUSTAINABLE CULTURAL TOURISM IN THE GREEK ISLANDS. CASE STUDY: THE<br>ISLAND OF SANTORINI (K02036)<br><b>Kriga Mimika (Dimitra)</b>                                                                                                              |
| 13.00-13.15        | CORRELATION BETWEEN THE DEGREE OF PRESERVATION AND PROMOTION OF THE<br>CULTURAL HERITAGE WITH THE LEVEL OF TOURIST ACTIVITY IN THE CITY OF LAMIA<br>(K02044)<br><b>Pineli Triantafyllia</b>                                                      |
| 13.15-13.30        | CONTEMPORARY PHOTOGRAPHIC NARRATIVES AS AN EDUCATIONAL TOOL FOR<br>THE DEVELOPMENT OF RELIGIOUS TOURISM IN GREEK URBAN AND REGIONAL<br>AREAS (K02062)<br><b>Tsilimpokou Vasiliki, Vlassas Vasileios, Koronaiou Aikaterini, Vlassas Grigorios</b> |
| 13.30-13.45        | ALTERNATIVE AND SPECIAL FORMS OF TOURISM IN THE GREEK CONTEXT, AS A<br>MOTIVE FOR RUSSIAN SPEAKING TOURISTS TO VISITING GREECE (K02063)<br><b>Zografos George</b>                                                                                |
| 13.45-14.00        | TIME-DRIVEN ACTIVITY-BASED COSTING & BUDGETING IN ECOTOURISM (AN ECO-<br>TOURISTIC HOTEL IMPLEMENTATION MODEL) (K02051)<br><b>Karagiannis Ioannis, Vazakidis Dimitrios</b>                                                                       |
| 14.00-15.00        | Conference Lunch - Finger Food                                                                                                                                                                                                                   |

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| 18.<br>09.00-11.00 | Pre-organised Special Session: <b>“Sustainable urban development”</b><br>Organised and chaired by <b>Prof Rodi Alcestis &amp; Chatzidimitriou Angeliki</b><br>(Room A4) (main building) |
| 09.00-09.15        | INDUSTRIAL DOMAINS AS FUTURE’S RUINS: CHALLENGES AND STRATEGIES FOR<br>SUSTAINABLE TRANSFORMATION (K02232)<br><b>Pikramenou Ourania</b>                                                 |
| 09.15-09.30        | THE 'GREEN' DIMENSION OF THE 15-MINUTE CITY. THE CASE STUDY OF ATHENS<br>MUNICIPALITY, GREECE. (K02236)<br><b>Geronta Eirini Chrysovalanto</b>                                          |
| 09.30-09.45        | UNDERGROUND DWELLINGS: THE COEXISTENCE OF MAN AND NATURE BENEATH<br>THE EARTH (K02237)<br><b>Geneiataki Elissavet, Chatzidimitriou Angeliki</b>                                         |
| 09.45-10.00        | MNEMONIC PATHWAYS AT THE ROMAN ODEON AND ROMAN STADIUM OF<br>PATRAS, ACHAIA, GREECE (K02240)<br><b>Papadopoulou Miranda</b>                                                             |

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| 10.00-10.15 | TOWARDS POST-GROWTH OPERATIONALIZATION: A BIOREGIONAL LENS OF SPATIAL PLANNING ( <a href="#">K02259</a> )<br><b>Xanthopoulos Giorgos</b>                                                                                  |
| 10.15-10.30 | CLIMATE RESPONSIVE ENVIRONMENTAL DESIGN IN ARCHITECTURE STUDIES ( <a href="#">K02262</a> )<br><b>Chatzidimitriou Angeliki</b>                                                                                             |
| 10.30-10.45 | READINGS OF THE NATURAL AND BUILT LANDSCAPE OF LAKE TRICHONIDA - A GUIDE TO DESIGN INTERVENTIONS BASED ON POINTS OF INTERFACE (Thesis project) ( <a href="#">K02263</a> )<br><b>Bovolou Eirini</b>                        |
| 10.45-11.00 | A LITERATURE REVIEW ON THE INTRODUCTION AND FUTURE DOMINANCE OF THE AUTONOMOUS VEHICLES IN THE CITY WITH THE AIM OF PREPARING THE CITY FOR THE FUTURE ( <a href="#">K02265</a> )<br><b>Petri G. Ioanna, Rodi Alcestis</b> |
| 11.00-11.15 | LIVING TOGETHER: AN EXPLORATION OF CO-LIVING FROM THE NEOLITHIC ERA TO THE 21 <sup>ST</sup> CENTURY ( <a href="#">K02264</a> )<br><b>Koutsogiannopoulou Angeliki Panagiota</b>                                            |
| 11.00-11.30 | Coffee Break                                                                                                                                                                                                              |

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| 19.<br>11.30-14.00 | Session: “ <b>Smart Cities and Sustainable Development</b> ”<br>Chaired by <b>Assoc Prof Konstantinidou Elena</b><br>( <a href="#">Room A4</a> ) ( <a href="#">main building</a> )                   |
| 11.30-11.45        | DIGITAL INNOVATION AND SUSTAINABLE DEVELOPMENT IN LOCAL GOVERNMENT. THE CASE OF GLYFADA MUNICIPALITY. ( <a href="#">K02037</a> )<br><b>Ahamnou G. Panagiota</b>                                      |
| 11.45-12.00        | OUR CITY IS SMART. WHAT ABOUT US? - THE CASE STUDY OF THE MUNICIPALITY OF PERISTERI, ATTICA, GREECE ( <a href="#">K02052</a> )<br><b>Tsagkari Ioulia</b>                                             |
| 12.00-12.15        | A REVIEW OF SMART CITIES’ TECHNOLOGIES IN THE GOVERNANCE AND THE EVERYDAY LIFE OF CITIZENS IN GREEK CITIES ( <a href="#">K02079</a> )<br><b>Zompos Kostas, Chasiotis Angelos, Piromalis Dimitris</b> |
| 12.15-12.30        | VIRTUAL WORLDS AND SUSTAINABLE ARCHITECTURE: NEW PATHWAYS TO SUSTAINABILITY IN THE ERA OF THE INDUSTRY 4.0 ( <a href="#">K02101</a> )<br><b>Kalemis Alexandros</b>                                   |
| 12.30-12.45        | EXPLORING SOCIAL PATTERNS AND CHALLENGES IN ADOPTING SMART HOUSING SOLUTIONS: THE HUNGARIAN CONTEXT ( <a href="#">K02106</a> )<br><b>Csizmady Adrienne</b>                                           |
| 12.45-14.00        | Discussion                                                                                                                                                                                           |

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| 20.         | <b>Keynote Speech</b><br>(Room A5) (main building)                                                                            |
| 09:00-09:30 | SUSTAINABLE CITY DEVELOPMENT (K02245)<br><b>Joseph Stefanou</b> , Professor Emeritus, National Technical University of Athen. |

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| 20.         | Session: <b>“The Physiognomy of cities”</b> , Chaired by <b>Prof Joseph Stefanou</b><br>(Room A5) (main building)                                                                                                                               |
| 09.30-11.00 |                                                                                                                                                                                                                                                 |
| 09.30-09.45 | URBAN LANDSCAPES OF SUSTAINABLE CO-EXISTENCE (K02107)<br><b>Petratou - Fragiadaki Smaragda</b>                                                                                                                                                  |
| 09.45-10.00 | CO-CREATING PLACE IDENTITY: PARTICIPATORY WORKSHOPS FOR PLACE<br>BRANDING ALIGNED WITH LOCAL VALUES (K02135)<br><b>Apostolou Angelina, Birou - Athanasiou Vasiliki, Chatzigiannidou Alkisti,<br/>Katsavounidou Garyfallia, Kourti Paraskevi</b> |
| 10.00-10.15 | CULTURE AND SUSTAINABLE DEVELOPMENT OF CITIES: THE PHYSIOGNOMY OF THE<br>CITY OF LAGKADAS (K02095)<br><b>Athanasaki Marina</b>                                                                                                                  |
| 10.15-10.30 | THE FORMATION OF THE PHYSIOGNOMY OF THE ISLAND OF ZAKYNTHOS - THE<br>OPINION OF RESIDENTS AND VISITORS (K02061)<br><b>Papadopoulos Joseph</b>                                                                                                   |
| 10.30-10.45 | THE FORMATION OF THE PHYSIOGNOMY OF THE CITY OF TRIPOLI- THE OPINION OF<br>RESIDENTS AND VISITORS (K02058)<br><b>Karamanos Konstantinos</b>                                                                                                     |
| 10.45-11.00 | THE FORMATION OF THE PHYSIOGNOMY OF THE CITY OF KALLITHEA - THE OPINION<br>OF RESIDENTS AND VISITORS (K02114)<br><b>Laoutari Nikoletta</b>                                                                                                      |
| 11.00-11.30 | Coffee Break                                                                                                                                                                                                                                    |

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| 21.         | Session: <b>“Digital Cities and Sustainable Development”</b><br>Chaired by <b>Prof Panetsos Georgios</b><br>(Room A5) (main building)                                                                                                                    |
| 11.30-14.00 |                                                                                                                                                                                                                                                          |
| 11.30-11.45 | AN ONLINE PLATFORM FOR ENABLING OPEN DATA COLLECTION, STORAGE,<br>ANALYSIS AND CLASSIFICATION OF WATER MANAGEMENT DATA FOR THE ATTICA<br>REGION IN GREECE (K02045)<br><b>Antoniadis Ioannis, Drakou Evangelia, Tsadimas Anargyros, Kousiouris George</b> |
| 11.45-12.00 | TOWARDS A SUSTAINABLE DIGITAL TRANSFORMATION: THE ROLE OF HUMAN<br>RESOURCES IN PUBLIC ADMINISTRATION AND CITIZEN SATISFACTION. THE CASE OF<br>THE MUNICIPALITY OF KILLELER (K02078)<br><b>Trakala Georgia, Koukoumialos Stylianos</b>                   |

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| 12.00-12.15 | THE ROLE OF NEW TECHNOLOGY INTO FIGHTING AGAINST POVERTY AND SOCIAL ALIENATION. STUDYING THE INNOVATIVE DIGITAL PLATFORM USE WITHIN THE REGION OF CRETE ( <a href="#">K02097</a> )<br><b>Spyridaki Aikaterini, Papadakaki Maria, Vassilakis Kostas, Markakis George</b> |
| 12.15-12.30 | THE DESIGN AND DEVELOPMENT OF A MOBILE APPLICATION FOR SUSTAINABLE INTERACTION WITH CULTURAL HERITAGE: THE ‘THESSALONIKI REIMAGINED’ PROJECT ( <a href="#">K02139</a> )<br><b>Dialechti Anthi</b>                                                                       |
| 12.30-12.45 | RECONNECTING MYSTRAS: LINKING ARTIFACTS TO HISTORY THROUGH DIGITAL NARRATIVES ( <a href="#">K02235</a> )<br><b>Panagiotidis V. Vayia, Georgakopoulou Garyfalia</b>                                                                                                      |
| 12.45-13.00 | CREATION OF A DEVELOPMENT RIGHTS MANAGEMENT MECHANISM USING BLOCKCHAIN TECHNOLOGY ( <a href="#">K02194</a> )<br><b>Christodoulou Dimitrios</b>                                                                                                                          |
| 13.00-13.15 | INFORMATION LITERACY FOR CULTIVATING SUSTAINABLE MINDSET ( <a href="#">K02068</a> )<br><b>Katsira Georgia, Koulouris Alexandros, Vraimaki Eftichia, Efthymiou Foteini</b>                                                                                               |
| 13.15-14.00 | Discussion                                                                                                                                                                                                                                                              |

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| 22.<br>09.00-10.00 | Session: “ <b>Urban Environment and Sustainability</b> ”<br>Chaired by <b>Prof Skarvelis Michail</b><br>(Room A6) (main building)                                                                                                                                                                  |
| 09.00-09.15        | ASSESSMENT OF THE EFFECT OF GREEN ROOFS ON URBAN STORMWATER MANAGEMENT IN THESSALONIKI, GREECE ( <a href="#">K02110</a> )<br><b>Almazidou-Kairi Ioanna-Viktoria, Salasidou Elissavet, Kapouniari Maria, Zafeirakou Antigoni</b>                                                                    |
| 09.15-09.30        | ACHIEVING URBAN SUSTAINABILITY THROUGH CIRCULARITY: THEORIES AND PRACTICES ( <a href="#">K02075</a> )<br><b>Stogianovits Matei</b>                                                                                                                                                                 |
| 09.30-09.45        | Km Vert (Green Kilometer project) SYSTEM FOR URBAN REGENERATION ( <a href="#">K02171</a> )<br><b>Marcuccetti Andrea</b>                                                                                                                                                                            |
| 09.45-10.00        | THE MULTIFUNCTIONAL ROLE OF BOTANICAL GARDENS FOR THE SUSTAINABLE DEVELOPMENT OF CITIES: AN URBAN RENEWAL STUDY WITH THE CREATION OF AN ARBORETUM AT THE UNIVERSITY OF THESSALY IN KARDITSA, GREECE ( <a href="#">K02137</a> )<br><b>Eleftheriou Vasilis, Samaras Dimitrios, Skarvelis Michail</b> |

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| 23.<br>10.00-11.00 | Session: “ <b>Industry, Services and Sustainability</b> ”<br>Chaired by <b>Prof Arauzo-Carod Josep-Maria</b><br>(Room A6) (main building)                                                                           |
| 10.00-10.15        | INTEGRATING SUPPLY CHAIN PRACTICES TO MITIGATE CIRCULAR ECONOMY RISKS: A QUALITATIVE STUDY OF THE GREEK FURNITURE SECTOR ( <a href="#">K02066</a> )<br><b>Ntio Despoina, Adamopoulos Antonios, Kotsas Stamatios</b> |

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| 10.15-10.30 | FROM QUANTITATIVE TO QUALITATIVE SERVICES: HOW TO PROMOTE INTEGRATED PLANNING FOR THE REVISION OF THE SERVICE PLAN OF MANTUA, MUNICIPALITY IN ITALY ( <a href="#">K02179</a> )<br><b>Borini Martina</b> |
| 10.30-10.45 | SUSTAINABLE DEVELOPMENT AND THE GREEK PHARMACEUTICAL INDUSTRY ( <a href="#">K02117</a> )<br><b>Charitou Aikaterina</b>                                                                                  |
| 10.45-11.00 | INDUSTRIAL SYMBIOSIS – SITUATION IN MAURITIUS ( <a href="#">K02138</a> )<br><b>Erceg Aleksandar, Sannegadu Rajesh</b>                                                                                   |
| 11.00-11.30 | Coffee Break                                                                                                                                                                                            |

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| 24.<br>11.30-14.00 | Session: <b>“Urban and Regional Sustainable Development”</b><br>Chaired by <b>Prof Nikolaou Dimitra</b><br>(Room A6) (main building)                                    |
| 11.30-11.45        | MANAGING AGRICULTURAL LAND AND LANDSCAPE IN THE ISLANDS: CHALLENGES AND STRATEGIES ( <a href="#">K02042</a> )<br><b>Vlahos George, Pavlis Evangelos</b>                 |
| 11.45-12.00        | COGNITIVE URBAN MAPS AS A BINDING ELEMENT OF LOCAL IDENTITY ( <a href="#">K02092</a> )<br><b>Kalergis Dimitris</b>                                                      |
| 12.00-12.15        | ISSUES OF DEATH AND ECOLOGY: RECONSIDERING THE ROLE OF FUTURE CEMETERIES IN THE CITY ( <a href="#">K02099</a> )<br><b>Nikolaïdi Galini, Lountzis Georgios Dionysios</b> |
| 12.15-12.30        | WITH THE GAZE OF PLACE-MULTIFUNCTIONAL COMPLEX IN DORIDA ( <a href="#">K02076</a> )<br><b>Apostolatou Eleni</b>                                                         |
| 12.30-12.45        | MOVING FROM LOCALITY TO LOCABILITY TOWARDS SUSTAINABLE PLACE BRANDING ( <a href="#">K02172</a> )<br><b>Briana Maria, Malindretos George</b>                             |
| 12.45-13.00        | ANCIENT HARBOR OF LECHAION: REDEFINING THE PLACE ( <a href="#">K02096</a> )<br><b>Nikolaou Dimitra, Sakki Athin, Skoupa Anastasia-Alexandra</b>                         |
| 13.00-13.15        | A SPATIAL ANALYSIS OF URBAN POVERTY: THE CASE OF KUSTEPE NEIGHBORHOOD ( <a href="#">K02049</a> )<br><b>Gözde Arzu Sarıcan, Elifsu Şahin, N.Hülya Berkmen</b>            |
| 13.15-14.00        | Discussion                                                                                                                                                              |
| 14.00-15.00        | Conference Lunch - Finger Food                                                                                                                                          |

Delegates will soon receive an email regarding a special visit for Saturday, February 15th, from 15:00 to 20:00, to the Athens Olympic Museum and Olympic Athletic Center of Athens ‘Spiros Louis’.

Your participation would be appreciated and confirmation for this visit is required. Please note that this visit is contingent on there being a minimum number of participants.



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### DAY 3 - Sunday 16/02/2025

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| 25.<br>09.00-10.30 | <b>Session: “Tourism, Culture and Sustainable Development of Places” Chaired by Olga-Eleni Astara (online) <a href="https://meet.google.com/adr-trzz-gvv">https://meet.google.com/adr-trzz-gvv</a></b>                                                                                |
| 09.00-09.15        | SUSTAINABILITY AND CULTURAL HERITAGE: AXIOM OR OXYMORON? (K02180)<br><b>Imbesi Paola Nicoletta</b>                                                                                                                                                                                    |
| 09.15-09.30        | THE EUROPEAN CITIES: CULTURAL CHANGE FOR SUSTAINABLE CITY SPACES (K02152)<br><b>Mickov Biljana</b>                                                                                                                                                                                    |
| 09.30-09.45        | THE IMPACT OF HERITAGE-LED URBAN REGENERATION ON DESTINATION IDENTITY AND DESTINATION MARKETING; STAKEHOLDERS’ PERSPECTIVE; THE CASE OF THE TOBACCO WAREHOUSE IN KAVALA. (K02030)<br><b>Fragkoudi Vasiliki (Vicky), Gkritzali Alkmini, Manolitzas Panagiotis, Sarantakou Efthymia</b> |
| 09.45-10.00        | ASSESSING THE FEASIBILITY OF PARTICIPATORY GOVERNANCE IN SUSTAINABLE TOURISM: CASE STUDY, SYROS (K02046)<br><b>Tsimpoulis Georgios</b>                                                                                                                                                |
| 10.00-10.15        | THE ECONOMIC, SOCIAL AND ENVIRONMENTAL IMPACT OF SPORTS TO TOURISM IN THE CASE OF GREECE (K02178)<br><b>Panagiotopoulos Panagiotis</b>                                                                                                                                                |
| 10.15-10.30        | DEVELOPMENT OF ALTERNATIVE FORMS OF TOURISM IN THE ISLAND REGION OF THE MUNICIPALITY OF WEST SAMOS (K02134)<br><b>Lepenioti Despoina-Dimitra</b>                                                                                                                                      |
| 10.30-10.45        | THE FORMATION OF THE PHYSIOGNOMY OF THE CITY OF NAFPAKTOS (K02266)<br><b>Oikonomou Konstantina</b>                                                                                                                                                                                    |

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| 26.<br>11.00-12.30 | <b>Pre-organised Special Session: “Cities Physiognomy”<br/>Organised and chaired by Joseph Stefanou &amp; Roido Mitoula (online) <a href="https://meet.google.com/fqw-hmbv-pqp">https://meet.google.com/fqw-hmbv-pqp</a></b> |
| 11.00-11.15        | THE FORMATION OF THE PHYSIOGNOMY OF THE ISLAND OF HERAKLIO. THE OPINION OF RESIDENTS AND VISITORS. (K02040)<br><b>Michelaki Eleftheria</b>                                                                                   |
| 11.15-11.30        | THE FORMATION OF THE PHYSIOGNOMY OF THE CITY OF IOANNINA - THE OPINION OF RESIDENTS AND VISITORS (K02098)<br><b>Spachos Triantafyllos</b>                                                                                    |
| 11.30-11.45        | THE FORMATION OF THE PHYSIOGNOMY OF THE CITY OF MONEMVASIA - THE OPINION OF RESIDENTS AND VISITORS (K02111)<br><b>Alpa Natalia-Maria</b>                                                                                     |

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| 11.45-12.00 | THE FORMATION OF THE PHYSIOGNOMY OF THE CITY OF VOLOS - THE OPINION OF RESIDENTS AND VISITORS (K02127)<br><b>Vasilakou Eftychia</b> |
| 12.00-12.15 | ENVIRONMENTAL PROFILE A REGION KARDITSA (K02122)<br><b>Velagia Maria</b>                                                            |
| 12.15-12.30 | Discussion                                                                                                                          |

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| 27.<br>12.00-13.00 | Session: “ <b>Entrepreneurship and Local Sustainability- ESG Criteria</b> ”<br>Chaired by <b>Panagiota Karametou</b> (online) <a href="https://meet.google.com/fqa-rcmd-adi">https://meet.google.com/fqa-rcmd-adi</a> |
| 12.00-12.15        | THE APPLICATION AND EFFECTIVENESS OF ESG CRITERIA IN GREEK COMPANIES (K02090)<br><b>Kani Anastasia-Theodora, Karametou Panagiota, Mitoula Roido, Economou Agisilaos</b>                                               |
| 12.15-12.30        | THE EFFECT OF ESG CRITERIA ON CONSUMER PREFERENCES REGARDING THE CHOICE OF A COMPANY’S PRODUCTS AND SERVICES (K02108)<br><b>Christofilis Konstantinos, Karametou Panagiota, Mitoula Roido, Sdrali Despina</b>         |
| 12.30-12.45        | SUSTAINABLE DEVELOPMENT AND ENTREPRENEURSHIP IN MOUNTAIN COMMUNITIES. METSOVO CASE STUDY (K02143)<br><b>Karagiannis George</b>                                                                                        |
| 12.45-13.00        | THE HUMAN SIDE OF SUSTAINABILITY: THE ROLE OF LEADERSHIP IN EMPLOYEE WELLBEING (K02091)<br><b>Dologlou Maria, Mitoula Roido</b>                                                                                       |

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| 28.<br>13.00-14.45 | Session: “ <b>Urban Regeneration and Environment</b> ”,<br>Chaired by <b>Dr Papavasileiou Angelos</b> (online) <a href="https://meet.google.com/axo-bpym-zky">https://meet.google.com/axo-bpym-zky</a>                   |
| 13.00-13.15        | THE IMPACT OF ENVIRONMENTAL EDUCATION ON SUSTAINABLE DEVELOPMENT, ENVIRONMENTAL CONSCIOUSNESS AND PRO-ENVIRONMENTAL BEHAVIOUR (K02038)<br><b>Nastos Georgios, Mitoula Roido, Theodoropoulou Eleni, Astara Olga-Eleni</b> |
| 13.15-13.30        | THE ‘ELLINIKON’ RENOVATION PROJECT: BALANCING ECONOMIC DEVELOPMENT AND SOCIAL EQUITY IN ATHENS (K02118)<br><b>Karametou Panagiota, Mitoula Roido, Papavasileiou Angelos, Tsimpoulis Georgios</b>                         |
| 13.30-13.45        | THE USE OF NEW TECHNOLOGIES IN THE PRIMARY PRODUCTION SECTOR (K02149)<br><b>Petridis Dimitris, Mitoula Roido, Kalantonis Petros, Astara Olga-Eleni</b>                                                                   |
| 13.45-14.00        | SUSTAINABLE DEVELOPMENT, HUMAN HEALTH AND QUALITY OF LIFE - CASE STUDY: REGIONAL UNIT OF PIRAEUS, GREECE (K02081)<br><b>Derventi Maria, Mitoula Roido, Theodoropoulou Eleni, Karagianni Vilelmini</b>                    |
| 14.00-14.15        | CONTRIBUTION OF URBAN REGENERATION TO SUSTAINABLE DEVELOPMENT: THE CASE OF PIRAEUS (K02085)<br><b>Tsiare Kolliopoulou Thaleia Eleni, Mitoula Roido, Economou Agisilaos, Karametou Panagiota</b>                          |

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| 14.15-14.30 | IDENTIFICATION OF BOUNDARIES OF MEASUREMENTS FOR CITY ENVIRONMENTAL QUALITY (K02024)<br><b>Hasni Gayathma Gunasekara, K. K. K. Sylva, T. D. S. V. Dias</b> |
| 14.30-14.45 | FROM WASTE MANAGEMENT TO CIRCULAR ECONOMY? THE ROLE OF ENVIRONMENTAL CONFLICTS IN POLICY MAKING IN ATTICA REGION (K02174)<br><b>Kolokouris Orestes</b>     |

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| 29.<br>14.00-19.00 | Pre-organised Special Session: “ <b>ECO4ALL FOR CONSUMER PROTECTION THROUGH CIRCULAR ECONOMY STRATEGIES - THE CONTRIBUTION TO SUSTAINABLE DEVELOPMENT</b> ” Organised by <b>Prof Plotnic Olesia</b> (COST ACTION 22124 ECO4ALL) and chaired by <b>Mihaela Tofan</b> (online) <a href="https://meet.google.com/dbk-yiey-dnw">https://meet.google.com/dbk-yiey-dnw</a> |
| 14.00-14.15        | CIRCULAR ECONOMY AND SUSTAINABLE CONSUMPTION AS LEVERAGE FOR GREEN GROWTH AND CONSUMER PROTECTION (K02150)<br><b>Radukic Snezana, Stankovic Zorana, Sakici Şehnaz, Yaprak Burak, Avdullahi Ajtene, Dionizi Brikene, Espinosa Nieves</b>                                                                                                                              |
| 14.15-14.30        | CIRCULAR ECONOMY: CONNECTING INDUSTRY WITH SOCIETY (K02200)<br><b>Gama Nuno</b>                                                                                                                                                                                                                                                                                      |
| 14.30-14.45        | OVERCOMING THE BARRIERS TO CIRCULAR ECONOMY PRACTICES IN DIFFERENT REGIONS: THE CASE OF TURKEY (K02202)<br><b>Karabulut Yasemin</b>                                                                                                                                                                                                                                  |
| 14.45-15.00        | FOSTERING CIRCULAR ECONOMY PRACTICES IN ALBANIAN PUBLIC UNIVERSITIES: A PATHWAY TO SUSTAINABLE DEVELOPMENT (K02204)<br><b>Idrizi Altin</b>                                                                                                                                                                                                                           |
| 15.00-15.15        | ANALYSIS OF POLICY FRAMEWORKS RELATED TO CIRCULAR ECONOMY IMPACT IN AGRICULTURE, ALBANIAN CASE (K02206)<br><b>Gecaj Merita</b>                                                                                                                                                                                                                                       |
| 15.15-15.30        | THE ROLE OF RENEWABLE ENERGY IN SHAPING INCOME (IN)EQUALITY DYNAMICS IN SOUTHEAST EUROPEAN COUNTRIES (K02207)<br><b>Kalaj Ermira</b>                                                                                                                                                                                                                                 |
| 15.30-15.45        | AN EXAMINATION OF ZERO WASTE MANAGEMENT IN UNIVERSITIES IN THE CONTEXT OF CIRCULAR ECONOMY: A CASE STUDY OF DUZCE UNIVERSITY (K02208)<br><b>Gultekin Pinar</b>                                                                                                                                                                                                       |
| 15.45-16.00        | BIBLIOMETRIC ANALYSIS OF ACADEMIC STUDIES PUBLISHED ON CIRCULAR ECONOMY IN TURKEY (K02209)<br><b>Gültekin Yaşar Selman</b>                                                                                                                                                                                                                                           |
| 16.00-16.15        | INTEGRATING CIRCULAR ECONOMY INTO SUSTAINABLE DEVELOPMENT GOALS: INSIGHTS FROM LIFE CYCLE IMPACT ASSESSMENT (K02211)<br><b>Rajic Milena</b>                                                                                                                                                                                                                          |
| 16.15-16.30        | SMART CITIES AS DRIVERS OF TWIN TRANSITION - EVIDENCE FROM THE REPUBLIC OF SERBIA (K02212)<br><b>Vukadinovic Simonida, Jesic Jelena, Kisin Jovana</b>                                                                                                                                                                                                                |

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| 16.30-16.45 | FROM POLICY TO PRACTICE: EXAMINING THE AGENCY-DRIVEN DYNAMICS OF TURKEY’S ZERO WASTE MOVEMENT AND ITS IMPACT ON RECYCLING (K02213)<br><b>Ates Seyithan</b>                                                                       |
| 16.45-17.00 | WASTE MANAGEMENT PRACTICES IN TURKEY PAST AND PRESENT (K02220)<br><b>Kafadar Muhammed Halid</b>                                                                                                                                  |
| 17.00-17.15 | CIRCULAR ECONOMY APPLICATIONS WITHIN THE FRAMEWORK OF SUSTAINABILITY IN TURKEY (K02221)<br><b>Acma Bulent</b>                                                                                                                    |
| 17.15-17.30 | ENHANCING SUSTAINABILITY WITH CIRCULAR ECONOMY PRACTICES: MULTI-CRITERIA SOLUTIONS (K02222)<br><b>João Zambujal-Oliveira</b>                                                                                                     |
| 17.30-17.45 | THE ROLE OF EDUCATION IN SUSTAINABLE CONSUMPTION AWARENESS AMONG ALBANIAN STUDENTS (K02223)<br><b>Sula Oliana</b>                                                                                                                |
| 17.45-18.00 | FOSTERING CROSS-BORDER COOPERATION BETWEEN NORTH MACEDONIA AND GREECE FOR CIRCULAR ECONOMY SUCCESS: A MODEL FOR REGIONAL SUSTAINABILITY (K02233)<br><b>Bojkovska Katerina, Stojkovski Viktorija, Pelivanoska-Dameska Daniela</b> |
| 18.15-18.30 | IMPLEMENTATION OF THE GLOBAL GATEWAY STRATEGY THROUGH THE NEW EU CIRCULAR ECONOMY RESOURCE CENTRE (K02102)<br><b>Khachikyan Sos, Sakici Şehnaz, Cunha Carlos, Yaprak Burak, Rajic Milena</b>                                     |
| 18.30-18.45 | CIRCULAR ECONOMY STRATEGIES FOR SUSTAINABLE RESOURCE MANAGEMENT IN THE CONSTRUCTION INDUSTRY (K02198)<br><b>Petrovski Aleksandar</b>                                                                                             |

Closing of the Conference

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# **CONFERENCE PAPERS**

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## **Keynote Papers**

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### **EROS AND THE CITY: MAKE THE CULTURAL URBAN-SCAPE FLOURISH!**

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#### **Abstract**

We shall present ‘Eros’, as a metaphor of our need and desire to encounter others and, moreover, as a metaphor of an instinctive force that social ethics and social morality continuously attempt to control. Nevertheless, despite this controlling effort, new desired drives emerge, challenging social controlling indications.

In our text, the title ‘Eros and the City’ seems provocative enough. However, what is even more provocative than the reference to the bodily contact may be the comment that besides your or others’ top-down restriction, bottom-up desires will attempt to ‘flourish’, definitely. It was in the late 19<sup>th</sup> century that Charles Baudelaire described in his *Les Fleurs du Mal*, his erotic gaze to a seductive lady, in the Parisian urban context of important cultural and political transformations. Were his political aspirations, his political ‘Eros’ more important than his love fantasies? It is in central Athens that a contemporary Greek composer sees his own female image of attraction, “αυτήν που περνάει – the one passing by”; she makes the neutral Athenian streets blooming. I could probably ask for a real garden embellishment of the urban-scape, or for the ‘blooming’ of the collaborative osmosis of the citizens.

In comparison to the previous poetic descriptions, I prefer to insist on the most impressive metaphor of erotic urbanity, on our love for our city itself, or, on our effort for the cohesion of the urban population as presented in three examples:

- a collaborative urban formation of transcultural coexistence in a student’s project under the title Plato’s Gardens,
- a ‘post-processual’ historic itinerary from Kerameikos ancient cemetery to the Islamic temple of Eleonas, and finally,
- a proposed hybrid guided visit of cultural and political narratives, in the twin central squares of the Kaisariani municipality.

**Keywords:** Eros, city and cultural urban-scape, ‘erotic’ urbanity, bottom-up, top-down, urban coexistence, transcultural coexistence, collaborative urban gardening.

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### **An introductory comment:**

The following text was presented as a conference lecture on February 14<sup>th</sup>, on St. Valentine’s Day. Nevertheless, at the time that the subject of the text and its title were decided the author did not know about the exact date of its presentation. Was it a strange coincidence?

### **Eros as a general metaphor of our need to encounter others**

Is this a poetic approach or a scientific one? We shall return to this question at the end of our presentation.

We shall present ‘Eros’, as a metaphor of our need and desire to encounter others and, moreover, as a metaphor of an instinctive force that social ethics and social morality continuously attempt to control. Nevertheless, despite this controlling effort, new desired drives emerge, challenging social controlling indications. Is ‘open-air’ urban-scape the par excellence space for the expression of social common desires? ***‘Open-air’, terms associated with the subject of the conference in which this text was presented, terms associated with the extended public urban identity.***

In our text, the title ‘Eros and the City’ seems provocative enough. However, what is even more provocative than the reference to the bodily contact may be the comment that besides their or our top-down restriction, bottom-up desires will attempt to ‘flourish’, definitely. It was during late 19<sup>th</sup> century that Charles Baudelaire described in his *Les Fleurs du Mal*, his erotic gaze to a seductive lady, “à une passante – to a passer-by lady”, in the Parisian urban context of important cultural and political transformations (Baudelaire, 1861 – Benjamin, 1955 & 1994). Were his cultural and political aspirations, his cultural and political ‘Eros’ more important than his love fantasies (Bataille, 1990: pp. 43-45)? Were those erotic fantasies projected in the seductive urban environment of the Parisian arcades, during his poetic “flâneries”, his leisurely poetic stroll – during his leisurely walk in the ‘porosity’ of the city?

It is in the context of an analogous urban phantasy, in the center of Athens that a contemporary Greek composer sees his own female image of attraction, “αυτήν που περνάει – the lady passer-by”, probably in correlation to the previous Beaudelaire’s poetical description; she makes, according to him, the neutral Athenian streets ‘blooming’; or the Athenian streets are not neutral anymore. What invigorates the composer’s erotic gaze, is the intensity of urban life, in relation to a part of the city full of commercial stores and coffee shops, at the vicinity of active academic buildings, where the passing-by young lady, a university student at the School of Philosophy, is directed. I could probably ask for a real garden embellishment of the urban-scape or is it even more interesting to ask for the ‘blooming’ of the citizens’ conduct in general, for collaborative osmosis of the citizens, in the ‘open-air’ part of the city.



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**Img. 1:** Charles Baudelaire described, in his *Les Fleurs du Mal*, his erotic gaze to a seductive lady, “à une passante – to a passer-by lady”, probably in the context of the Parisian arcades - “The deafening street roared on. Full, slim, and grand... A woman... Noble and swift, her leg with statues matching” (upper line of images). In an analogous context, the Greek rock musician, singer, and songwriter Phoebus Delivorias, describes his own erotic urban fantasy (bottom image).

### The space and social ‘porosity’ of the city

Let us move from the terms ‘open-air’ to the term ‘porosity’, as introduced by the middle 20<sup>th</sup> century German intellectual Walter Benjamin, ‘Porosität’ in its initial German application, is etymologically correlated with the Greek words ‘porodis – πορώδης’ and ‘poros – πόρος’. In materials science, a porous medium or a porous material is a material containing pores, voids. In Benjamin’s theoretical approach ‘porosity’ may also describe the voids existing in the city formation, voids among the buildings or even voids in the interior of them being in immediate conduct with the exterior ‘open-air’ city. Analogous ‘porous’ city-scape formations as those noticed by him during his visit to the Italian city of Naples (Demetz edit., 1986), may offer to the city life intense conduct among the citizens, by corroding the barriers between secluded privacy and social life. It is the same result that Benjamin attributed to the porous formations of the commercial arcades, ‘les passages couverts’ in French, characteristic of many important Western cities (Benjamin, 1997 – Buck Morss, 1991 - Moraitis, 2024: pp. 305-367). Though strongly related to commercial needs, the arcades created a positive urban environment, an important urban cultural landscape, an important urban-scape, ‘open’ to passers-by and protected in the same time. An open and protected urban environment, characterized by ‘la fantasmagorie’, the phantasmagoria as a crystallization of collective desires and phantasies, motivated by the illusionary halo of commercial promotion.

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**Img. 2:** On the right, the ‘porous’ quarters of Naples. There, Asja Lācis (upper left) and Walter Benjamin (left down) firstly conceived the importance of urban porosity.

Commercialized or not, the urban porosity seems to me an important quality of the city, not solely a material quality but rather, as Benjamin described it in correlation with Naples, a social quality, a quality related to the social conduct, thus culturally and probably politically crucial. A cultural quality that could be considered as socially important in general, even outside its commercial appropriation; or to use a better statement, a cultural quality whose general social importance is exploited by commercial promotion.

In 2010, working on a research program concerning the Central Areas of Athens and Piraeus and more precisely their cultural landscape and their environmental upgrading, we decided to work on the approach of the Athenian porosity, firstly analyzing the continuity of the open spaces, and the arcades or the covered walkways of the city <sup>1</sup>. Then we decided to focus on a specific type of urban porosity, using the terms ‘green porosity’, and insisting on a proposal for a Landscape Network, in the Metropolitan Territory of Athen. We could thus go back to an initial 19th century approach characterized by the famous American landscape architect Frederick Law Olmsted, under the description “Emerald Necklace”; needless to explain that emeralds are precious stones of green color. Olmsted’s emerald necklace, proposed in the general context of the 19th century ‘park movement’, referred to the territory of Boston, insisting on the central concept that park, park ways or ‘green corridors’, constitute

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<sup>1</sup>The proposal presented was elaborated as part of the research program “Changing Characters and Policies in the Center of Athens and Piraeus”, a program assigned to the School of Architecture NTUA, by the Hellenic Ministry of Environment, Energy and Climate Change (scientific responsible prof. P. Tournikiotis, Athens 2010-2011). In this context the author, in collaboration with architect S. Mouzakis, principally investigated the network of the open-air parts of the city, in the central urban area of Athens and, in addition, the possible plantation ‘green’ network in the Athenian metropolitan territory.

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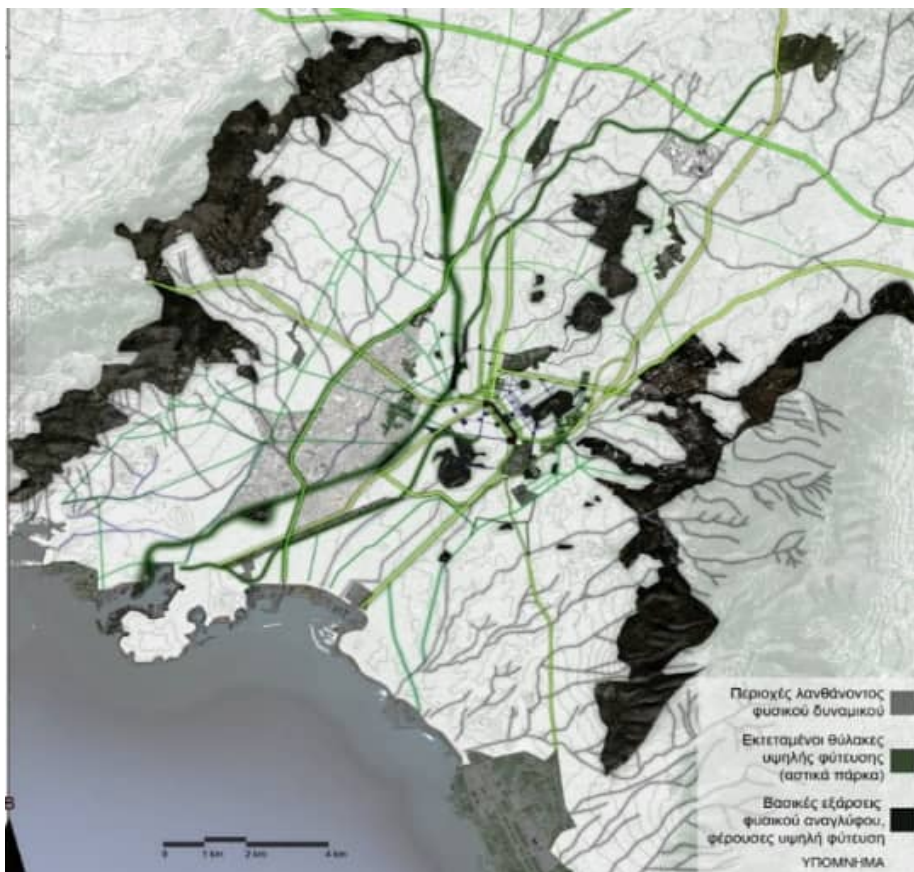
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a democratic right of the urban citizens (Chadwick, 1966 – Beveridge & Rocheleau, 2005: 96-108).



**Img. 3:** Porosity in the metropolitan area of Athens: the continuity of the open-air urban places and their correlation to the interior of historic and important building complexes.



**Img. 4:** ‘Green Porosity’ in the metropolitan area of Athens.

Eros, according to ancient Greeks was “the first among the gods - πρώτιστος... θεών... πάντων”, as described by the pre-Socratic Greek philosopher Parmenides, in a fragment of his poem “On Nature – ΠερίΦύσιος” (Karagiannis, 2019: pp. 43-44). “Of all the gods, firstly



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Eros was contrived”, the one participating to the formation of every existence, the one who initially fertilized nature helping “the earth, and the sun, and the moon, and the sky that is common to all, and the Milky Way, and the outermost Olympos, and the burning might of the stars (helping all those substances to) arose”.

Surely, Eros also invigorated the existence of human communities, driving humans to embrace each other. In closer to us presentations, Eros strongly evolves in urban context, in the porosity of the cities, in the porous urban context of Naples, where Benjamin firstly impressed by the social importance of the ‘open-air’ parts of city, in its porous correlation with built structure, in the porous correlation seductively described in the well-known film by Vittorio de Sica “Yesterday, Today, Tomorrow - Ieri, Oggi, Domani”, a film with Sophia Loren, and Marcello Mastroianni. You may find analogous reference of erotic fragrance and intense community contact in a film of Greek neo-realism, under the title “A neighborhood named Dream – Συνοικία το Όνειρο”, by Alekos Alexandrakis (Moraitis 2024, pp. 316–318). An intense community contact, existing in the poor neighborhoods of the past, nevertheless lost in the richer, nowadays urban context.



**Img. 5:** Upper image, “Yesterday, Today, Tomorrow - Ieri, Oggi, Domani”, a 1963 film by Vittorio de Sica, with Sophia Loren, and Marcello Mastroianni; Italian neorealism in the ‘porous’ quarters of Naples, where Lācis and Walter Benjamin firstly conceived the importance of urban porosity. Bottom images, neo-Hellenic, post-war Athenian social and erotic porosity: “A neighborhood named Dream”, by Alekos Alexandrakis.

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**\* Plato's Gardens**

**\* proposed green network, Plato's Academy**

**ακριβής θέση του οικοπέδου παρέμβασης**

**Ακαδημία Πλάτωνος**

**\* Athens city center**

**\* Permaculture**

Permaculture is a design system with holistic way of thinking that aims to create socially, economically and ecologically sustainable communities. Plato's Gardens aimed to apply the permaculture principles throughout the designing process, as well as in the functioning of the park.

**DESIGN PRINCIPLES**

- use edges & value the marginal
- use & value diversity
- use small & slow solutions
- integrate rather than segregate
- design from patterns to details

**PERMACULTURE ETHICS**

- care of the earth
- care of people
- use & value renewable resources & services

**3 αρχές της Permaculture**

**\* Permaculture Principles**

1. use & value renewable resources & services

2. use & value local knowledge & resources

3. use & value local knowledge & resources

4. use & value local knowledge & resources

5. use & value local knowledge & resources

6. use & value local knowledge & resources

7. use & value local knowledge & resources

8. use & value local knowledge & resources

9. use & value local knowledge & resources

10. use & value local knowledge & resources

11. use & value local knowledge & resources

12. use & value local knowledge & resources

**8**

**Plato's Gardens**

**map of situation, scale 1:40,000 • map of location, scale 1:20,000**

Is erotic desire an important part of human behavior? Is it an important part of human nature to live in communities? Is it this, communal existence, an important expression of human nature? As a consequence, is urban landscape important for human communities, for communal human nature that there, this communal human nature, may be ‘planted’ and ‘germinate’, in the open-air parts of the cities and in their correlation to the porous build environment? Trying to respond to this aporia we shall present a proposal for the formation of a complex of collective self-managed gardens, under the name *“Plato’s Gardens”*, at the territory of Plato’s Academy, a complex of collective self-managed gardens organized on the principles of Permaculture <sup>2</sup>. Let us explain that *“Permaculture”* is an approach to land

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management and settlement design that adopts arrangements observed in flourishing natural ecosystems. It includes a set of design principles using *whole-systems thinking*. *It applies these principles in fields such as regenerative agriculture, town planning, rewilding, and community resilience.*



**Img. 7:** General masterplan describing the proposal of Plato's Gardens. Winery (1), open-air market dedicated to the sale of the Gardens' products (2), installations of experimental hydroponic horticulture (3), pre-existing archeological site (4), vegetable gardens (5), greenhouses (6), vineyards (7), fruit gardens (8), educational vegetable garden (9), zone at the periphery of the site dedicated to olive trees (10).

The term 'Permaculture' was coined in 1978 by Bill Mollison and David Holmgren, who formulated the concept in opposition to modern industrialized methods, instead adopting a



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more traditional or close to nature approach to agriculture. Let us insist on the remark that the term ‘permaculture’ may refer to the ‘*per*-manent agri-*culture*’, as well as to the “*per*-manent human *culture* in general”. We have previously described permaculture as a whole-systems way of thinking, associated with community resilience. ***It is thus a matter of eco-productive as well as of socio-cultural demand. Its correlation to an important cultural- archeological territory, such as Plato’s Academy, may be considered extremely stimulating.***

***The general masterplan of the proposal for Plato’s Gardens describes several possible functions. An openair market dedicated to the sale of the Gardens’ products, installations of experimental hydroponic horticulture, a pre-existing archeological site, vegetable gardens, greenhouses, vineyards and a winery associated to them, an educational vegetable garden, fruit gardens and finally a zone at the periphery of the site dedicated to olive trees. Moreover, Plato’s Gardens constitute a promenade area for the inhabitants of the nearby neighborhoods, as well as an area of trans-local importance correlated with the archeological site of the nearby Plato’s Academy.***



**Img. 8:** Plato’ Gardens: 3D depictions of the proposal (on the left) and description (on the right) of the hydroponic procedure.



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### A first ‘Symposium’, of Collaborative Permaculture in Plato’s ‘Khôra’

In Plato’s dialogue *Symposium* (Plato 2013 & 2018), Eros is recognized both as an erotic reference and as a phenomenon capable of inspiring courage, valor, great deeds and works, and vanquishing man's natural fear of death. It is seen as transcending its earthly origins and attaining spiritual heights. I shall not dare to propose feasts like the one depicted by Anselm Feuerbach, presented in our text. I may, nevertheless, propose in a much more modest way continuous community coexistence, a love of community coexistence, correlated with the ‘cultivation’ of social values. *More precisely, in the case of Plato’s Gardens, or in Plato’s ‘Khôra’<sup>3</sup> we may refer to community coexistence that may bring together citizens of different ethnic, cultural and religious identities as those living today, side by side, in the territory of Plato’s Academy.*



**Img. 9:** Plato's *Symposium*, as depicted by Anselm Feuerbach (1869). Symposium, a banquet where the participants were drinking the precious wine of ancient Attica; precious wine as the one which could probably be produced in the winery of the promising Plato’s Gardens.

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<sup>3</sup> ‘Khôra’ (also ‘chora’; ‘χώρα’ in [Ancient Greek](#)) is the space that gives a place for [being](#). The term was used by [Plato](#) again, in another dialogue of his, [Timaeus](#), to designate a receptacle, a formless interval, alike to a [non-being](#), in between which ‘[Forms](#)’ were received from the intelligible realm and were shaped into the transitory forms of the sensible realm ([Πλάτων](#), 2014: 48e4).

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**Img. 10:** Or, instead of a symposium dedicated to the philosophical approach of Eros, we could expect cultural activities, presented in the context of a garden environment. In an analogous context, the ancient Thespis' Chariot gave historical birth to the cultural performance of Eros, to the theatrical praxis, in the agricultural periphery of ancient Athens. *Thespis' Chariot*, by Gustav Klimt (Burgtheater, in Vienna).

Let us insist on the last part of our sentence: *community coexistence that may bring together citizens of different ethnic, cultural and religious identities as those living side by side, in the territory of Plato's Academy*. Could we insist on this multicultural coexistence? To this aim is also dedicated the next project to be presented, a 'post-processual'<sup>4</sup> historic itinerary from Kerameikos ancient cemetery to the Islamic temple of Eleonas, in Athens.<sup>5</sup>

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<sup>4</sup> 'Post-processual': Correlated with non-ordinary, conventional proposals of the 'supposedly' objective (nevertheless ideologically pre-determined) archeology. "Post-processualists suggest that we can never confront theory and data; instead, we see data through a cloud of theory" (Johnson 1999, p. 102).

<sup>5</sup> The proposal was presented as a post-graduate diploma project, by architect Doito Bonotulshi, under the title "Introducing the Multi-temporal and Multicultural notion of space from Kerameikos to Academy of Plato". It was achieved under the didactic guidance of prof. K. Demiri and K. Moraitis in the School of Architecture NTUA (acad. year 2021-2022), in the context of the Erasmus Plus Joint Master Course "Architecture-Landscape-Archeology" (organized by the Sapienza Univ. of Rome, the National Technical Univ. of Athens, the University of Coimbra and the University of Naples).

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**Let us insist on the correlation between Hellenic and Islamic civilization: a second ‘Symposium’ of cultural and political dialogue, focused to the positive coexistence of different ethnic groups**

In Ancient Greece the symposium (*sympósion* or συμπόσιον in Ancient Greek language) was the part of a banquet that took place after the meal. The participants were drinking together, but they could also discuss serious subjects, like those related to philosophical approaches. It is in this context that Plato’s *Symposium* was dedicated to a philosophical dialogue and that, in modern usage, the term has come to mean an academic or scientific conference, a serious dialogue of cultural value. A wine-drinking banquet could probably be alien to the Islamic habits, nevertheless a cultural and political dialogue could be extremely important, for both sides, westerners, Greeks in our case, and people of Islamic origin.

It is common for a big part of the Western population, to refer to the controversial relations between their own civilization and the Islamic East, or to interpret the latter in a distorted ‘orientalized’ way. A different way of approach could signalize the important influence of it to the Europeans, during an extended medieval period, through important intellectuals, mathematicians and physicians, through their Arabic libraries of the medieval Spain and, in relation to a sensitive landscape approach, through their delicate design as those in the case of the Arabic gardens of Alhambra.

Analogous cultural correlations may be described in the case of the Byzantine civilization, in its contact with the adjoining Arabic populations and, through this conduct in its intimate approach of the Arabs with Hellenic references in general. We may guess that Plato’s *Symposium* could not be easily accepted by Islamic communities of the past and the same is rather true for the Islamic communities of the present day. Nevertheless, a great number of ancient Hellenic canons were saved by Arab scholars, who were especially interested in the Neoplatonic philosophy. The Arab dynasty of the Abbasids was interested in reorganizing the middle-ages Bagdad in a circular form, in accordance with the Plato’s description of the Universe, and Sinbad the Sailor in one of his legends imitated Ulysses’ ruse in order to be saved by a monstrous cannibal similar to the Homeric Polyphemus. The most important legendary hero of the Byzantine era, The Border Lord, is a fearless warrior of double origin, son of a Christian Byzantine mother and an Arab war lord. The construction of his villa and garden in the Euphrates River territory, described in a 12<sup>th</sup> century folksong, precedes the Tuscan Medici’s villas and gardens for two centuries (Moraitis, 2018).

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**Img. 11:** Focus Areas – Kerameikos, Plato’s Academy, Votanikos Mosque and the proposed Nodal Points. Emblematic structures – ‘folies’, installed on focal places could signalize the continuity of the visiting itinerary and could offer, to visitors and inhabitants of the city, guiding didactic narratives in hybrid form, written notes and digital guidance.

*The diploma project presented insists on the previous context.* It refers to the formation of a visiting itinerary, connecting the territory of the ancient cemetery of Kerameikos, in Athens, with the newly established mosque in the territory of Votanikos, through the archaeological site of Plato’s Academy. The project according to its own description “attempts to create interaction spaces between heterotopic enclaves”, those of the archaeological sites, the mosque’s site and the nearby quarters of the housing of immigrants; many of them are of Islamic origin. “These (heterotopic) spaces are politically aware, mnemonic, and create an opportunity of sensorial inquiry that offers engagement with multi-temporality”, with multiculturalism and multi religious approach as well, “as opposed to a disinterested and ‘objective’ reconstruction of a selected past”.

The main goal of the research was to enhance the relationship between Greek locals and Arab immigrants, to re-evaluate and democratize the archaeological remains as multicultural and multitemporal spaces. It attempted, firstly, an ethnographic study, to record the social life of the modern inhabitants. Through this analysis, the research aimed to create a dialogue and a



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holistic narrative relatable to the differentiated ethnic references: the classical Greek, the contemporary urban practices and the post-migration imaginary of the immigrants. The second objective of the project was the integration of open-air places, as urban activity generators, which would provide equal opportunities for communication and expression for the different groups of inhabitants.



**Img. 12:** Charbagh (Four- Square) Garden as described in traditional Islamic tapestry or in micrographs (upper images) and its formal schematic analysis (bottom images).

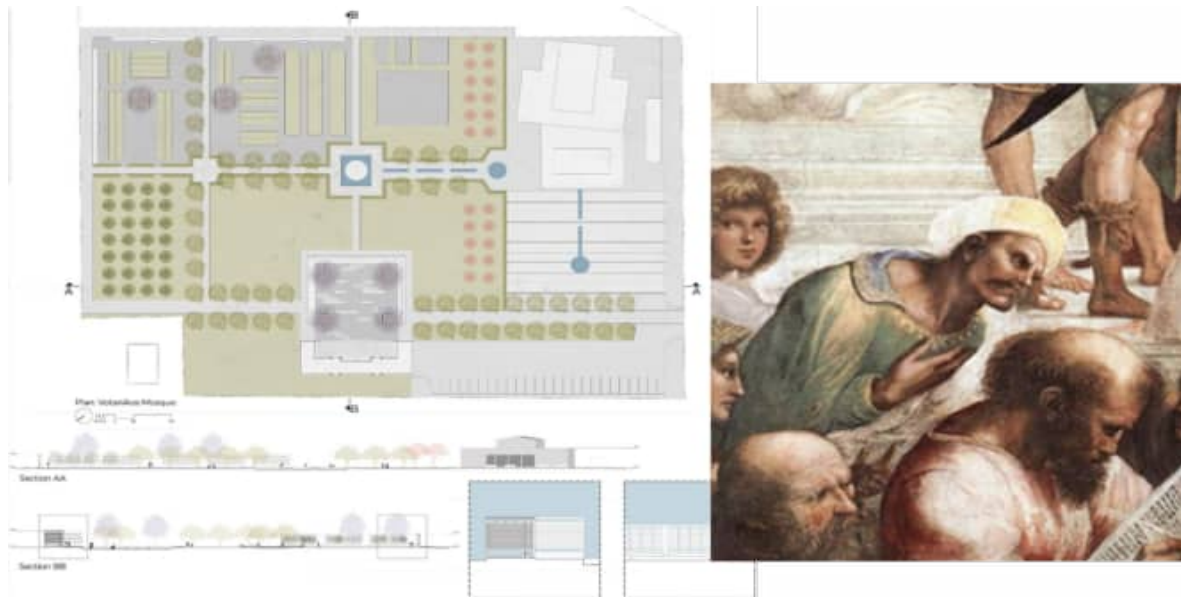
The design strategy begins with an analysis of a path that can be used as backbone for the narrative to continue from Kerameikos to Votanikos Islamic Mosque area. The thematic path is characterized by a set of nodal points which have been selected based on a previous thorough contextual and historical analysis of the focus area. Emblematic structures – ‘folies’, installed on those focal places could signalize the continuity of the visiting itinerary, and could offer, to visitors and inhabitants of the city, guiding didactic narratives in hybrid form, written notes and digital guidance. Finally, the thematic path arrives at the newly created Islamic Mosque in the territory of Votanikos. There, the open-air public space, in front of the

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Mosque, was composed in reference to the four squares formation of the Islamic Garden, as described in the traditional tapestry or in micrographs of analogous depictions. The central idea of the project was thus declared in the optimum possible way. ***Islamic and Hellenic cultures may co-exist, side by side as in the depiction of Raphael’s “The School of Athens”. There, among the important ancient Greek philosophers, the Arab intellectual Averroes is presented, side by side with Pythagoras.***



**Img. 13:** Votanikos Mosque Garden composed, according to the previously presented principles of the Islamic Garden Design (on the left) - Averroes and Pythagoras as depicted by Raphael in the famous fresco of *The School of Athens*, in Vatican (on the right).

### **An erotic Saturday night at the Athenian symbiotic municipality of Kaisariani**

We finally arrived at the third project presented in our text. It insists, as the two previous proposals suggest, on several contemporary social, cultural, and political demands concerning urban co-existence. Nowadays, the need for landscape urbanism and urban environmental sustainability is quite evident. Nevertheless, such an ‘ecosophical’ approach could not be successful, but only under a simultaneous social and political contribution based on democratic extended participation. Insisting on this final term, ‘participation’, we may reach a second important, contemporary urban condition already described in our text: the recognition, already previously presented, that urban populations, in most contemporary cities, in the majority of them, are not uni-cultural. On the contrary, mixed urban communities of differentiated ethnic, cultural, and religious identities must co-exist, living in the same urban realm, often featuring contradictory interrelations. It is in this context that we insist on the



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terms ‘eco-social sustainability’: our societies could not survive or claim their natural existence, their natural sustainability, unless in correlation to their social sustainability. The principal ecological quality of social formations has to do with their social quality. The evaluation of their natural context of existence seems to be intrinsically associated with their political and ethical integrity, even if this demanded integrity is not the result of a passive stabilized tranquility. It is rather the result of an energetic mutation of the social formations, of their ability to infiltrate historic social transformations and, more precisely, in correlation to contemporary reality, to be able to accept their multicultural approaches and evolve. In a meta-Darwinian description, societies that may accept and positively incorporate unavoidable changes of their social environment, would be ‘the fittest to survive’.

### **‘Hybrid’ urban place as a combination of real and virtual urbanity**

*We have reached again the central object of our presentation, the importance of the urban public domain as par-excellence place of social communication. It is in this same public common environment that we may create the most attractive conditions for a positive dialogue, among differentiated urban communities.* Nevertheless, one of the most crucial problems of this desired communication, has to do with the functional differences of spoken and written languages and, furthermore, of differences concerning the educational background and the differentiated cultural concern, among groups of different ethnicity, religion, and age. *In which way could we facilitate and ensure positive contact among all these different groups, using different languages and means of communication?*

Could hybrid guidance, in real and digital space, contribute and facilitate our urban co-existence? Digital response to our questions could offer a possible multi-formal solution, using many parallel narratives as answers to our urban anxiety. We could thus dream, for example, of a real urban public place of communication, a real urban square co-existing with a virtual condition of publicity and, moreover, we could design real urban public place – ‘real urbanity’ together with the proposed ‘virtual urbanity’. *We could thus propose a holistic approach to ‘hybrid’ urban public place, to ‘hybrid urbanity’.* Such an approach was used in the project for the rehabilitation of the central public squares of Kaisariani<sup>6</sup>, in the homonymous municipality in the metropolitan area of Athens. The case study seems to be extremely interesting, because of the specific cultural and political identity of the site.

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<sup>6</sup> The project presented was the result of the collaboration of the Arsis Architect’s Design Team with the Technical Service of the Municipality of Kaisariani (end of the study, 2022). The author participated to the Arsis Architects’ design team, together with the architects A. Chelidoni, V. Kolikai and R. Bakopanou. Unfortunately, the project had not materialized in its initially proposed form.

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**Img. 14:** A map of the western Minor Asia coast, wherefrom the first inhabitants of the contemporary municipality of Kaisariani arrived, as refugees, during 1922, would be formed on the floor of the central square of Kaisariani municipality. QR codes inscribed on metallic plates inlaid on the square floor, at the exact locations of important Minor Asia origin places, would offer to the visitors, passing by, narratives concerning the historical and political past of the municipality.



**Img. 15:** The execution of the members of the Hellenic Resistance, by the Nazi occupation troops, in the Kaisariani Rifle Range, on 1st May 1944.

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### **‘Hybrid’ public contact in the central squares of Kaisariani; a dialogue between urban groups of differentiated ethnicities, of immigrants and refugees of past and present**



**Img. 16:** 1922 - the seaside of the city of Smyrna at the Minor Asia coast, full of Greek and Armenian inhabitants, trying to save themselves. The world was going up in flames, but those flames were not new to our dead and, moreover, they were not the last to burn our hopes. Warfare, environmental and economic destruction will not stop driving populations to exile roads.

The contemporary municipality of Kaisariani, was created on the place of a refugee camp, formed in 1922, to house refugees from the Greek cities of Minor Asia; refugees that were trying to survive under conditions of extreme poverty. Later on, the first built structures were produced and a municipality at the periphery of Athens was created. Nevertheless, the important historic adventures of the territory did not stop. During the Second World War the installations of the Rifle Range, existing in the municipality of Kaisariani as an athletic center, were used by the Nazi forces occupying Greece as an execution place. There on the 1st of May 1944, two hundred members of the Hellenic Resistance were shot; we refer to an incident able to inscribe its place of reference in the historical and political memory of the world.

In addition to the previous historical references, Kaisariani municipality was characterized by a third important association, a cultural one, regarding neoteric Hellenic folk-culture. Rebetico song is a cultural production, created after 1922, by refugees of Greek ethnicity, arriving in Greece, from their initial places of millennia's-long installation in Minor Asia. The refugees brought their musical modalities and singing traditions of Asiatic cultures. Then mixed those ancestral approaches with the folk music of the Greek mainland inserted in the industrial territories of the big Greek cities by the internal immigrants, arriving there in search of work. Reputed as such a testimony is a place in Kaisariani, strongly correlated with



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Rebetico song; the tavern ‘Χώραμα - Dawn’ in Greek, where famous Rebetico composers, bouzouki players and singers appeared.

In the case of Kaisariani, it would be a promising possibility to correlate all previous references with the everyday life of citizens, harmonizing everyday amusement or regular everyday public contact, with a promising navigation in the turbulent ‘sea’ of the cultural and political identity of the place. It could also be extremely invigorating for the immigrants and refugees that reached Athens during the previous decades, to be reminded that their recent to us historic-political adventures are not isolated in the history of Europe, especially in the Eastern Mediterranean territory, and that the Greek population of Kaisariani was partly created by analogous previous historic incidents. Thus, we ought to insist not on contradictions among differentiated historic identities, but on the similarity of historic events that reformed, in the past, indigenous culture through mixing and juxtaposition, through cultural osmosis. Being historically precise, we must accept that culture in general is the result of analogous osmotic symbioses, ‘erotic’ symbioses in our allegorical description, and that such a condition will undoubtedly continue in the decades to come. Warfare, environmental and economic destruction will not stop to drive populations to exile roads, and the acknowledgment of this reality is of utter importance for the indigenous citizens in our countries and newcomers as well, in Europe and in the entire world.



**Img. 17:** Correlating a possible night out at the Kaisariani square as presented in the above 3D presentation, with a famous Rebetico song under the title ‘Saturday night in Kaisariani’; a song with both political and erotic references – *could the death, the execution, efface the seduction, the warmth of his eyes?* On the contrary, according to Plato’s *Symposium*, Eros may vanquish human's natural fear of death...

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### **Creating a map of cultural and political guidance**

The floor level of the Kaisariani square was designed based on the previously presented approach, reproducing the map of the eastern parts of Mediterranean, describing the eastern Isles of Greece and the west coastline of Turkey. Metallic plates would be inlaid on the places of the map where important urban settlements of the past flourished, or present cities exist; metallic plates with QR codes inscribed on them. Passersby could be attracted by the plates and QR codes and be invited, through digital navigation, to several differentiated narratives. That being so, we chose to insist on the exemplary historic incident that we already previously mentioned, on the 1922 extended genocide and forced immigration of Greek and Armenian refugees from Minor Asia, which decisively influenced Hellenic history, the political, cultural, and urban history of modern Greece. Evidently it was important for us to refer to a historical incident well known for our country that immediately influenced the life of our ancestors and consequently our own cultural and political feeling as well, our own cultural and political existence. We refer to a historic event, which radically transformed the 20th century Greek cities being infused by an extended number of Minor Asia refugees' quarters; a historic event which deeply influenced both the centralized urban Greek civilization and the neoteric Greek folk-culture.

Nevertheless, our effort in our proposal for the design of the Kaisariani square would prefer to use the reference to the destruction of the Hellenic part of the Minor Asia in 1922, principally as a pretext, not intended to be associated with a nationalistic approach, or to an effort to revitalize nationalistic confrontations of the past. We should like to abstain from an analogous vulgar confrontation. What we would really desire is to offer a requiem, dedicated not only to the inhabitants of the pre-destroyed Smyrna, or to the actual victims of analogous extermination, but also to the continuous massacres and urban destruction that have not ceased to exist, that continue to take place, till now, in a large part of our 'civilized' world.

### **Coming back to the 'eco-social sustainability' and multi-cultural coexistence, through our hybrid, real and 'smart' approach**

Using as an exemplary case the previous 1922 reference, we could then try to present though our virtual navigation narratives, contemporary refugees', and immigrants' movement, in the Mediterranean territory principally from Asia and Africa to southern European countries. An analogous presentation could be offered to the multiple visitors of the Kaisariani square, in many different languages that could facilitate the communication with refugees and immigrants, whose languages are not in common usage in contemporary Greece. As a next step we could then imagine multidirectional communication, incorporating in the digital data of our guidance system, the comments, criticism, and statements form the part of the multicultural, multiethnic visitors of the territory. Songs and music of multicultural origin

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could greatly enrich the communication system and create a place reference that could attract a multiplicity of visitors.

It would be in such a communication context that the cultural validity, the socio-political echo of the place would be multiplied (Moraitis, 2023); real place itineraries and, in parallel, digital continuous navigation, ‘in situ’, in real place, as well as through distant internet navigation.

The previous ‘augmented’ possibility of multicultural and multilevel urban communication is what we would like to correlate with the key concept of the ‘eco-social sustainability’, a concept to which we would like to insist again at the conclusive part of our text. The important condition of the sustainability of our human communities has primarily not to do with the sustainability of their natural environment, but rather with their socio-political sustainability, a condition that must be considered as principal for both natural and social preservation. Urban landscape, the public urban landscape, the public urban place must be recognized as the place ‘par excellence’, where the need for our ‘eco-social sustainability’ may be performed and preserved, through the densest possible communication. It is in this context that we have insisted on a place formation, promoting historic and political memory and multicultural positive co-existence through a hybrid, real and ‘smart’ approach...

We could finally conclude the previous description, insisting on the erotic seduction of a Saturday night, a summer or spring Saturday night at Kaisariani. “Saturday night at Kaisariani”, being the title of a song with erotic and political connotations, well known to the late 20<sup>th</sup> century Greek audience.

## Epilogue

Was this a poetic approach or a scientific one? Moreover, could poetic approaches contribute to the scientific conception, if not to managerial proposals, at least to my design visualization? Does psychoanalytic theory explain not solely individual psychopathology but, in addition, cultural and even political formations? If psychoanalysis may explain the way that individual behavior is formed under the social transformation of erotic instinctual drives, then the psychoanalysis of the city would be a field of interest that would obsess me during the next few years of my life.

Plato, in his *Symposium*, describes the dialogue between Socrates and Diotima, the priestess from Mantinea. According to this dialogue, Eros equates neither to perfectness nor to imperfectness, but to the in-between condition, to the desire to move from a lower state of deficiency to a higher state of accomplishment. It principally refers to the power of desire, in our case to the desire for the positive formation of the urban communities, expressing itself in the open-air urban context.

I think I could not wait anymore... I shall dare to pronounce, NOW, the final conclusive statement of the above, promising, future theoretical expectation of mine.



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Although Freudian psychoanalysis focuses on the predominance of the erotic libidinal instinct, eroticism is not crucial because of its hedonistic orientation principally. It is rather important because it seems to be an instinctual force, which could easily be controlled, thus ‘educating’ immature young humans to accept the imposition of societal ethics and morals. It is thus a ‘politically’ crucial, constitutive blind force that has to be formed through the enforcement of societies. Surely, individuals or even parts of the involved communities may react, and the controlling pressure may be transformed and even collapse. An analogous theoretical approach was suggested by Herbert Marcuse, in his book on *Eros and Civilization* (Marcuse, 1998); not ‘Love and Civilization’ but going back to the ancient Hellenic term ‘Eros and Civilization’. ***What our proposal suggests in addition is that the important place formation where this controlling procedure or its bottom-up denial occurs is urban place in general and in an even more exact indication, the open-air part of the city.***

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**Image 4:** Created by architect S. Mouzakitis, in collaboration with the author.

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**Image 5:** Combined image (<https://takeonecinema.net/2012/ieri-oggi-domani/> - 8/7/2023), (Fair Use - [https://el.wikipedia.org/wiki/Συνουκία\\_το\\_όνειρο#/media/Αρχείο:Συνουκία\\_το\\_όνειρο\\_\(αφίσα\).jpg](https://el.wikipedia.org/wiki/Συνουκία_το_όνειρο#/media/Αρχείο:Συνουκία_το_όνειρο_(αφίσα).jpg) – 8/7/2023), (<https://www.tilestwra.com/vrechi-sti-ftochogitonia-istoria-enos-yperochoou-tragoudiou-ke-mias-exeretikis-tenias-tou-alekou-alexandraki/> - 8/7/2023).

**Images 6 – 7 - 8:** Created by architect Chr. Golemi.

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[https://en.wikipedia.org/wiki/Symposium\\_\(Feuerbach\)#/media/File:Plato's\\_Symposium\\_-\\_Anselm\\_Feuerbach\\_-\\_Google\\_Cultural\\_Institute.jpg](https://en.wikipedia.org/wiki/Symposium_(Feuerbach)#/media/File:Plato's_Symposium_-_Anselm_Feuerbach_-_Google_Cultural_Institute.jpg) – 2/21/2025.

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**Image 11:** Created by architect D. Bonotulshi.

**Image 12:** (<https://www.azerbaijanrugs.com/guide/early-nw-iran-azerbaijan/early-azerbaijan-nw-iran-rug16-louvre-museum-garden-carpet.htm> – 3/13/2025), (<https://www.theheritagelab.in/mughal-charbagh-paradise-gardens/> - 3/13/2025), combined with three images created by architect D. Bonotulshi).

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[https://it.wikipedia.org/wiki/Scuola\\_di\\_Atene#/media/File:"The\\_School\\_of\\_Athens" by Raffaello Sanzio da Urbino.jpg](https://it.wikipedia.org/wiki/Scuola_di_Atene#/media/File:) – 2/21/2025)

**Image 14:** Created by Arsis Architects' design team, in collaboration with the author.

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# ADVANCING CONSUMER PROTECTION THROUGH THE CIRCULAR ECONOMY: STRATEGIC IMPERATIVES OF REDUCTION, REUSE, AND REPAIR

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## Abstract

The transition from a linear to a circular economy is essential for enhancing consumer protection, reducing environmental impact, and promoting sustainable development. This paper investigates the strategic imperatives of reduction, reuse, and repair within the circular economy, focusing on their role in safeguarding consumer rights and fostering sustainable consumption. As part of the EU Circular Economy Network for All (ECO4ALL) COST Action, this study addresses existing gaps in understanding and implementation by emphasizing consumer empowerment through sustainable practices.

The research examines the legal, economic, and social dimensions of circular economy strategies that involve consumers in sustainable practices. It highlights the current policy landscape, identifying both opportunities and barriers to implementing circular economy measures across EU and non-EU countries. The study also underscores the importance of interdisciplinary collaboration among academia, industry stakeholders, public administration, and civil society to develop innovative solutions that enhance circularity and consumer protection.

Through a comparative analysis of best practices across various countries, this paper provides insights into optimizing circular economy efficiency, particularly in terms of consumer education and behavior change. The findings demonstrate that a proactive consumer role in the circular economy is crucial for achieving the EU's goals of sustainability, climate neutrality, and economic resilience by 2050.

Ultimately, this paper contributes to the ongoing discourse on the circular economy by integrating consumer protection as a fundamental component of environmental and economic policy. It offers practical policy recommendations and strategies for researchers, policymakers, and industry stakeholders to advance sustainable development through a circular economy that works for all.

**Key words:** circular economy, consumer protection, sustainable development, reduction, reuse, repair, policy recommendations, comparative analysis.

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# CIRCULAR ECONOMY AS A DRIVER OF ENERGY TRANSITION AND CARBON NEUTRALITY

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## Abstract

Circular economy is the new economic model which is intended to hopefully replace the still prevailing linear economy one, described as “take, make, dispose”.

The aim of the circular economy is to reduce the environmental, climate and energy footprint of any human activity to preserve the resources of the planet and their overexploitation. Key resources of the planet, such as the critical raw materials, are instrumental for the energy transition as they are needed for eco-innovation, AI, RES, energy storage and electromobility. They need to be managed efficiently and recovered from waste containing them.

Circular economy is not only reuse and recycling of waste or wastewater. It is to be conceived holistically to cover all the sectors of the economy and to be mainstreamed in all of them. It requires circular economy plans both vertically and horizontally. From the national to the local level - we should be speaking about « circular city » - and in the business sector, as circular entrepreneurship and Circular ESG, C-ESG.

Circular economy is a new narrative and a new culture. We have one planet that we need to protect in the framework of the Sustainable Development, the SDGs, the Green Deal, the UNFCCC and the Paris Agreement. Circular economy becomes instrumental in serving all the above and is also a key element of the Taxonomy Regulation of the EU on Green projects and Green financing.

It is the « umbrella » of Green growth, Blue economy and Digital economy and as such it will boost the Green transition and by reducing substantially the emissions, enable us to reach climate neutrality by 2050, while protecting the environment, biodiversity and ecosystem services which are vital for the planet.

**Key words:** circular economy, ESG, energy transition, net zero.

## Introduction

The planet is currently facing several challenges due to different causes, which often interact and lead to a spillover effect. The major one is climate change which has reached a critical level and is thus referred to as climate crisis, combined with the energy crisis, exacerbated by the wars, a food crisis, risks of pandemics and health related risks, and with a new flow of

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migration due to the wars, to the climate impacts and to political instability and human rights violations in different parts of the globe. All the above are exacerbated by the overpopulation problem the planet is confronted with, which exceeds its carrying capacity and undermines the needs of the current and *a fortiori* the future generations. The circular economy as the new economic model is the only one that can preserve the resources of the planet, ensure resource efficiency, protect its environment and the quality of life, and preserve biodiversity and the ecosystem services that the green capital of the planet is providing. As it contributes significantly to the reduction of greenhouse gases and of pollution, it constitutes the key driver of the energy transition towards carbon neutrality.

### **I. The Circular economy concept**

Circular economy is the new generation economic model aiming at progressively overriding the still prevailing linear economy one, described as "take, make, dispose", in other words use resources that are often scarce to produce products which have a short life cycle, are not repairable and become rapidly waste, are difficult to reuse, valorize or recycle. Often those products have a high environmental, climate and energy footprint and in certain third countries are produced in violation of CSR and ESG patterns which do not institutionally exist there.

As the environment has no borders, any human activity that leads to pollution or uncontrolled emissions of CO<sub>2</sub> and methane affects the quality of the environment of the planet, its biodiversity and boosts the climate crisis. Circular economy in its holistic concept can clearly reduce the environmental, energy and climate footprint of any human activity with the view to preserving the resources of the planet, their sustainability and reduce their overexploitation. It promotes resource efficiency by using less, in a more selective manner, resources, reintroducing resources into the economy through reuse, recycling, industrial symbiosis and waste to energy processes.

Key resources of the planet, such as the critical raw materials and rare earths are instrumental for the energy transition as they are needed for eco-innovation, AI, Renewable energy sources, energy storage, carbon capture storage and electromobility. They are also instrumental for the development of the *Net Prosumer* concept, from the words energy producer and energy consumer also in a net metering framework, which in practice encourages the production of RES by companies or households, mainly through solar panels and batteries storage of the energy produced during the day to be used during the night or sold to other entities or back to the grid, using digital and AI devices.

Circular economy *lato sensu* has started as a sound waste management model, managing solid - hazardous, industrial, and municipal - and liquid waste - industrial and sewerage - as raw materials or secondary products, in a zero-waste perspective, with the view to reintroducing them into the economic cycle and avoid downstream waste management. In this context the reverse waste hierarchy pyramid is the model to follow: waste prevention, reuse, recycling, waste to energy and a minimum landfilling fraction of the residue only - 10% under the revised EU waste framework directive, by 2035.

In this context industrial symbiosis is key; it covers what is industrial waste for company A, to be taken care of under the extended producer responsibility, and enables it



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instead to be used as a resource - raw material or secondary product - by company B and/or C, in a win-win situation. Industrial symbiosis is instrumental to promote circular economy through the development of Industrial Symbiosis Data Banks using digital economy and AI tools. As solid waste management is at the heart of circular economy, the development of the appropriate framework of the extended producer responsibility and of the other economic tools is key to serve the waste hierarchy: The *Pay as you throw* and the *Deposit Return Systems (DRS)* reduce the production of waste, encourage reuse and promote recycling, and are key for the separate collection of waste and for collection at source.

In parallel, circular economy in liquid waste - industrial and sewerage - can lead to the extraction of raw materials and secondary products, and when it comes to municipal wastewater treatment - especially tertiary - to the reuse of treated wastewater or grey water for irrigation or industrial purposes. The relevant EU legal framework is established by Regulation (EU) 2020/741 of 25 May 2020, on minimum requirements for water reuse (OJ L 177, 5.6.2020, p. 32-55). The Water Reuse Regulation (WRR) will increase the trust of consumers and farmers in this circular approach to the use of water, ensuring it is safe and reducing the pressures of abstractions on increasingly scarce water resources. It will also help preserve the water resources needed by the aquatic and terrestrial ecosystems. This is a tool to help protect biodiversity, for achieving zero pollution and adapting to climate change. This new Regulation requires that urban wastewater, which has already been treated in accordance with the Urban Wastewater Treatment Directive (UWWTD), is further treated to meet the minimum quality standards of the Regulation to be suitable for agricultural use. As water stress is exacerbated by climate change impacts, the use of this reclaimed water in agriculture can play an important role in tackling water scarcity and drought. By setting minimum quality standards, the WRR promotes the safe use of reclaimed water in agriculture and ensures the protection of human and animal health and the environment. Circularity in the use of water for increased resilience is instrumental. Good quality water in sufficient quantity is vital for the sustainable growth of European society and economy and for the protection of the environment. However, freshwater resources in EU countries are increasingly coming under pressure, leading to water stress and poorer water quality. Climate change, with its unpredictable weather patterns and more frequent and severe droughts, is contributing significantly to lower water availability. In line with the European Green Deal and the principles of the Circular Economy, water reuse for agriculture can help preserve our freshwater resources and increase our resilience to water stress by reducing the water abstraction from rivers, lakes, and groundwater.

Agriculture supports the production of food and other agricultural products necessary for the health and prosperity of European citizens. EU is the global leader of agri-food exports, employing over 40 million people. However, the EU agriculture sector is also one of the major users of freshwater resources in Europe, accounting for approximately 50% of total annual water consumption. Water demand from agriculture is highest in late spring and summer when water availability is at its lowest in many parts of Europe. Water reuse can ensure that farmers have access to a more predictable supply of clean water and help them adapt to unpredictable water availability, as well as improve resilience to climate change and mitigate its impacts. In addition, reusing water can increase investment in innovative treatment technologies and competitiveness on the market. The Water Reuse Regulation sets

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out minimum standards to give EU citizens and businesses confidence in the quality of reclaimed water and agricultural products. It also sets out common monitoring requirements, risk management provisions for possible health and environmental risks, and ensures transparency, so that key information about any water reuse project will be available to the public. The Water Reuse Regulation is applicable as of 26 June 2023. The Regulation sets out: Minimum water quality requirements in the European Union for the safe reuse of treated urban wastewaters in agricultural irrigation; Harmonized minimum monitoring requirements, notably the frequency of monitoring for each water quality parameter, and validation of monitoring requirements; Risk management provisions to assess and address potential additional health risks to human and animals, and possible environmental risks; Permitting requirements for producing and supplying reclaimed water; Transparency, whereby key information about any water reuse project is made available to the public. The Member States have been preparing for the application of the new rules, with many choosing to integrate the new rules into relevant national laws or strategies. Some are also regulating water reuse for applications beyond agricultural irrigation. Where treated wastewater is reused for irrigation in agriculture, this has to be done in accordance with the new rules.

However, the Water Reuse Regulation allows Member States to decide not to practice water reuse in their territory or to limit the water reuse in certain areas. Some Member States, where freshwater resources are abundant and irrigation demand is low, have planned not to allow water reuse for irrigation in their countries. Other Member States have not yet made a final decision, as resource and infrastructure costs still are being evaluated.

Apart from the higher standards of the WRR, treated water can also be used for industrial purposes - cooling - and to possibly support a secondary network of water to be used for washing boats and yachts in marinas.

Finally, the dried - ideally through RES - sludge from the Wastewater treatment plants can be used for the production of compost or for alternative fuels.

As regards solid waste, the amended 2008/98/EC waste framework directive establishes ambitious reuse and recycling targets: by 2025 the preparing for re-use and recycling of municipal waste shall be increased by weight to a minimum of 55%. The target by 2030 is 60% and by 2035 65%, while by 2035 landfilling cannot exceed 10%. Only the residue can be landfilled, while there is a percentage of approximately 25% to 35% of residual waste that could be incinerated in line with the waste to energy communication. To reach those targets, economic instruments are key. The *Deposit and Refund Scheme (DRS)* and the *Pay as you throw (PAT)* in combination with the *extended producer responsibility (EPR)* are to be fully implemented as they lead to separate collection and to clean recyclables streams, avoiding thus detergents to clean the sorted waste, and additional mechanical sorting.

EPR schemes require producers to take responsibility for the entire lifecycle of their products, in particular at the end of the product's life. The level of the financial contributions of the producers will be based on the circularity and environmental performance of the products concerned.

As regards non-hazardous construction and demolition waste, the target for re-use, recycling, and other material recovery by 2020 was 70% by weight.

The most recent amendment of directive 2008/98/EC is presented in the 2023 proposal of the Commission which regulates prevention of food waste generation in primary

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production, in processing and manufacturing, in retail and other distribution of food, in restaurants and food services, as well as in the households. The proposal foresees that the Member States shall review and adapt their food waste prevention programs to achieve by 31.12.2030 the following targets: a) reduce, by 2030, the generation of food waste in processing and manufacturing by 10% in comparison to the amount generated in 2020; b) reduce by 2030 the generation of food waste per capita, jointly in retail and other distribution of food, in restaurants and food services and in households by 30% in comparison to 2020.

The proposal also establishes an extended producer responsibility (EPR) scheme for textiles and footwear products. Under such schemes, textile producers will contribute to the management of used and waste textiles. By being responsible for the end of lifetime of the products they sell, producers will be encouraged to design longer-lasting textile products that are easier to be reused, repaired, and recycled and thus promote circular economy in the sector. In the proposal it is foreseen that Member States shall ensure by 1 January 2025 the separate collection of textiles for re-use, preparation for re-use and recycling. The first *Whereas* of the proposal refers to the Green Deal and the Circular Economy Action Plan which call for action to ensure sustainability of the textiles and food sectors as they represent top resource intensive sectors that cause significant negative environmental externalities. On 18 February 2025 a provisional agreement was reached. The amended directive will promote circular economy throughout the EU, notably by fostering innovation and moving towards more sustainable industrial and consumer practices as regards textile and food waste.

Circular economy is to be conceived *lato sensu*, i.e. in its broadest sense, covering not only solid and liquid waste, but also sustainable production and consumption patterns, Renewable energy sources (RES), electromobility, energy storage and eco-innovation. The idea is to produce new generation products which use circular economy resources, originating from recycling, have a longer life cycle, are repairable and can be easily recycled at the end of their life cycle. Important to that effect is the proposal for a Directive on common rules promoting the repair of goods and amending Regulation (EU) 2017/2394, and Directives (EU) 2019/771 and (EU) 2020/1828. This is part of the Green Deal objective of sustainable production and consumption in a comprehensive manner, combined with various other initiatives that tackle different aspects of premature disposal of goods on both the supply and demand side.

On the supply side, the Regulation (EU) 2024/1781, of 13.6.2024, establishing a framework for the setting of ecodesign requirements for sustainable products, sets the framework for product reparability at the production phase, in particular on product design requirements and the availability of spare parts. The aim is to make sustainable products the norm and to reduce the overall carbon footprint and environmental footprint of products over their life cycle. This proposal results from the Circular Economy Action Plan of 2020. The plan underlines that, for citizens, the circular economy will provide high-quality, functional, and safe products, which are efficient and affordable, last longer and are designed for reuse, repair, and high-quality recycling.

On the demand side, the proposal for a Directive (COM/2022/143 final, 30.3.2022) on empowering consumers for the green transition through better protection against unfair practices and better information, provides for better information on the durability and reparability of goods at the point of sale. This enables consumers to take informed sustainable

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purchasing decisions. This Directive is complemented by another Commission proposal, adopted on 22.3.2023, for a Directive on new rules on substantiating green claims, which tackles false environmental claims, and the wide expansion of public and private environmental labels. The two aforementioned proposals establish a regime for environmental claims and labels with the aim of combatting greenwashing.

Another relevant proposal is the Regulation on harmonized rules on fair access to and use of data (Data Act), under which users of connected products shall have access to data they generate during their use and have the right to give such data to a third party of their choice. Such data access will be relevant for independent repairers.

## **II. Energy transition and green transition towards carbon neutrality**

Climate change and environmental degradation are an existential threat to the EU and to the world. To overcome these challenges, the European Green Deal is the new growth strategy of the EU, aiming at transforming the Union into a sustainable, resource efficient and competitive economy. The goal is to make the EU climate neutral by 2050, boost the economy through green technologies, develop sustainable industry and transport, cut pollution, and create green jobs. The road map is to reduce greenhouse gas emissions by 55% in 2030, 90% by 2040 and reach net zero by 2050. The Greek climate law foresees an 80% reduction target by 2040, established when the EU had no 2040 target foreseen.

The energy and green transition are the process towards climate neutrality. Turning climate and environmental challenges into opportunities will make the transition just and inclusive for all.

The energy or green transition is thus a road map on how progressively the greenhouse gas emissions can be reduced and the economy transformed with the view to reducing the environmental, energy and climate footprint of any human activity. It also encompasses the promotion of RES against hydrocarbons, the production of alternative fuels, the electromobility, and the development of green energy in general, including hydrogen, as well as storage capacity. This process combined with zero pollution and the protection of biodiversity is enshrined in the Green Deal and in its implementing rules: the Fit for 55 package and REPowerEU. The European Commission helps Member States design and implement reforms that support the green transition and contribute to achieving the goals of the Green Deal. Moreover, the EU is fully committed to being a front runner in implementing the 2030 Agenda for Sustainable Development, jointly with its Member States. The 17 sustainable development goals (SDGs) aim at protecting the planet from climate change and environmental degradation and at improving quality of life, so that it can support the needs of present and future generations, the very notion of sustainable development. As of 2020 the European Commission has reinforced its analysis and monitoring of the achievement of SDGs in the European Semester process. In parallel Member States are mainstreaming SDGs in their policy making and developing targeted policies to move towards sustainable development.

The green transition is broader than the energy one as the former is holistic in terms of transformation of the economy and management of human activities, while the latter refers to the transition of the energy sector. Decarbonising the energy system is critical to reach the EU's climate objectives in 2030, 2040 and 2050. At the same time energy needs to be secure

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and affordable for consumers and businesses. To that effect, Member States must transform their energy systems into a fully integrated, digitalised and competitive component of an EU energy market that is based largely on RES. In addition to regulatory reforms, Member States need to enable and promote further investments in clean energy, including energy efficiency. In that respect the promotion of green hydrogen, as the fuel of the future, is key for the energy transition and is eligible for financial support by the European Hydrogen Bank, a financing instrument to accelerate the establishment of a full hydrogen value chain in Europe, by creating investment security and business opportunities for European and global renewable hydrogen production. Trans-European Networks of Energy (TEN-E) supported financially by the Connecting Europe Facility (CEF) are instrumental in promoting the green transition and developing through Projects of Common Interest (PCIs) and/or Projects of Mutual Interest (PMIs) the appropriate new cross-border energy infrastructure in Europe or rehabilitating and upgrading the existing one.

### **III. The interaction between circular economy, green transition, and carbon neutrality.**

The still prevailing linear economy model is the one that leads to the still prevailing unsustainable production and consumption patterns, to the overuse of the planet's resources exceeding its carrying capacity, to environmental degradation, loss of biodiversity and to the climate crisis. It is only thanks to circular economy, the new economic model, that all the above challenges can be successfully addressed. Indeed, circular economy will preserve the already scarce resources of the planet, ensure resource efficiency, reintroduce in the economy the so much needed for the energy transition and digital economy critical raw materials, and most importantly reduce the climate, environmental and energy footprint of any human activity, while creating green jobs. As regards the latter, the International Labor Organization estimates that transitioning to a circular economy could increase global employment by 7-8 million jobs by 2030.

The key main pillars of EU action are green growth, blue economy, and digital economy. The overarching umbrella is circular economy which needs to be mainstream to all these three pillars to make them circular and promote interaction amongst them: ensuring thus circular digital green growth and circular blue, green growth economy. This mainstreaming needs to be both vertical - top down and bottom up - and horizontal. Vertical from the EU level, to the Member State level, covering the central, regional and municipal level, and horizontal in mainstreaming circular economy into all EU and national policies with the view to making them circular: circular agriculture, fisheries and aquaculture, circular tourism, transport, energy, etc. Circular economy has also to be mainstreamed in the business sector as circular entrepreneurship, and in the Environmental and Social Governance, ESG to upgrade it into CESG, i.e. circular environmental and social governance. Indeed, moving to a circular model can benefit businesses. By redesigning business models, production processes and products, circular businesses can significantly reduce their material, energy, and waste management costs, resulting in higher yields and competitive advantages, and benefit from green financing for their projects.



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Promoting circular economy within the three aforementioned pillars of EU action and mainstreaming it vertically and horizontally ensures also compliance with the EU Taxonomy Regulation which promotes green projects and ensures green financing. The implementation of all the above requires circular economy strategies and plans, at national, regional and local level. As regards the last one, it is important from now on to promote the holistic concept of circular city, instead of the narrower smart city one. It also requires circular economy plans at company level through Circular ESG, to promote circular entrepreneurship. New EU reporting requirements are foreseen to that effect, together with the interdiction of green washing.

The circular economy contributes to climate neutrality by fundamentally changing *inter alia* the production process, the use of resources and the way we dispose of resources. About 45% of global greenhouse gas emissions come from product manufacturing and use, along with food production. Applying circular economy strategies in just five key areas - cement, aluminum, steel, plastics, and food - could eliminate almost half of global greenhouse gas emissions from the production of goods - 9,3 billion tonnes of CO<sub>2</sub> by 2050. This is equivalent to cutting current emissions from all transport to zero (Circular economy Overview 2024, EIB).

In concrete terms the contribution of circular economy is deployed in the following terms:

- a) Reduction of the greenhouse gas emissions by keeping products and materials in use longer - through reuse, repair, remanufacturing, and recycling the circular economy cuts emissions associated with raw material extraction, production, and waste management.
- b) Minimization of waste. Landfills and mass burning incineration release significant CO<sub>2</sub> and methane. Circular strategies reduce waste generation, thus reducing emissions from waste treatment.
- c) Lowers demand for virgin resources. Extracting and producing new materials (like steel, aluminum, or plastic) is energy intensive. Using recycled materials or designing for longevity cuts this demand, saving energy and reducing emissions.
- d) Encourages renewable energy and sustainable design. Circular models often align with clean energy use and eco-design principles, which further support climate neutrality goals.
- e) Promotes carbon capture through biological cycles. In the bio-based part of the circular economy (e.g., composting, regenerative agriculture), carbon is absorbed and stored in soils and biomass, acting as a natural carbon sink.

In short, the circular economy supports climate neutrality by decoupling economic growth from resource consumption and emissions, helping to build a low-carbon, resilient, and sustainable future.

To boost green transition, eco-innovation, AI, robotics, RES investments and energy storage are instrumental. They require mostly for their production critical raw materials for which the EU is in need: they are scarce and the rare earths in the EU are seldom. Critical raw materials are also key for aerospace and defense.

It is thanks to the circular economy and the recycling pillar of waste management that such critical raw materials can be identified, recovered, and reintroduced in the economy. To



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that effect, Regulation (EU) 2024/1252 of 11 April 2024 establishing a framework for ensuring a secure and sustainable supply of critical raw materials was adopted (OJ L, 2024/1252, 3.5.2024).

### IV. Conclusions

Notwithstanding the declaratory emblematic importance that circular economy has gained in the EU thanks to the Green Deal and its implementing legal framework, as well as worldwide thanks to the references to it in the last COPs under the UNFCCC, and in the SDGs, the rate of circularity worldwide is declining. In the last five years up to 2023, humanity consumed 500 billion tonnes of materials, nearly equal to what was consumed during the entire 20th century. The global circularity rate has fallen steadily from 9.1 in 2018, when Circle Economy Foundation began measuring, to 7.2% in 2023. More virgin materials are consumed than ever, while the share of secondary materials is in decline. This results in exhausting more and more the carrying capacity of the planet and making the threat that two planets will be needed by 2050 seem unfortunately realistic.

At the EU level, the aim is to double recycled material use, in terms of its share of the economy's total material use, between 2020 and 2030, as set in the 2020 Circular Economy Action Plan. Increasing the use of secondary materials would reduce the extraction of primary raw materials and related environmental and carbon impacts. Recycled material accounted for 11.8 % of material used in 2023, an increase of 1.1% from 2010, a rate which is considered low, indicating the economy is still mostly linear. This slight positive trend is mainly due to increases in waste recycling rates driven by Member States to meet EU recycling targets. Nevertheless, the EU is not currently on track to double the circular material use rate by 2030 and more generally to transform progressively its economy into a circular one.

The circular transition process goes hand in hand with the energy and green transition ones and requires all the adopted pieces of legislation under the policy framework of the Green Deal to be fully implemented at EU level and within the Member States. The circular economy transition process is both a top down and a bottom up and has a strong social component represented by the social circular economy, as regards the latter. Energy communities promoting RES and social cooperative initiatives are key to fully involve in the process the civil society in a circular entrepreneurship mode and to enable it to gain ownership in the implementation of circular economy. Moreover, the phasing of fossil fuels, in particular of coal is supported by the Just Transition Fund in the territories expected to be the most negatively impacted by the transition towards climate neutrality.

The exacerbation of the climate crisis and the limited mainstreaming of the circularity in the economy requires additional efforts for a vertical and horizontal mainstreaming at all policy levels and in all the sectors of the economy through tailored circular economy plans and CESG as regards circular entrepreneurship. The new narrative requires the holistic model of circular economy to become the rule and to prevail, not only at EU but also at global level. Key drivers to that effect can become the citizens of the planet shaping the new concept of circular citizen and of circular household leading to a reduction of the environmental, carbon and energy footprint of any human activity. The environment has no borders and in this

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combat against climate change only a universal response can provide the solution through circular economy.

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### WHAT DETERMINES DRIVERS AND BARRIERS OF THE IMPLEMENTATION OF CIRCULAR ECONOMY MEASURES AT REGIONAL LEVEL?

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#### **Abstract**

Circular economy (CE) initiatives are considered as key strategies to contributing to energy and ecological transition and to achieving sustainability development goals. Although the importance policy makers give to these measures little is known about what drives and hinder them, so further research is needed to help to provide the optimal conditions maximizing the drivers and minimizing the barriers. Here we aim to identify the drivers and barriers of the implementation of CE measures at EU regional level. To do so we will use the Flash Eurobarometer Survey 498 on “Small and Medium Enterprises, Resources Efficiency and Green Markets, wave 5”, a dataset that allow us to understand how an extensive sample of European regions undertake circular strategies to be more sustainable with reliable, complete, and homogenous data. This survey was undertaken by the European Commission between November and December 2021 and contains information gathered from interviews with 14,158 managers of SMEs from the 27 Member States of the EU and includes a series of questions that allow the exploration of SMEs' activities in relation to the circular economy and the drivers and barriers they face. One of the main strengths of this survey is that the micro-data file contains the codes of the regions where enterprise headquarters are located. This paper will contribute by better understanding what is behind each one of these drivers and barriers, which will facilitate the design of policy tools to boost circularity measures carried out by EU firms and will then facilitate sustainable transition to achieve EU targets of climate neutrality by 2050.

**Keywords:** Circular economy, drivers, barriers, regions, European Union

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# THE NEW TRADITIONAL URBAN PLANNING AND ARCHITECTURE AS A GUIDE TO SUSTAINABILITY

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## Abstract

Since the Renaissance, learned architects, as producers of urban and architectural forms, have argued for the validity of their design choices based on the mythical or historical past, invoking the classical theory of imitation or the various versions of historical architecture recorded in theoretical treatises or documented by impressions.

Originality and inventiveness, qualities related to the historical category of artistic avant-garde, became values of architecture and elements of distinction of the architect only with the advent of Modernism, at the beginning of the 20th century.

A little earlier, local traditional architectures, architectures without theoretical substance or interest in innovation, based on the building practice and the decorative, had begun to emerge as one of the potential sources of a new scholarly architecture with ethical and, sometimes, political arguments.

The tug-of-war between (scholarly) Modernism and any (scholarly neo-)Traditional Architecture resulted in the reduction of the latter to a style, which undertook to invest otherwise Modernist structures. The final fusion of the two, especially under the influence of the demand for heritage conservation, produced completely meaningless hybrids, which only respond to the demands of the hasty consumption of images.

In the context of globalization, a New Traditional Urbanism and Architecture emerges not as an obsession with a particular local style, but as an international design approach. Based on the logic of continuous improvement, which governed Classical architecture, it seeks to combine individual intelligence with handed down knowledge. Above all, it is a cultural choice that seeks to incorporate elements largely foreign to the “authentic” tradition: sincere tolerance for the differentiation of stylistic approaches and transcendental views of architecture, knowledge and thought, sound reason and vision, precise performance, economy and sustainability, political responsibility, public duty and symbolic representation, which create communities and identities, cultural plurality and diversity, and of course the responsible, moral and ethical exercise of the corresponding professional practices.

**Keywords:** Literary architecture, traditional architecture, classical tradition, imitation, sustainability

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### URBAN AND PERI-URBAN FORESTS, THEIR CONTRIBUTION TO SUSTAINABLE DEVELOPMENT

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#### Abstract

Urban Forests and trees outside forests are vital for sustainable development. Forests play a significant role in achieving the United Nations' Sustainable Development Goals (SDGs). They function as extensive carbon sinks, absorbing greenhouse gases and contributing to SDG 13 (Climate Action), and they provide a wealth of biodiversity, aligning with SDG 15 (Life on Land). Forests are indispensable in fostering clean air and water, thus contributing to SDG 6 (Clean Water and Sanitation), SDG 3 (Good Health and Well-being), and SDG 11 (Sustainable Cities and Communities). Peri-urban forests play a multifunctional role and provide various important ecosystem services. Forest management can influence forest structures through silvicultural treatments (forest system, rotation age, and thinning regime) and affect environmental services provision.

This work aims to present the ecosystem services provided by peri-urban forests in Greece, and an analysis of two peri-urban forests will be discussed in the presentation. These forests consist mainly of Conifers species, mainly *Pinus brutia*, and they are vulnerable to disturbances (forest fires), pests and diseases, and environmental stress conditions. They require specific forest management. The peri-urban forest protects the city from floods, regulates the runoff and absorption of rainwater and extreme phenomena, prevents erosion, and protects the soil. It improves environmental conditions in the city, reduces extreme air temperatures, retains a large amount of dust, and protects from noise. The peri-urban forest improves climate change's effects by storing carbon in five pools (above ground, underground biomass, dead wood, forest floor, and soil carbon). Above all, peri-urban forests have a high recreational and amenity value, as they provide recreation to residents of the city, which is highly appreciated due to the lack of open space in the cities and insufficient space for tree growth.

**Key words:** forest ecosystems, forest management, conifers species, environmental services.



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### CITY OVERTOURISM VERSUS ECONOMIC, SOCIAL AND ENVIRONMENTAL SUSTAINABILITY

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#### **Abstract**

Tourism has undoubtedly contributed significantly to the economic development and cultural prominence of many cities over the last century. In recent decades, world tourism has grown at an accelerating rate, which has had considerable impacts on the economy, the society and the environment of the expanding tourist areas of cities.

The increase in tourist flows (more pronounced during the last two years, that followed the covid period), created pressures that exceed any “capacity limits” of the reception areas. This has been explained in terms of city «overtourism» - characteristically intense in Venice but also intense mainly in cultural heritage zones of several cities of Southern Europe, including Athens.

More severe tensions due to **overtourism** -expressed through the impressive rise of the Airbnb sector- concern housing; in particular, increase in **rents for natives**. Other important tensions include infrastructure (transportation, parking, health facilities) and changes in land use - at the expense of green spaces and areas with traditional building ensembles.

All this requires a new approach for tourism – culture and cities, aligned with the respective UN SDGs – which are gaining wider and wider recognition.

It is more necessary to integrate the strategic priorities for tourism - culture and cities into the overall strategic planning of cities, which should include objectives and measures to address the housing problem, protect and promote cultural heritage and regulate other critical sectors.

The presentation will discuss in more depth both general proposals for the sustainable spatial planning of tourist zones of cities as well as more specific proposals for the tourist zones of Athens in particular.

**Key words:** Overtourism, sustainable development, cities, Athens, European Union

## **DEMOCRATIC THEORY, URBAN PLANNING IDEOLOGY AND PUBLIC PARTICIPATION IN THE ERA OF ARTIFICIAL INTELLIGENCE**

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### **Abstract**

The subject focuses on the intersection of democratic governance, urban development, and advanced technology. Democratic theory deals with the principles and practices that enable effective and equitable governance by the people. Historical philosophical insights reveal that figures like Rousseau advocated for direct democracy and expressing the general will, while John Stuart Mill emphasized liberty, representative democracy, and the empowered, informed citizenry necessary for active public dialogue and engagement. Herodotus and Thucydides highlight the foundational role of public discourse in early democratic societies.

Urban planning ideology, informed by these democratic perspectives, emphasizes both technocratic expertise and participatory approaches. Many theorists argue that planning is inherently political and inseparable from issues of politics and ethics. Recognizing this, contemporary planners generally agree that "value-neutral" planning is impractical and inappropriate as an ideal.

Public participation in urban planning is crucial for aligning urban development with democratic ideals. It focuses on inclusive decision-making processes that reflect the diverse needs of communities, empowering citizens to express their preferences through advanced participatory technologies.

AI offers transformative potential in urban planning by optimizing resource distribution, improving traffic flow, and supporting sustainability. However, urban planning ideology must carefully consider the ethical implications to ensure these technologies promote equity and sustainability rather than exacerbate existing inequalities. While AI can enhance democratic processes by facilitating participatory decision-making through the analysis of extensive citizen input, it also poses risks concerning data privacy, algorithmic bias, and transparency, which could undermine democratic values.

Integrating AI in urban planning must be guided by a democratic ethos, ensuring that technological solutions align with public interests and respect democratic principles like participation, representation, and accountability. Maintaining transparency in AI algorithms and processes is crucial for building trust and adhering to democratic ideals, avoiding potential issues of power imbalance or disenfranchisement.

By understanding these foundational democratic theories, we are better equipped to guide the implementation of AI in urban planning, ensuring that it serves the public good and supports robust, participatory governance.

**Key words:** Democratic theory, public participation, planning ideology, participatory planning, artificial intelligence, means of participation

## **CULTURAL HERITAGE AND SUSTAINABILITY: AN INTIMATE RELATIONSHIP**

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### **Abstract**

Cultural heritage and sustainable development are increasingly seen as interconnected concepts that support one another in significant ways. The heritage of the “past” and the sustainability of the “future” are undeniably linked, coexisting and depending on each other. Cultural heritage is regarded as a crucial resource for socio-economic progress and sustainable development, contributing significantly to the creation of smarter, greener, and more socially aware and inclusive societies.

Preserving and promoting cultural heritage is essential for safeguarding the identities, traditions, and histories of communities. It also plays a crucial role in advancing sustainable development across economic, social, and environmental dimensions. Culture is a vital factor in development, and preserving heritage is key to achieving sustainability.

This presentation focuses on several key questions regarding the future and potential uses of the Cultural Reserve in the context of sustainable development. Some of these questions include: Have we fully understood the potential of cultural heritage in promoting sustainability? In what areas and contexts can we explore the connection between cultural heritage and sustainability? How can cultural heritage serve as a driving force for sustainable development? What is the relationship between sustainability and the intrinsic and functional values of heritage? What conflicts, contradictions, pressures, challenges, threats, and issues affect the sustainability, resilience, and longevity of our heritage? What practices can ensure effective and efficient heritage management? What principles, best practices, approaches, methodologies, and tools can be used to integrate cultural heritage into sustainable development? Additionally, what is the current situation in Greece?

The preservation and promotion of cultural heritage, alongside sustainable development policies, is becoming increasingly important. As we face major global challenges such as climate change, energy transitions, armed conflicts, and social inequalities, the need for effective management and integrated protection of architectural cultural heritage has never been more vital.

**Key words:** Cultural heritage, Sustainable development, cultural reserve, sustainability

## **CLIMATE NEUTRAL CITIES AND CITIZENS’ WELFARE**

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### **Abstract**

Six Greek cities have signed climate contracts with the European Commission (EC) driving them to climate neutrality by 2030 through a holistic approach and massive action plans. Climate contracts with the EC are strategic agreements that align national and local climate goals with EU-wide initiatives to combat climate change. These contracts provide a structured framework for funding, collaboration, and implementation of climate policies, ultimately contributing to sustainable development and improving citizens' welfare.

Research on climate-neutral cities underpins their potential to significantly improve citizen welfare through environmental, economic, and social benefits. These benefits entail, Improved Air Quality and Health, economic growth and job creation, social inclusion and community resilience and enhanced urban livability. Cities awarded with the EU Mission Label benefit from financial and technical support, enabling them to implement impactful climate actions while serving as models for others. Furthermore, mechanisms adopted provide guidance and support in transforming cities to modern, smart, climate neutral communities. Such mechanisms include access to resources and funding, policy alignment and coherence with EU objectives, stakeholder engagement.

Athens, Thessaloniki, Kalamata, Ioannina, Kozani, and Trikala are the six Greek cities that have been awarded with the Climate Neutral Label of the EC. These cities, among the 100 European ones, have committed themselves to implement structural plans aiming at a different city model. Climate contracts with the EC are not just environmental tools; by integrating climate action into welfare-enhancing strategies, these contracts offer a pathway to a sustainable and prosperous future for all citizens.

Baretta and Bracchi (2023a; 2023b) examine the European Mission to create at least 100 climate-neutral cities by 2030. They emphasize the role of cities as innovation hubs, using Climate City Contracts (CCCs) to actively engage citizens and stakeholders.

This approach fosters public trust and delivers health, environmental, and economic benefits while reducing urban vulnerability to climate risks. In their second article, they explore the social dimensions of climate-neutral strategies, highlighting their potential to address equity and improve the quality of life for marginalized communities.

Ricciardi and Callegari (2023) focus on innovative urban planning tools, such as digital twins, to model and enhance the resilience and welfare outcomes of climate-neutral cities. Hirvilammi et al. (2021) argue that addressing climate neutrality requires rethinking traditional welfare models to integrate ecosystem health and social wellbeing. The paper highlights how urban initiatives for biodiversity preservation and sustainable living can directly improve mental health, physical health, and social welfare, particularly in the face of global environmental challenges.

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This paper aims at stressing the importance of CCCs and provide a case study from a Greek city and its climate contract, so that we can identify key challenges and opportunities and infer policy considerations.

**Key words:** Climate neutral cities, welfare

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### ENABLING ACCESSIBILITY, DISABLING DISABLEISM

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#### **Abstract**

From Leonardo da Vinci’s Vitruvian Man to Le Corbusier’s Modular Man and the standardized figures in architectural handbooks, design has historically been shaped by norms of able-bodiedness. These ideals, rooted in the image of the white, non-disabled male, have long influenced architectural thought, shaping both education and professional practice.

In recent decades, concepts such as Universal Design and All-Inclusive Design have dominated discourse, promoting accessibility for all. However, emerging research in access studies reveals new challenges due to evolving disability and inclusion frameworks, intersectional perspectives, and diverse bodily experiences. While accessibility codes provide a legal baseline, their implementation often stops at minimal compliance—such as the mere addition of ramps—without considering the emotional and experiential impact of spaces. As a result, disabled individuals frequently encounter built environments that fail to support their dignity, autonomy, and full participation in public and private life.

This presentation seeks to move beyond regulatory compliance by exploring critical spatial dimensions of disability and inclusion that can inspire designers to develop accessibility-focused solutions that are creative rather than restrictive. Drawing from historical perspectives and contemporary accessibility thinking, we examine the role of designers in shaping inclusive environments and their impact on users.

Our research investigates the Greek built environment where systemic planning failures have contributed to widespread barriers to dignity and mobility. At scales ranging from apartments and buildings to city blocks and neighbourhoods, we analyse key urban factors that promote inclusive design: adaptability, aesthetics, autonomy, efficiency, equitability, flexibility, perception, privacy, safety, and social interaction.

By integrating culturally specific evidence with innovative urban paradigms, our findings provide a transformative approach to accessibility with far-reaching implications for researchers, practitioners, and policymakers. This research not only expands the discourse on inclusive design but also offers actionable strategies to shape more equitable, dignified, and user-centred environments.

**Key words:** Universal Design, disability studies, accessibility, inclusive environments, design for all, Greek built environment.



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### **BUILDING NEW PLACES OF CREATIVE ECONOMIES;RENEWAL AND RE-USE OF ABANDONED BUILDINGS AS COWORKING BUILDINGS IN ATHENS’ CENTRAL DISTRICTS**

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#### **Abstract**

In the past decade, *‘coworking spaces’* (CWS) have emerged as a new and promising urban phenomenon promoting new entrepreneurship, creativity and innovation, and especially related to young professional practitioners. The emergence of CWS is strongly associated to real market conditions in many large European cities. More specifically, high rent prices of office spaces act as constraints for young entrepreneurs and professional practitioners of the creative middle classes to make a start and develop their business. Moreover, existing real estate laws as well as landlords usually require tenants to sign multi-year leases, often a 3 to 5-year minimum commitment. Given the unpredictable future of new businesses, entrepreneurs and young professionals are reasonably reluctant to make such long-term commitments, opting to start in a home-office. However, home-office is often not a proper professional installation due to location away from the city centre or inner-city zone. This creates certain difficulties for young entrepreneurs and professionals to meet their clients and also bad feelings of a kind of isolation. Handling the above situation, abandoned old industrial edifices and warehouses, and yet old vacant office buildings in declined urban areas, were renovated and transformed into Coworking spaces (CWS) in many large European cities. CWS are regarded as accelerators of flourishing urban economies, designed to host creative people and entrepreneurs who endeavor to break isolation of home-office, and to find a proper modern environment that favors meetings and collaboration. The rise of CWS and its implications and impacts are largely unstudied yet.

This presentation focuses on Athens’ inner-city areas and their potentials of creating CWS. Following almost a decade of public depth economic crisis in Greece (2010-18), a large number of commercial spaces, office spaces, residences, as well as whole buildings have been abandoned and remain unused in declined inner-city areas in Athens. The present paper provides maps of existing vacant spaces and buildings; it analyses and classifies them into specific categories and spatial clusters. It finally draws from experience in other European cities to propose guidelines to local authorities, policy makers, and building owners, for their reuse and transformation into CWS, and the creation of specific new epicentres of entrepreneurship, creativity and innovation in Athens’ inner-city areas.

**Keywords:** ‘coworking’ buildings, spatial clusters of new entrepreneurship, creativity and innovation, Athens’ inner-city areas.

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# DEMOGRAPHIC TRANSITIONS, LOCAL ECONOMIES AND METROPOLITAN SYSTEMS IN-BETWEEN SUSTAINABILITY AND RESILIENCE

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## Abstract

By integrating different exploratory and interpretative approaches, this study identifies various explanatory models of the life cycle of a metropolitan system, based on progressive phases that respond to differentiated and complex regional and local contexts, with specific reference to the European continent. The empirical results indicate the most current trends in the old continent, which has basically reached the end of a long socio-economic cycle, and is about to enter a new urban regime. To better prefigure this new regime, an interpretative framework has been proposed that analyses the development paths and simultaneously analyses the temporal, spatial and sectoral dimensions. The progressive demographic decline and the structural change of many regional economic systems suggest a slow transition towards models potentially less sustainable from an environmental point of view, and with a particularly heterogeneous level of resilience to future exogenous shocks. Also thanks to the impact of the economic crisis and the pandemic, the new urban regime will presumably be very different from those observed throughout the last century. Its integrated analysis requires continuous improvements in official statistics indicators and in interpretative approaches based on exploratory and inferential techniques. In recent years, regional and local socioeconomic systems have increasingly been interpreted as complex, articulated and internally fragmented organisms, difficult to manage and plan. The intrinsic difficulty in the quantitative analysis of how these systems are articulated and consolidated, growing or progressively declining, highlights the need for original interpretative visions, which can link regional economic theory and statistical analysis with the most current themes of demographic, historical and geographical disciplines. The seminar therefore proposes a study path, and a presentation of the research tools used, which integrate different methodologies and empirical approaches. Also by exploiting the rich heritage of digitalized data gradually available on a large scale from unofficial sources, the quantitative analyses presented here allow us to outline evolutionary models of local systems and urban growth, so as to capture differentiated socioeconomic dynamics that have shaped metropolitan regions in Europe over the last century. Based on the use of a large collection of multidisciplinary indicators, the statistical analysis has also allowed the identification and profiling of integrated development dynamics at different scales of observation, which can be traced back to specific historical phases, social contexts and economic cycles, thus contributing to the understanding of how urban development can adhere to principles of sustainability and resilience in the long term. The results of the analysis demonstrate how scale and agglomeration factors – which played a very relevant role in the last century – are increasingly less linked to growth processes, also suggesting the growing importance of non-strictly economic forces acting at a local scale.

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Larger metropolitan systems seem to escape this general model, adhering to individualistic growth paths that are difficult to predict, even in the short term. Also thanks to the impact of the economic crisis and the pandemic, the new urban regimes in Europe are, already in the most recent decade, very different from those observed throughout the last century. The knowledge acquired stimulates the construction of development models that take greater account of endogenous and exogenous constraints on urban growth, with the aim of planning more sustainable regional economic systems, and allowing metropolitan regions to approach those sustainability and resilience objectives long pursued on paper and more difficult to achieve in practice.

**Keywords:** Economic growth, urbanization, demographic transitions, local economies, metropolitan systems, sustainability, resilience

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**Special session:**

### **FORESTRY AND FOREST-BASED WOOD PRODUCTS: DISCUSSING THEIR ROLE FOR SUSTAINABILITY AND CLIMATE NEUTRALITY AT LOCAL, REGIONAL AND GLOBAL SCALE**

Organized by:

*University of Thessaly, Department of Forestry, Wood Sciences and Design*  
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#### **Abstract and Topics**

Forests have long played an extremely important role in our economy and society, as they help create jobs and are a source of wood, food, medicines, materials, clean water, and many other goods. For centuries, forests have been a thriving source of cultural heritage and construction, tradition, and innovation, with wood serving as a cornerstone of these activities.

However, as important as forests—and the wood they provide—have been in the past, their role will be even more essential for our future. Forests are a natural ally in adapting to and combating climate change and will play a vital role in making Europe the first climate-neutral continent by 2050. Greenhouse gas emissions and removals from forests, as well as forest products like wood, will play a key role in achieving the ambitious net sink target of -310 million tons of carbon dioxide equivalent for the Union. Forests and their wood-based resources also make an important contribution to our ambitious biodiversity targets, safeguard livelihoods in rural areas and beyond, and support a sustainable forest bio-economy based on the most sustainable forest management practices. This is underpinned by a recognized and internationally accepted dynamic concept of sustainable forest management, which considers multifunctionality, forest diversity, and the three interdependent pillars of sustainability.

Furthermore, given the increasing and sometimes competing demands on forests, we also need to ensure that the amount of wood we use remains within the limits of sustainability and is used optimally, in line with the principle of cascading use and the circular economy approach. This will ensure, as far as possible, the substitution of fossil-based materials with wood and other circular products that have a long lifespan and are of greatest value for carbon storage and the circular economy. Wood, as a renewable material, plays a pivotal role in fostering a future that balances innovation with environmental responsibility.

The special session will focus on the role of forestry and forest-based wood products in sustainable development at local, regional and global level and more specifically at the following key topics:

- Sustainable forest management
- Forestry and sustainability
- Biomass- wood for energy production
- Sustainable development of mountainous areas
- Circular economy in forestry and forest – based products
- Forest bioeconomy and innovation
- Wood technology and forest-based wood products

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- Non wood products
- Forest based wood biomass and renewable energy.
- Sustainable construction with wood.
- Climate change and the role of forestry and forest based products.
- Carbon markets and the role of forests and wood products
- Entrepreneurial ventures in the forest value – chain
- Biodiversity and sustainable development
- Agroforestry
- Urban forestry
- Innovative and IT technologies in management of forest resources

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# EUROPEAN PROGRAMS AND GREECE’S FOREST BIO-ECONOMY: REVIEW AND RESEARCH GAP IDENTIFICATION AND METHODOLOGY APPROACH

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## Abstract

This paper explores the ongoing debate surrounding the forest bioeconomy and its potential to transform national economies, with a particular focus on Europe’s strategic policies and financial tools. In light of the recent report on the progress made in implementing the European Bioeconomy Strategy, this study aims to explore how Europe’s renewable organic resources, specifically those derived from forests, can be utilized more sustainably to mitigate the impacts of climate change and address environmental pressures (European Commission, 2011). While significant efforts have been made to monitor and measure forest bioeconomy development across Europe, existing literature reveals a lack of standardized methodologies for assessing its impact across EU member states, making cross-country comparisons challenging. Moreover, there is no consensus on the definition or scope of the forest bioeconomy, further complicating the evaluation of financial support and its effectiveness across different forest bioeconomy sectors, such as sustainable forestry, biomass production, and forest-based industries (Lovrić et al., 2020; Kardung et al., 2020; Rinn et al., 2022).

The objective of this study is to address this gap by evaluating the impact of European funding and expertise on Greece’s forest bioeconomy. Specifically, the study will develop an evaluation model to measure the economic benefits derived from European funding, such as co-financed programs and research projects, and analyze their contribution to regional development and sustainability outcomes in Greece’s forest bioeconomy.

**Keywords:** Forest Bioeconomy, European Programs, Sustainability, Bioeconomy Policies, Greece

## Introduction

The bioeconomy has seen rapid growth in recent years, driven by the need for sustainable resource management and climate change mitigation. It focuses on producing and transforming renewable biological resources into food, animal feed, bio-based products, and bioenergy (Trydeman et al., 2015). Through circular and sustainable models, the bioeconomy



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can address global challenges like climate change, soil erosion, and increasing demand for food and energy (European Network for European Development, 2019). Additionally, it contributes to economic development and job creation, particularly in rural areas, while promoting environmental sustainability.

The 2018 revision of the European Bioeconomy Strategy emphasizes the importance of financing mechanisms to support bio-based industries. However, research on the role of European funding programs in forest bioeconomy policy implementation remains limited. Studies such as those by Thöle et al. (2021), Albrecht et al. (2021), and Lovrić et al. (2020) have explored regional bioeconomy financing, yet there is a lack of comprehensive analysis on Greece’s forest bioeconomy.

This study aims to assess the impact of European funding on Greece’s forest bioeconomy by developing an evaluation model that measures economic and regional benefits. Given Greece’s historically low bioeconomy development (Haarich, 2017) but strong interest in its expansion (Silaidi, 2018), understanding the role of EU programs is essential for shaping future policy strategies and setting priorities for sustainable development.

## Theoretical Background

### Conceptual Approach to the Bioeconomy

The bioeconomy is a broad concept with multiple definitions depending on the context (Mittra & Zoukas, 2020). Initially coined by Enriquez and Martinez in 1997, it refers to economic activities derived from scientific research on biological mechanisms applied in industry (Martinez, 1998). The European Commission (2012) defines the bioeconomy as the economy based on renewable biological resources and their transformation into food, feed, materials, and energy. This broad definition allows for multiple interpretations and strategic approaches. Bugge et al. (2016) identify three main bioeconomy models:

1. **Biotechnology-driven** – Focuses on research commercialization and technological applications, with a strong emphasis on genetic engineering, synthetic biology, and industrial bioprocesses (Philp, 2017).
2. **Bio-resource-based** – Aims to balance economic expansion with environmental sustainability by optimizing resource use, enhancing agricultural productivity, and promoting the use of underutilized land for biofuel crops (Luana & Blind, 2017).
3. **Bio-ecology-oriented** – Prioritizes biodiversity, circular economy principles, and sustainable resource management by emphasizing ecosystem protection, reducing soil degradation, and maximizing organic waste recycling (Hausknot et al., 2017).

These models influence policy and investment decisions worldwide, as nations develop bioeconomy strategies tailored to their economic, environmental, and technological contexts.

### Bioeconomy as a Policy Project

The bioeconomy has been central to EU policy since the 1993 White Paper, which emphasized investment in biotechnology for economic growth. The concept gained prominence with OECD reports (2001, 2009) and the European Commission’s strategies,

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including "Bioeconomy for Europe 2020" and the 2012 Bioeconomy Strategy, which integrated sustainability and circular economy principles. The 2018 revision expanded the definition to encompass all sectors using biological resources, highlighting innovation and the role of digitalization in bio-based industries (EC, 2018).

### **Bioeconomy Policies in Europe**

Since 2007, EU policies have actively promoted the bioeconomy as a driver of sustainable development. Germany pioneered national bioeconomy strategies in 2010, followed by Finland in 2014. By 2015, several EU member states had adopted bioeconomy policies, aligning them with green growth and circular economy principles (Global Bioeconomy Policy Report, 2020). The integration of bioeconomy policies with other EU frameworks, such as the Green Deal and Farm to Fork Strategy, underscores the shift toward sustainable resource use and climate resilience.

### **The Bioeconomy in Greece**

Despite its relatively low ranking in bioeconomy development compared to other EU member states (Haarich, 2017), Greece possesses significant potential for bioeconomy expansion (Silaidi, 2018). The sector generates €27 billion in turnover and employs approximately 500,000 workers, with agriculture accounting for 80% of bioeconomy activities (Karagouni, 2017). Although Greece lacks a dedicated national bioeconomy strategy, several policies support biological resource management, including:

1. **Common Agricultural Policy Strategic Plan (2023-2027)** – Promotes sustainable agriculture and bio-based innovations.
2. **National Climate Change Adaptation Strategy** – Encourages the sustainable use of biological resources to mitigate climate change.
3. **National Smart Specialization Strategy (RIS 2021-2027)** – Focuses on regional innovation in bio-based industries.
4. **National Development Strategy (2021)** – Identifies the agro-food sector as a priority for economic growth.

### **Forests and the Bioeconomy**

Forests play a crucial role in the bioeconomy by providing raw materials, supporting biodiversity, and offering ecosystem services. The European Green Deal promotes forest resilience within the circular bioeconomy framework, emphasizing the transition to bio-based products and sustainable forestry practices. Non-timber forest products (e.g., medicinal plants, mushrooms) are valued at €23 billion annually in the EU, yet Greece lacks systematic data collection and policy integration for these resources (Lovrić et al., 2020). Sustainable forest management is critical for maximizing the economic and ecological benefits of forest-based bioeconomy activities.

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### **Biomass and Sustainability Indicators**

Biomass plays a pivotal role in bioeconomy development, as it serves as a renewable energy source and a raw material for bio-based industries (Lewandowski, 2015). Biomass sources include forestry and agricultural residues, organic waste, and algae-based materials. Assessing the sustainability of biomass production requires evaluating key indicators such as resource efficiency, pollution reduction, and socio-economic impacts (Fritsche et al., 2018).

Two primary approaches to sustainability in the bioeconomy include:

- **Weak sustainability** – Maintains a market-driven perspective, allowing economic growth while implementing compensatory environmental measures (Hoffman, 2012).
- **Strong sustainability** – Imposes strict ecological constraints, ensuring that natural resource use does not exceed regenerative capacities (Bennich & Belyazid, 2017).

Understanding these frameworks is essential for evaluating bioeconomy policies and shaping Greece’s transition to a sustainable bioeconomy model. A holistic approach to bioeconomy policy must integrate economic, environmental, and technological factors while ensuring long-term ecological balance.

### **Monitoring and Evaluation of the forest bio-economy**

Tracking bioeconomy transitions and their impacts can be seen as a Herculean task, as they cannot be easily captured using current economic statistics. Organic and non-organic products are rarely distinguished when official data are collected. However, production along bioeconomy supply chains and its impacts on sustainability require measurement and evaluation to enable informed policy making. (Jander, 2020).

For example, the BioMonitor project (2022) attempts to address the information gap in bioeconomy research by reframing the existing data and modeling framework. The study Kutay (2021): A Cross-Country Measurement of the EU Bioeconomy: An Input–Output Approach, within the Biomonitor project, manages to measure the added value of the bioeconomy that is not immediately apparent but rather hidden in other industries in part bioeconomy. The information platform created within the project provides a measure of the share of the bioeconomy for the EU-28 countries for the period 2005–2015 based on input-output tables.

In the study by Lovrić, et al. (2020), an attempt was made to form an overview of the European forest-based bioeconomy research field by mapping the actual research activity in the field, based on projects from the EU Framework Programs and the European Research Area, supplemented with data on self-reported research abilities. Projects included in the CORDIS database were used as the main data source for mapping research activity in the field of forest-based bioeconomy. The analysis is limited to the period 2008–2018, where the projects listed fall under FP7, H2020 and the European Research Area Work Program (ERA-NETs). The study assesses the coherence and synergies of public research and innovation programs and maps research activity across industries and sectors in order to help improve the existing knowledge base, while making two clear policy recommendations: the need for stronger involvement of research organizations from countries of Eastern Europe to the international scientific community in the field of forest-based bioeconomy, emphasizing a geographical coverage criterion in future research and innovation planning and the design of

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research and innovation calls for projects that thematically cover multiple forest-based bioeconomy supply chain categories.

In the recent study by Rinn, et al. (2022), a comparative analysis of forest bioeconomies and our understanding of them in selected countries is carried out, and the level of comprehensive data on projects supported by the RDP 2014–2020 is assessed. This analysis showed that the perception and definition of the forest bioeconomy varies from country to country. That is why it is not possible to compare the level of financial support of the forest bioeconomy between countries. It is also not possible to use it as a single and comparable indicator to measure sustainability.

The study by Lovric, et al. (2021) provide an insight into the future of the forest-based bioeconomy sector in selected countries in South-Eastern Europe. It elicits forest-based bioeconomy experts' understanding, opinion and level of agreement on the future implementation of the bioeconomy concept by 2030/2050, through two rounds of the Delphi method. The study contributes to a better understanding of regional contexts related to forest-based bioeconomy status and further development, while demonstrating that regional and national priorities in forest-based bioeconomy should be set in regional, national and sub-national strategic documents (Winkel, 2017), to further support the implementation of the concept.

### Research Objective

Over the past twenty years, EU policymakers have prioritized the expansion of organic value chains through various EU policy initiatives and research programs. Despite the growing popularity of the bioeconomy in Europe, its research and statistics lag in several ways, such as the lack of a comprehensive database and statistics for bio-based industries, the lack of a transparent methodology for bio-based data collection, and the lack of comprehensive data and value chain indicators depicting the processing system flows of different biological materials (Kardung et al., 2019).

Despite efforts to monitor the EU's bioeconomy and individual national bioeconomies, there is still no common approach to monitoring and measuring the bioeconomy across EU states, making cross-country comparisons difficult. Furthermore, according to Kardung (2020), there is a pressing need for methodological improvements in monitoring and measuring bioeconomy-based production models.

In particular, Greece currently lacks a targeted National Strategy for the bioeconomy, despite the high priority assigned by the Greek government to resource efficiency, energy efficiency, and low-carbon investments (Papadopoulou, 2018). While the importance of the bioeconomy is widely recognized globally for its economic, social, environmental, and touristic dimensions, in Greece, the bioeconomy model has not yet received the attention it deserves.

From a review of the relevant literature, the following key gaps have been identified:

- **Lack of a comprehensive database:** Despite increasing policy interest, the absence of structured, evidence-based monitoring systems for bioeconomy sectors hinders effective policymaking and adaptation (Ronzon, 2021).
- **Absence of a transparent methodology for data collection:** While agriculture and forestry sectors are always included in bioeconomy monitoring, other sectors, such as the

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chemical industry, are only partially accounted for in most international monitoring frameworks, resulting in inconsistencies in data collection and interpretation (Jander, 2020).

Additionally, as the concept of bioeconomy evolves, it becomes increasingly necessary to integrate various interdisciplinary approaches that combine economic, environmental, and technological perspectives. A successful bioeconomy model relies not only on the sustainable use of biological resources but also on innovative processing techniques, digitalization, and market-oriented solutions. The role of digital tools, artificial intelligence, and blockchain technology in monitoring and improving supply chain traceability is becoming more prominent, highlighting the need for more advanced methods in data collection and analysis.

Furthermore, policy fragmentation remains a key challenge. While several EU member states have developed targeted bioeconomy strategies, Greece still lacks a coherent national policy framework dedicated to bioeconomy implementation. This creates inconsistencies in the allocation of resources, regulatory frameworks, and investment strategies. A critical aspect of this research will be to assess the effectiveness of existing policy instruments in supporting the forest bioeconomy in Greece, identifying both best practices and bottlenecks that hinder progress.

The primary objective of this research is to create a comprehensive database consolidating all funding sources that have supported forest bioeconomy initiatives in Greece—whether in research, business support, or project development. The goal is to evaluate the impact of these funding mechanisms and the expertise they provide on the forest bioeconomy sector in Greece through the development of an evaluation model. This model will assess the economic benefits derived from these support mechanisms and their contribution to regional development.

Through this research, a better understanding of the bioeconomy's role in achieving sustainability goals will be established, ensuring that Greece can harness its rich natural resources effectively while balancing ecological conservation with economic growth. The study will also explore how Greece can align its national bioeconomy strategies with broader EU objectives to attract more funding, stimulate innovation, and enhance the competitiveness of its forest-based industries in the global market.

This study aims to examine the role of European programs in the implementation of bioeconomy policies in the forestry sector in Greece. It seeks to identify the main challenges and constraints that hinder the effective application of these policies in Greek forests. Furthermore, it explores how bioeconomy policies can be better integrated into forest management practices to enhance sustainability and economic growth. A key focus is assessing the impact of European programs on local economies and environmental sustainability through the promotion of forest bioeconomy initiatives. Additionally, the study aims to develop proposals and best practices that can optimize the use of European resources in advancing Greece's forest bioeconomy.

This research provides a unique contribution by focusing on the application of bioeconomy policies in the forestry sector, an area of significant importance that remains underexplored in Greece. While the bioeconomy has gained traction across Europe, limited research has been conducted on how these policies are effectively implemented in Greek



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forests and the extent to which they contribute to sustainable resource management and regional development.

A key aspect of this dissertation is its in-depth analysis of European funding mechanisms, including Horizon Europe, the LIFE Programme, the European Agricultural Fund for Rural Development (EAFRD), Interreg Europe, and the Bio-Based Industries Joint Undertaking (BBI JU). By assessing the role of these programs, the study aims to identify both the opportunities and barriers associated with financing the forest bioeconomy in Greece. Furthermore, it examines how EU-funded initiatives align with national and regional priorities, ensuring that bioeconomy strategies are effectively integrated into forestry management and economic planning.

To provide a comprehensive assessment, the research employs an innovative mixed-method approach that combines qualitative and quantitative methodologies. This includes stakeholder interviews, case study analysis, policy evaluation, and statistical modeling to measure the economic, environmental, and social impacts of bioeconomy policies. By incorporating diverse analytical techniques, the study ensures a holistic understanding of how EU programs influence the forest bioeconomy and their potential to drive sustainable development.

Beyond policy evaluation, this dissertation seeks to develop actionable recommendations that address Greece’s specific challenges in implementing bioeconomy initiatives. The findings will support the design of tailored policy proposals that enhance the effectiveness of bioeconomy programs, promote investment in forest-based industries, and encourage the adoption of sustainable practices. These recommendations will be grounded in empirical evidence, making them valuable for policymakers, industry stakeholders, and researchers seeking to strengthen Greece’s bioeconomy framework.

Ultimately, this research aims to contribute significantly to both scientific knowledge and policy discourse on the forest bioeconomy in Greece. By shedding light on the role of European funding in fostering sustainable forest management, it provides insights that can inform future bioeconomy strategies at the national and EU levels. The study underscores the importance of aligning economic growth with environmental sustainability, ensuring that Greece can fully capitalize on its natural resources while meeting long-term ecological and economic objectives.

### **Methodology approach**

The research employs a mixed-method approach, incorporating both quantitative and qualitative methodologies to ensure a comprehensive analysis of the impact of European programs on Greece’s forest bioeconomy. The methodology is structured into two main components: data collection and data analysis.

### **Data Collection**

To obtain robust and diverse insights, a quantitative survey will be conducted using a structured questionnaire. The survey will target key stakeholders from the quadruple helix model, ensuring representation from multiple sectors that influence and are influenced by the bioeconomy. The target groups include:



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1. **Research Community:** This category includes universities, research institutions, and innovation hubs specializing in bioeconomy, forestry, and sustainability. Their input will provide valuable information on technological advancements, research gaps, and knowledge transfer within the sector.
2. **Businesses & Industry Representatives:** Engaging chambers of commerce, trade associations, and forest-based industries will shed light on the role of private investment in the bioeconomy, the commercialization of bio-based products, and the market dynamics shaping the sector.
3. **Public Sector:** Ministries, local and regional authorities will be surveyed to assess policy implementation, regulatory frameworks, funding mechanisms, and governmental support for bioeconomy-related initiatives.
4. **Civil Society:** Non-governmental organizations (NGOs), forest management organizations, and environmental advocacy groups will provide insights into community engagement, sustainability concerns, and the social impact of bioeconomy policies.

In addition to the survey, semi-structured interviews with key informants from these groups will be conducted to gain deeper qualitative insights. This will help capture expert opinions, challenges faced in the implementation of bioeconomy policies, and potential solutions to enhance effectiveness.

### Data Analysis

The collected data will be processed using advanced statistical and analytical techniques to ensure meaningful interpretations and actionable conclusions. The analysis will involve:

- **Descriptive Statistical Methods:** Measures such as averages, percentages, and variance analysis will be employed to summarize the data and identify key trends in funding allocation, policy implementation, and stakeholder participation.
- **Trend Analysis:** Historical data and survey responses will be analyzed to examine changes in bioeconomy-related indicators over time, such as investment trends, technological advancements, forest area utilization, and sustainability practices.
- **Comparative Analysis:** The study will compare Greece's bioeconomy development with other EU countries, identifying best practices and areas for improvement.
- **Regression and Correlation Analysis:** These methods will be used to assess the relationships between different variables, such as the impact of EU funding on economic growth, employment rates, and sustainability outcomes.
- **Thematic Content Analysis:** Qualitative data from interviews and open-ended survey responses will be systematically categorized and analyzed to identify recurring themes, stakeholder perceptions, and policy recommendations.

By employing this rigorous methodology, the study aims to provide a detailed assessment of the effectiveness of European programs in shaping Greece's forest bioeconomy. The findings will offer valuable insights for policymakers, researchers, and industry stakeholders, facilitating evidence-based decision-making and strategic planning for sustainable bioeconomy growth.

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### Conclusion

The transition to a sustainable society is increasingly challenged by complex factors such as climate change, population growth, rapid urbanization, and widening income disparities. Recognizing the need for a balanced approach, the United Nations affirmed in 2018 that sustainable development must integrate economic progress, social inclusion, and environmental protection. Over the past two decades, EU policymakers have acknowledged the bioeconomy as a crucial driver of sustainability, emphasizing its alignment with the Sustainable Development Goals (Wesseler & von Braun, 2017; Zilberman et al., 2018). This recognition has led to the launch of various policy initiatives and research programs at the EU level, including the European Bio-Based Industries Joint Undertaking, which aims to accelerate the transition to a circular bioeconomy (Wesseler & von Braun, 2017). The recent revision of the European Commission’s Bioeconomy Strategy (European Commission, 2018a) further underscores the high priority of bioeconomy policies on the EU’s political agenda.

Despite these efforts, quantifications of the bioeconomy have traditionally focused on economic and social aspects, with less emphasis on environmental considerations (European Commission, 2018b). A holistic approach is required to assess the broader implications of bioeconomy activities, particularly regarding their dependency on forest ecosystems. Evaluating the contribution of forest ecosystems to gross domestic product (GDP) demands an in-depth examination that extends beyond the direct economic impact of the forestry sector. This includes an assessment of the indirect and induced effects of forestry-related activities on other industries and their role in broader economic systems.

A resource-based bioeconomy necessitates a comprehensive understanding of available natural resources, their geographic distribution, and their economic potential. Identifying the synergies and trade-offs between forests and other land uses is essential for ensuring sustainable resource management. As Wolfslehner et al. (2019) highlight, a well-defined framework for resource utilization, property rights, and economic valuation is critical for optimizing bioeconomy strategies.

This research contributes to this broader understanding by applying a robust methodological framework to collect and analyze relevant data on Greece’s forest bioeconomy. Through the identification of key sustainability indicators, this study aims to provide a comprehensive assessment of the forestry sector’s role in the Greek bioeconomy. The findings will offer valuable insights for policymakers, industry stakeholders, and researchers, enabling more informed decisions that support sustainable development, economic resilience, and environmental stewardship. Ultimately, by advancing knowledge in this field, this dissertation seeks to enhance the effectiveness of bioeconomy policies and contribute to the long-term sustainability of Greece’s natural and economic resources.

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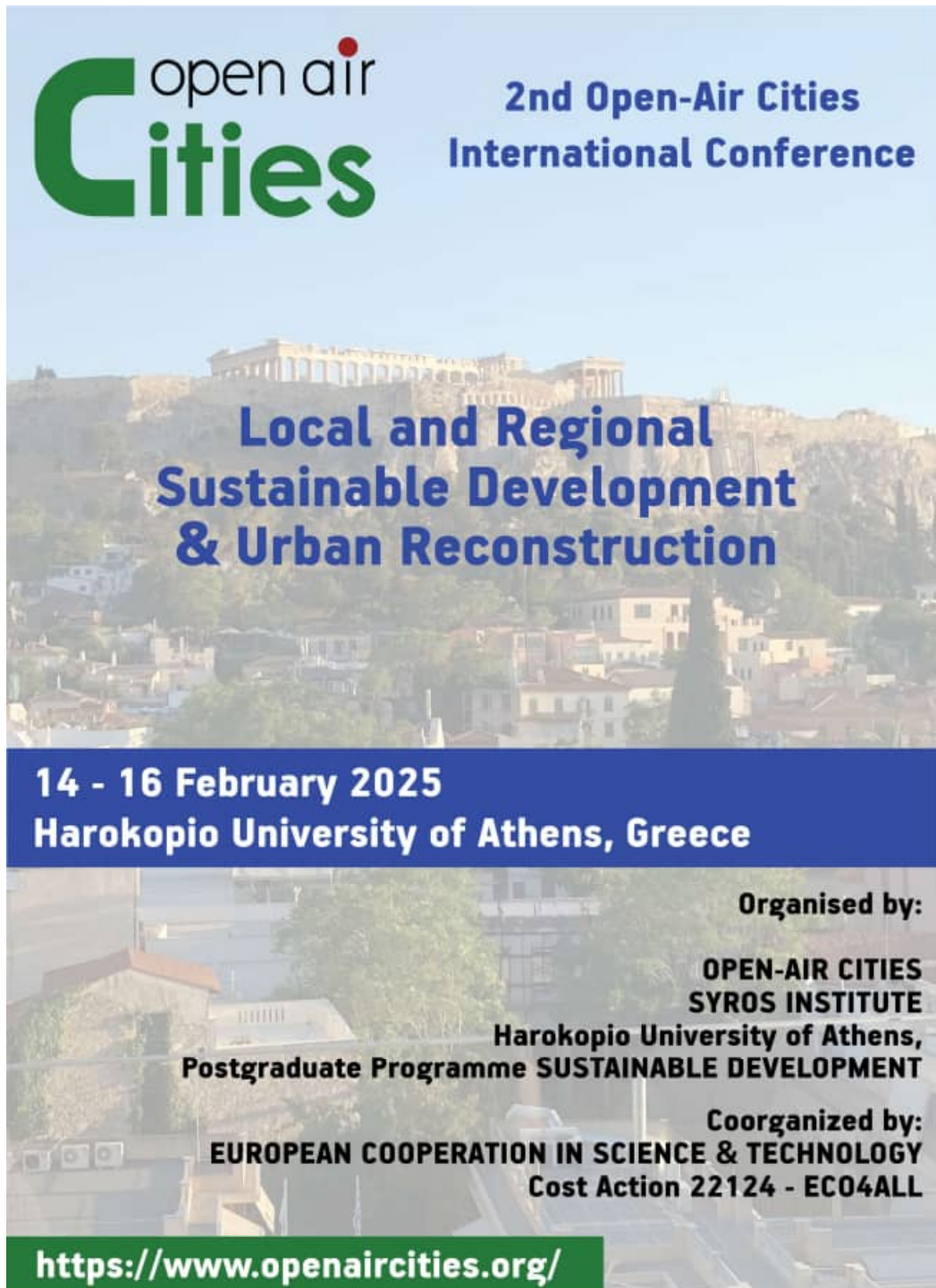
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### THE USE OF SUSTAINABLE WOOD-BASED CONSTRUCTION MATERIALS TOWARDS REDUCING ENERGY INPUT

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#### **Abstract**

The construction industry plays a pivotal role in global energy consumption and environmental impact, with traditional building materials and practices contributing significantly to carbon emissions and resource depletion. Sustainable wood-based construction materials present a promising solution to these challenges, offering renewable, low-carbon, and energy-efficient alternatives.

This study explores the potential of wood-based materials in reducing energy input across the lifecycle of construction projects, from production and transportation to use and disposal. Key attributes, including carbon sequestration, thermal efficiency, and adaptability, are highlighted alongside advancements in engineered wood products such as cross-laminated timber (CLT) and glued laminated timber (glulam).

The integration of these materials into modern construction practices not only reduces reliance on energy-intensive materials like concrete and steel but also supports the transition to a circular economy. Challenges such as resource management, certification, and resistance to widespread adoption are also addressed.

The findings underscore that the use of sustainable wood-based materials can significantly lower energy demands, enhance building performance, and contribute to achieving global sustainability goals.

**Key words:** Sustainable construction, wood-based materials, energy efficiency, engineered wood products, cross-laminated timber (CLT), circular economy, green building.

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# AI IN SMART FOREST MANAGEMENT: FROM DMRV SERVICES TO INTELLIGENT BIOMASS MANAGEMENT

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## **Abstract**

Nowadays, climate change has become a very threatening issue, affecting ecological stability and sustainable management of terrestrial ecosystems worldwide. Various task force groups currently seek big data and Artificial Intelligence (AI) related solutions for retaining forest ecosystems equilibrium. Hence, there is an urged need for investing in new big data AI technologies for achieving forest ecosystem stability and resilience against abrupt climate changes. Advanced technological approaches, such as the dMRV (digital Measurement Reporting Verification) framework, integrated with AI big data management and prediction methods, may be a promising mitigation solution against radical climate change ecosystem challenges. DMRV framework is a package of established technologies such as IoT, and satellite imagery, for environmental data monitoring, enriched with AI and Blockchain for data integrity and transparency.

This paper surveys latest advances in AI-based technologies, as well as case studies in smart forest management and sustainable development. As the migration of Forestry 4.0 to Forestry 5.0 paradigm encourages Human-AI interactions, this work aims at inspiring both forest officials and scientists to invest in AI technology solutions for efficient forest management against climate change challenges.

**Key words:** Forest ecosystems, AI technologies, dMRV, tree pruning biomass, Climate Smart Forestry (CSF), Sustainable Forest Management (SFM)



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### Introduction

Nowadays, climate change has become a very threatening issue, affecting ecological stability and sustainable management of terrestrial ecosystems worldwide. Forest ecosystems are straightforward related with their large volume carbon sequestration capacities, however, they seem to gradually degrade through uncontrolled deforestation, and unexpected wildfires. According to Food and Agriculture Organization of the United Nations (FAO), the last three decades, the area of primary forest worldwide has been decreased by over 80 million hectares through deforestation, forest degradation, and wildfire (<https://www.fao.org/state-of-forests/en/>).

Moreover, in many countries, current practices for forest and agricultural tree pruning residues, still encourage their elimination by open burning in the field, thus increasing the risk of fire spreading, while simultaneously leading to uncontrolled emission of greenhouse gases (GHG). It has been estimated that the open burning of olive branches in the field emits 1600 kg CO<sub>2</sub>/ton, 90 kg CO/ton, suspended particles 17 kg/ton, with a simultaneous loss of organic matter of 7.44 kg/ton (Kostenidou et al 2013). In Greece, residual biomass burned per each crop type lies within 4, up to 8 tn/ha per year (2021 reference year), according to national inventory report (NIR) for GHG (NIR of Greece for GHG and other Gases for the years 1990-2021, Ministry of Environment and Energy). In a circular bio-economy context, the utilization of residual tree pruning biomass is a key axis of the European Green Deal, which aims to reduce GHG emissions by 55% by 2030 compared to 1990 levels ([https://commission.europa.eu/strategy-and-policy/priorities-2019-2024/european-green-deal\\_en](https://commission.europa.eu/strategy-and-policy/priorities-2019-2024/european-green-deal_en)).

At the same time, regarding the 17 UN Sustainable Development Goals (SDG) in forest domain, various task force groups are seeking for big data, Artificial Intelligence (AI) related solutions for bringing back forest ecosystems equilibrium. On the other hand, Climate Smart Forestry (CSF) is an emerging paradigm in sustainable forest management (SFM), in order to tackle with the threatening challenges of climate change. CSF requires AI based, novelty and proactive forest management methods to efficiently equip modern decision making systems, that will in turn, provide forest ecosystem resilience.

Hence, there is an urged need for investing in new big data AI technologies to achieve forest ecosystem stability and resilience against abrupt climate changes. Advanced technological approaches, such as the dMRV (digital Measurement Reporting Verification) framework, integrated with AI big data management and prediction methods, may be a promising mitigation solution against radical climate change ecosystem challenges. DMRV framework is a package of established and well tested technologies, such as IoT (internet of things), and satellite imagery, for environmental data monitoring, enriched with AI methods and Blockchain structures, for data integrity and transparency.

This paper is a comprehensive review of cutting edge technologies, along with applied case studies and projects in forest domain, as a proof of indication for improvement in SMF and sustainable development. As the migration of Forestry 4.0 to Forestry 5.0 paradigm encourages human-AI interactions, we hopefully believe that this study may inspire both forest officials and scientists, to invest in AI integrated technology solutions for efficient forest management against climate change challenges.

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### Climate smart forestry integrated solutions for SFM

As mentioned, CSF term is directly related to the SFM and it is also associated to intelligent AI based solutions that attempt to mitigate carbon emissions, and therefore to tackle climate challenges (Nabuurs et al. 2017). Those solutions should be data driven and integrated with state of the art technologies (AI, Machine Learning, satellite imagery, IoT sensors, blockchain, etc) in order to efficiently provide flexible and resilient models against radical climate changes, that strongly affect forest ecosystems. The real challenge lies in the fact that there is still limited knowledge on the way that climate changes affect and interact with forest ecosystems. That precious knowledge should be gained, enriched, and managed properly via combined remote monitoring and intelligent AI methods and algorithms, in order to provide proactive and predictive solutions for SFM, and to build smart forest decision support systems (Keenan et al. 2019).

**Table I: Smart Forest sensor types**

| Sensor Type                   | Application                                                         | Advantages                                                                                                                                                                                       | Disadvantage                                                                                                                       |
|-------------------------------|---------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------|
| GNSS and Wifi, etc.           | Localization                                                        | Accurate position determination                                                                                                                                                                  | Problems in covered terrain due to signal inconsistency                                                                            |
| Temperature sensors           | Temperature monitoring                                              | Provide insight into temperature fluctuations and can be linked to multiple other inputs (e.g., moisture), available to measure temperature in different media                                   | Without linkage to other data, has a very narrow application in forestry. Continuous monitoring requires a good network            |
| Moisture and humidity sensors | Measuring water content in air or soil                              | Produces climate data and can be easily linked to inputs like temperature. Applications can range from humidity measurements under the canopy to determining the trafficability of forest roads. | Real-time monitoring is only possible with a good network. Setup can be complicated.                                               |
| Soil pH                       | Determining the solubility of different nutrients in soil           | Understanding the nutrient uptake capability in relation to the soil.                                                                                                                            | On-site measurements with embedded sensors cannot reach the accuracy as an in-lab measurement                                      |
| RGB camera                    | Generates images of the surroundings                                | Wildlife monitoring, understanding forest road condition, and navigational aid                                                                                                                   | Processing of pure image data can be challenging. Large amounts of data are generated when high-quality video/photo is used        |
| Thermal imaging camera        | Measures heat profiles of the surroundings                          | Understanding of thermal gradients; useful in phenotyping; forest fire detection SAR                                                                                                             | Large amount of data generation possible, and image processing can be challenging.                                                 |
| LIDAR sensor                  | Provides detailed topographical data                                | Assists in biomass estimation, forest structure analysis, and navigation                                                                                                                         | Most commonly used technologies today are expensive. Problem with rain or other contamination on the transparent window.           |
| Multispectral cameras         | Measuring multiple spectra at the same time for simple data linking | Simple setup to obtain a broad range of data that is directly linked to one another                                                                                                              | The collection of multiple wavelengths at the same time can lead to poor performance of each detector compared to specialized ones |

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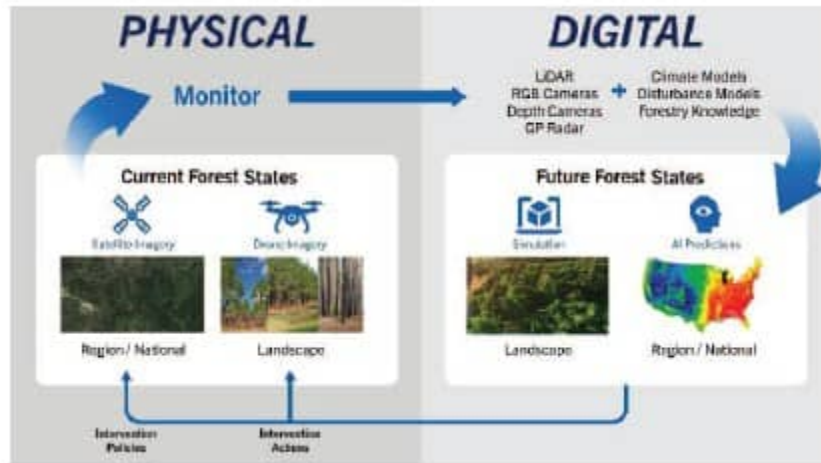
To put it simple, at first, we need to provide an automated means of measuring monitoring and collecting those dynamically evolving forest ecosystem information data, so as to build the necessary knowledge database. Normally, such data will emanate from the combined use of multiple IoT sensor cluster network implanted in designed areas within forest ecosystems (see Table I), and Proximity Detection Technologies (see Table II), at close range (lidar, cameras, UAVs etc), or remote satellite imagery (Ehrlich-Sommer et al. 2024). In this way, all raw data related with the current forest status, or timely deforestation changes, and the effects climate change eventually, has had on land, could be tracked and enrich that knowledge database. Apart from forest monitoring, those technologies could perfectly fit as a solution, to other application types, such as the monitoring and control of life cycle chain of forest or agricultural biomass, from its early origin to its finite customer consumption products. Moreover, those combined sensor and imagery technologies could enable the creation of three-dimensional (3D) forest models (Torresan et al. 2021).

**Table II: Proximity Detection Technologies**

| Device                    | Application                                                                                                                               | Advantages                                                                                                                 | Disadvantage                                                                                                                                       |
|---------------------------|-------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------|
| Satellites                | Remotely detect various data inputs (Temperature, moisture, images, etc.)                                                                 | Ease of access to data, standardized datasets, and ability to monitor almost the entire surface of the earth               | In many cases dependent on weather conditions. Continuous monitoring of a certain area is hardly possible. Large distance to the area of interest. |
| Drones                    | Remotely detecting various data inputs.                                                                                                   | Cheap and easy to operate by a human; operation below the tree canopy is possible                                          | Limited operation time for non-fixed wing variants; challenging to autonomize for flight below the canopy                                          |
| Unmanned ground vehicles  | Autonomous data collection and interaction with ground-based equipment. The potential communication link with other equipment like drones | Longer operation time compared to drones, with a high payload and is simple to use                                         | Without external computing sources, fully autonomous maneuvering is still not possible                                                             |
| Existing forest machinery | Data collection                                                                                                                           | Simple sensors that do not require a lot of human interaction can gather data without interfering with the human workflow. | Complex sensors pose issues due to harsh operating conditions, e.g., LIDAR on a harvester. Therefore, they are limited to simpler sensors          |

Those massive raw and heterogeneous data could be exploited and processed by predictive AI models to predict e.g. the size, spread, or probability of a fire outbreak in a certain area, or the spatial progression of a currently running fire, or carbon footprint estimations of forest management activities, etc. One step beyond, when AI is combined with 3D forest modelling, and virtual reality (VR), it could provide future predictions of forest states, via a virtual forest model (see Figure 1), which is actually, its forest digital twin (Luo et al. 2023).

Figure 1: Forest Digital Tween



The perspectives of an SFM integrated solution paves a way for smart forest digital transformation establishment (Ehrlich-Sommer et al. 2024). Digital transformation is about involvement of advanced technologies for SFM, via necessitating AI integrated technology solutions as mentioned above, which are all included in dMRV paradigm framework, as we will discuss in the next paragraph.

### DMRV integrated solution framework for SFM

As known, dMRV stands for digital measurement (or monitoring), reporting and verification, and it is considered as the updated “digital” version of the well tested, and established plain MRV paradigm. As its initials entail, it is a set of key technologies applied for multi stage process control activities, and particularly for real-time monitoring, data integration, and automated verification processes. It consists of four major technology pillars : 1. IoT, 2. AI, 3. Proximity Detection Technologies, and 4. Blockchain, where each one serves its own specific purpose, and altogether complement an end to end solution.

Particularly, IoT sensors and their associated network built in the surveillance field (e.g. a forest ecosystem), are used for monitoring environmental parameters (CO<sub>2</sub> levels, smoke levels, temperature, humidity), or carbon emissions with real-time data streams (see Table I). Then, the raw and heterogeneous data they produce from various sensor source types need to be processed and managed properly via AI algorithm dataset analysis (heterogeneous pattern identification, classification, anomaly and outlier detection). One step beyond, AI and its machine learning (ML) product models could provide predictions on various related areas, such as the probability of a fire outbreak in a certain area, or current running fires spatial progression, or carbon removal process predictions, thus improving accuracy and proactive management of carbon reduction processes.

The third pillar, the remote imaging technologies (satellite imagery), along with the close range ones (lidar, cameras, UAVs etc), where both form the proximity detection technologies (see Table II), provide high-resolution images for monitoring environmental



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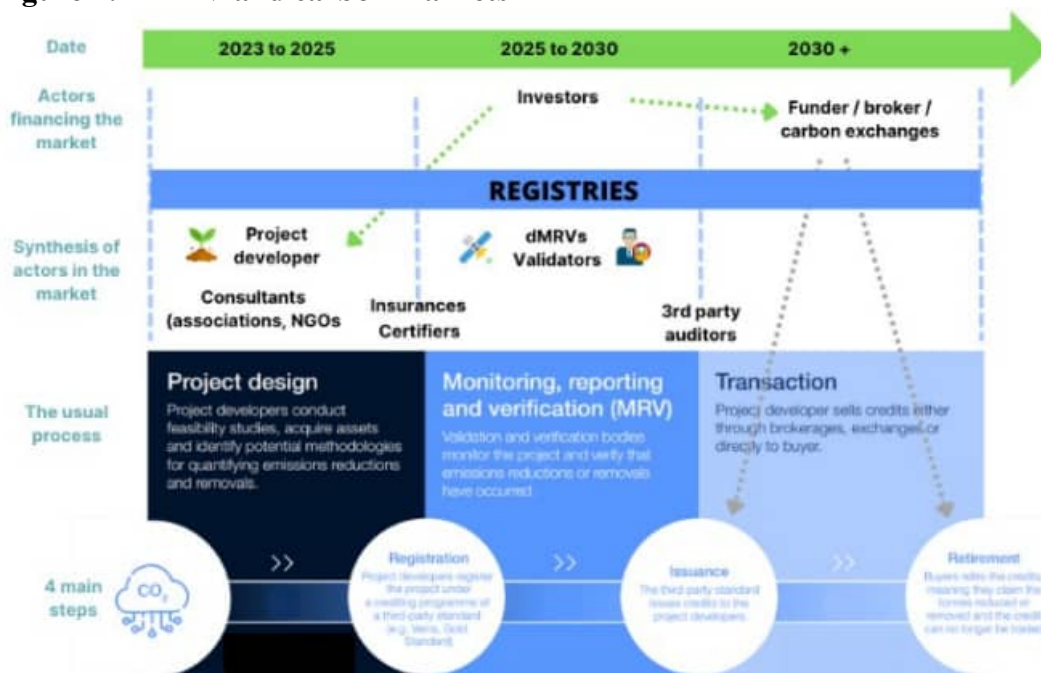
changes, and thus for tracking and verifying carbon sequestration processes. The dMRV advantages of using combined remote and close range imagery are multiple, including the reduced surveillance duration, the better field work organization, the lower costs, the improved work quality, and the elimination of various risk factors during manual inspection procedures. Moreover, dMRV synergy with AI's, Neural Network (NN) algorithms allow for faster detection and classification of aerial, satellite, and sensor monitoring data.

Finally, the blockchain completes the end to end integrated dMRV solution, acting as a decentralized ledger for recording and verifying data, maintaining unalterable records of all transactions and data entries by all ledger stakeholders, thus enhancing transparency and trust among participants during data transactions. CSF urges for dMRV integrated solutions, as it requires efficient forest management methods to support forest decision systems and thus, to address the challenges of climate change, including carbon markets and regulatory compliance of EUDR, as well.

### DMRV Solutions for Carbon markets

Carbon markets could be benefited in multiple ways from the integrated dMRV solutions. Particularly, dMRV and especially its blockchain component, ensure that carbon credits are based on real, measurable, and verifiable reductions, regarding GHG emissions. In this way, dMRV improves organization sustainability reports, thus contributing to global carbon emission reductions. dMRV could be considered as a robust framework for tracking and verifying emissions reductions and other environmental impacts, and therefore, it is a significant advancement in the compliance of the voluntary carbon market (VCM) framework.

**Figure 2: DRMV and carbon markets**



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Normally, in a typical carbon market all involved entities should be approved via an appropriate validation and verification body, which is actually a mediator (see Figure 2). Particularly, in the one end, the project developer (or else named supplier) supports carbon removal activity project, by providing all necessary assessment and documentation, which is actually a methodology complied with a standard framework (standard guidelines and methodology documents). On the other end, there is the buyer that purchases the verified credits, in order to compensate against its GHG exhausts and achieve zero neutrality. In between the two, many more entities could be involved (e.g. brokers, investors etc), but the critical intermediate entity is a third-party entity, a Validation and Verification body (VV), that provides project data integrity and transparency, standard regulatory compliance and credit custody management by requesting retirements of credits, at the end of carbon credit transaction chain. Nowadays, that VV body adopts dMRV framework, via an integrated platform, in order to deal with its validation and verification tasks in between the involved entities. Without dMRV, the integrity of the carbon credit market would be compromised, and could eventually lead to a lack of trust and decrease participation from carbon credit chain entity participants.

Many important global carbon market projects fully equipped with cutting edge technologies provide all the necessary means for a complete and robust support of carbon market transaction chain, such is the Open Forest Protocol (<https://www.openforestprotocol.org/>). OFP is an open platform, and particularly a digital, blockchain-based dMRV system, that measures, reports and verifies forest projects data worldwide. Along with Neutral, which is an automated carbon accounting, analysis, reporting platform for tokenized carbon credits and contracts, they both provide an end to end dMRV solution.

### **SFM and EUDR**

It is commonly known that EUDR is a new rule framework that mostly inspects any kind of illegal deforestation activities within EU region. SFM provides a well defined, compact pathway via EUDR, for businesses and governments, and adopts best practices that would protect forest ecosystems. In doing so, the critical issue here is traceability, which necessitates accurate monitoring of any kind of forest activity throughout all the supply chain (e.g forest biomass life cycle chain, from source material origin to its finite processed ready-for-consumption product). Normally, those monitoring data are raw and heterogeneous, as they are emanated from multiple different types of monitoring sources (satellite imagery, lidar, cameras, UAVs, IoT sensors etc), and they have to be processed in order to be accurate and ready for finite decision making systems. Moreover, those data have to be verified and aligned with the existing regulatory frameworks.

Therefore, end to end integrated monitoring and verification platforms are unavoidably urged, such as the dMRV type, that may be well used for inspecting illegal activity and ensuring regulatory compliance of related sector businesses and organizations (agriculture, forestry, and supply chain sectors), which should be aligned to EUDR framework. In this way, dMRV supports SFM to gain control of its goals regarding managing forests and providing the appropriate equilibrium between resource management, protection and sustainability, on a long term basis.



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### AI solutions for SFM

AI and its algorithms as a part of an integrated end to end dMRV solution, or even as stand alone approaches, could definitely help to big data forest management processing, prediction modelling, and virtual 3D forest representations, as already have been mentioned above. Nowadays, there are multiple AI software tools for dealing with various forest management tasks, such as, forest simulation optimization systems, forest carbon estimation analysis and accounting systems, carbon prediction systems, geospatial forest inventory data management platforms, intelligent forestry supply chain (procurement and transportation) platforms, to name but a few. In parallel, various sustainable forest management research projects have been carried out successfully, with the adoption of integrated modern technologies, such as the Qingyuan Forest CERN project, with its homonym platform, a holographic forest intelligent data acquisition system for monitoring and displaying 3D forest structure and carbon sink (Wang et al. 2025).

Yet, the most challenging bet to win, is the “human in the loop” promising trend, which is actually a synergistic approach to continuously allow humans to control AI, and at the same time, to align AI with human values, ethics, and legal requirements, to ensure privacy, security, and safety (Holzigner et al. 2022). The human in the loop approach is defined as a set of simultaneous interactions of both computational and human agents, aimed to optimize learning behavior. It actually encourages human activity with its interactive participation with AI agents, in every single process stage, from the very beginning up to the finite end of an automated process. Hence, it indeed, puts the “human in the loop” to enable what neither a human, nor a computer could do on their own.

Forester in the loop, is a similar, remarkable approach inspired by the generic “human in the loop” concept (Holzigner et al. 2022). This approach includes various steps and pathways that encourage the ever evolving continuous human-AI interactions, throughout all forest activity process stages. Particularly, such critical human-AI interactions begin the forest monitoring process, with the forest owners interaction with heads-up displays in their helmets, or VR glasses, in order for them, to gain individual tree information. Conversely, the AI will learn from the forestry worker’s experience during the monitoring process. Moreover, humans interact with a direct navigation system of a driving forest machine, via autonomous control of attached sensors. On the other hand, the expertise of the operators provides input to ML modules, so as together, to co operate, in a value-optimized manner. At the same time, machine manufacturers could be in close interaction with operators and driving forest machines, as well.

### Conclusions

Forest ecosystem stability and resilience against abrupt climate changes, urgently requests for investing in new big data, AI based integrated technologies, such as the end to end dMRV framework. Such combined solutions may be promising for achieving forest ecosystem stability and resilience, against abrupt climate changes. Apart from sustainable forest management, those end to end solutions could be adopted efficiently for EUDR regulatory compliance, or carbon market robust control purposes.

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The human in the loop approach, is a new concept applied successfully in those integrated solutions. Unlike the Industry 4.0 paradigm, this approach aims to integrate and increase human participation in the loop process, rather than to replace them, thereby ensuring continuous, secure, and trustworthy human-AI interactions. The migration of Forestry 4.0 to Forestry 5.0 paradigm encourages human-AI interactions, and particularly with its promising human in the loop approach, that will inspire both forest officials and scientists, to invest in AI technology solutions for efficient forest management against climate change challenges, bridging the human-centered AI gap, and the Forestry 4.0 to 5.0 gap, as well.

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## **CAN FORESTS HELP CRYPTOCURRENCIES BECOME SUSTAINABLE? A THEORETICAL APPROACH FOR RELATIVE STRATEGIES**

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### **Abstract**

Cryptocurrencies and blockchain technology have recently emerged as innovative tools in carbon markets. The decentralised and transparent nature of the blockchain makes it suitable for monitoring and verifying carbon credits, ensuring that credits are not double counted or fraudulently claimed. By creating a secure and transparent carbon transaction ledger, blockchain technology can enhance the credibility of carbon markets and increase investor confidence.

On the other hand, the environmental debate surrounding Bitcoin mining has largely focused on energy consumption and carbon emissions. Bitcoin's Proof of Work (PoW) algorithm is designed to be energy-intensive, requiring miners to solve cryptographic puzzles to validate transactions. This computing power, in turn, consumes large amounts of electricity, making Bitcoin mining subject to criticism in the context of global climate change.

The growing involvement of cryptocurrencies and blockchain technology presents new avenues of growth in carbon markets. By facilitating direct investments in forest conservation through contracted credits, these technologies enhance both the transparency and accessibility of carbon credit transactions. Nevertheless, it is vital to consider the environmental impacts of blockchain mining and cryptocurrency mining, as high-energy blockchain platforms may inadvertently counteract the environmental benefits of carbon credits. A transition to more sustainable blockchain protocols, such as proof-of-stake, will be necessary to ensure that the integration of digital technology aligns with the climate goals of carbon markets.

In conclusion, forest-based carbon credits, when integrated with blockchain technology, emerging innovations and fair governance, have the potential to contribute significantly to achieving global climate goals. As carbon markets continue to evolve, the combination of technology and natural conservation promises an escalating path to a carbon-neutral future, with forests at the core of climate resilience and environmental stewardship. By investing in forest conservation and expanding carbon credit markets, governments, companies and individuals can play a vital role in the global transition to a low-carbon economy, ensuring the protection of key natural resources for future generations.

**Key words:** Carbon markets, bitcoin, cryptocurrencies, forestry, blockchain

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# EVALUATION OF THE POTENTIAL SUPPLY OF AGRICULTURAL AND FOREST RESIDUES FOR BIOENERGY PRODUCTION IN GREECE

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## Abstract

This study examines the potential supply of agricultural and forest residues for bioenergy production in Greece, focusing on both the quantity and availability of these feedstocks. Utilizing official statistical data, field surveys, the research identifies the primary residue types from crop production, orchard pruning, and forest management. Emphasis is placed on evaluating the logistical aspects of collection and transportation, as well as the environmental impacts of residue extraction. Preliminary findings indicate that Greece possesses a substantial volume of underutilized residues that could serve as a significant source of renewable energy, thereby contributing to national targets for greenhouse gas reduction and energy security. However, challenges remain regarding seasonal variability, collection costs, and the need for modern infrastructure to efficiently convert residues into bioenergy. The study highlights the importance of policy support, integrated resource management, and stakeholder collaboration to optimize residue utilization. These efforts could enhance rural development, create new employment opportunities, and strengthen Greece's transition toward a more sustainable and resilient energy system.

**Key words:** Forest, bioenergy production, agricultural residues

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### **GEOGRAPHIC ROAD NETWORK DISTRIBUTION OF GREECE IN ACCORDANCE WITH LAND USE**

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#### **Abstract**

This study aims into the fascinating connections amongst the road network length, road density, altitude zones, and land use across Greece's unique and varied regions. By examining these relationships, we can uncover how geography shapes the way areas develop and interact within this diverse landscape.

Using freely available online data, GIS software is used to analyze and better understand the road network's role in shaping Greece's landscape. The analysis focuses on the road network and its density calculating the road network length, the percentage and the ratio of roads (km) per area (km<sup>2</sup>) for the thirteen regions of Greece. To explore altitude zoning, the road network is divided into distinct elevation ranges, providing a clearer picture of how roads function at different altitudes. For land use, areas are classified into categories, namely urban, agricultural, and forest, relying on the latest Corine Land Cover data to ensure accuracy and relevance.

Areas with low altitudes tend to have denser road networks and urban development, while inland mountainous regions have sparse roads and are primarily rural or forested. Integrated planning considers altitude, land use, and environmental preservation to ensure roads serve development without degrading ecosystems. Understanding this relationship is critical for developing sustainable infrastructure that balances economic growth, environmental conservation, and social equity.

**Key words:** Regions of Greece, road network, road density, land use, altitude zones, GIS

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### Introduction

The road network in Greece has played a crucial role in the country's economic, social, and cultural development. Over the years, the expansion and modernization of Greece's road infrastructure have significantly improved connectivity, trade, and tourism, which are essential for national growth. The structure of transportation networks over time depicts the social ability to overcome at a certain time the spatial constraints, in order the societies to communicate (Tsiotas & Polyzos, 2018). The research by Petrakos and Economou (2014) reveals that southeastern Europe is characterized by a growing regional imbalance, the increasing strengthening of metropolitan regions and by serious discontinuities at their borders, which, in most cases, are a product of isolated border areas. Urban systems with serious deficiencies in medium-sized cities are also a characteristic of southeastern Europe. In most European countries, a great part of the national and the regional network is quite old (Papageorgiou et al., 2012). Road construction is intertwined with the development of organized societies and state structures. It presupposes the formation of collective aspirations and the allocation of resources for the development of a transport system that satisfies the military, commercial, cultural and other purposes (Papageorgiou et al., 2019).

The geography of Greek transport infrastructure is shaped by the influence of historical, economic, political and geomorphological factors and often reflects and/or contributes to the development potential and organization of the spatial network (Mavraki et al., 2020). Transportation and land use are two different aspects of a landscape, but their relationship, despite not being clearly visible, is quite strong (Jedlička et al., 2019). Greece is a country which presents several geographical peculiarities, with many islands, but also several mountainous areas in mainland Greece. The different extent and geographical characteristics of the various Greek regions as well as their different economic activities are reflected in different mobility patterns and road behaviors among the inhabitants of these regions, but also in a different degree of development of the road network (Folla et al., 2023).

While Greece has made significant progress, challenges remain, such as maintaining older roads, addressing traffic congestion in urban centers, and promoting sustainable infrastructure. Future investments in smart roads and environmentally friendly transportation will further enhance national development. Overall, Greece's road network has been a cornerstone of the country's progress, enabling economic growth, improving quality of life, and strengthening regional and international connections.

### Material and methods

A Geographical Information System (GIS) is an organized collection of computer hardware, software, data and personnel designed to efficiently capture, store, update, manipulate, analyze and display all forms of geographically referenced information (Dale & Laughlin, 1987). A major strength of a GIS is that it can accept and merge diverse data into a single database, giving the user a flexible and powerful set of data which to work (Drosos et al., 2016). The process of gathering, managing, analyzing, and visualizing spatial or geographic data to understand patterns, relationships, and trends is the geospatial analysis. We also compute the Pearson's correlation coefficient (PCC) for the road network. PCC is a statistical



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measure that quantifies the strength and direction of the linear relationship between two continuous variables (Rodgers & Nicewander, 1988).

The road network data obtained and analyzed with the use of open data which are available on the basis of the OpenStreetMap (OSM). The project OSM is a collaborative GIS project with a crowd-sourced approach (Kaur et al., 2017). It is also known as the wikification of GIS, that encourages the volunteers throughout the world to contribute spatial data (Graser & Straub, 2017). In this study was calculated the kilometers and the road network percentage of the thirteen Greek Regions and also the ratio of roads in km per area in km<sup>2</sup>.

For altitude zones the data from Digital Elevation Model over Europe from the GMES RDA project (EU-DEM) was used. The EU-DEM is a Digital Surface Model (DSM) representing the first surface as illuminated by the sensors. The EU-DEM dataset is a realization of the “Copernicus” the European Union's Earth observation programme, managed by the European Commission, DG Enterprise and Industry. The EU-DEM is a 3D raster dataset with elevations captured at 1 arc second postings (2.78E-4 degrees) or about every 30 meters (Liampas et al., 2018). Four altitude zones created because each one presents distinct characteristics that influence land use, including climate, topography, and accessibility (Kazaklis et al., 2014).

For land use the data form CORINE Land Cover 2018 (CLC) was used. CLC is the oldest and most sought-after database of CLMS. CLC was specified to standardize data collection related to land in Europe to support environmental policy development (CLC, 2018). CLC data contribute to a wide range of studies and applications with European coverage. In this study three of the five main land cover / use groups are considered: 1) Artificial surfaces, 2) Agriculture, 3) Forests and seminatural areas. All the data and the categorization used in this study is presented in Table 1.

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**Table 1: Categorization of data that stand for the present study**

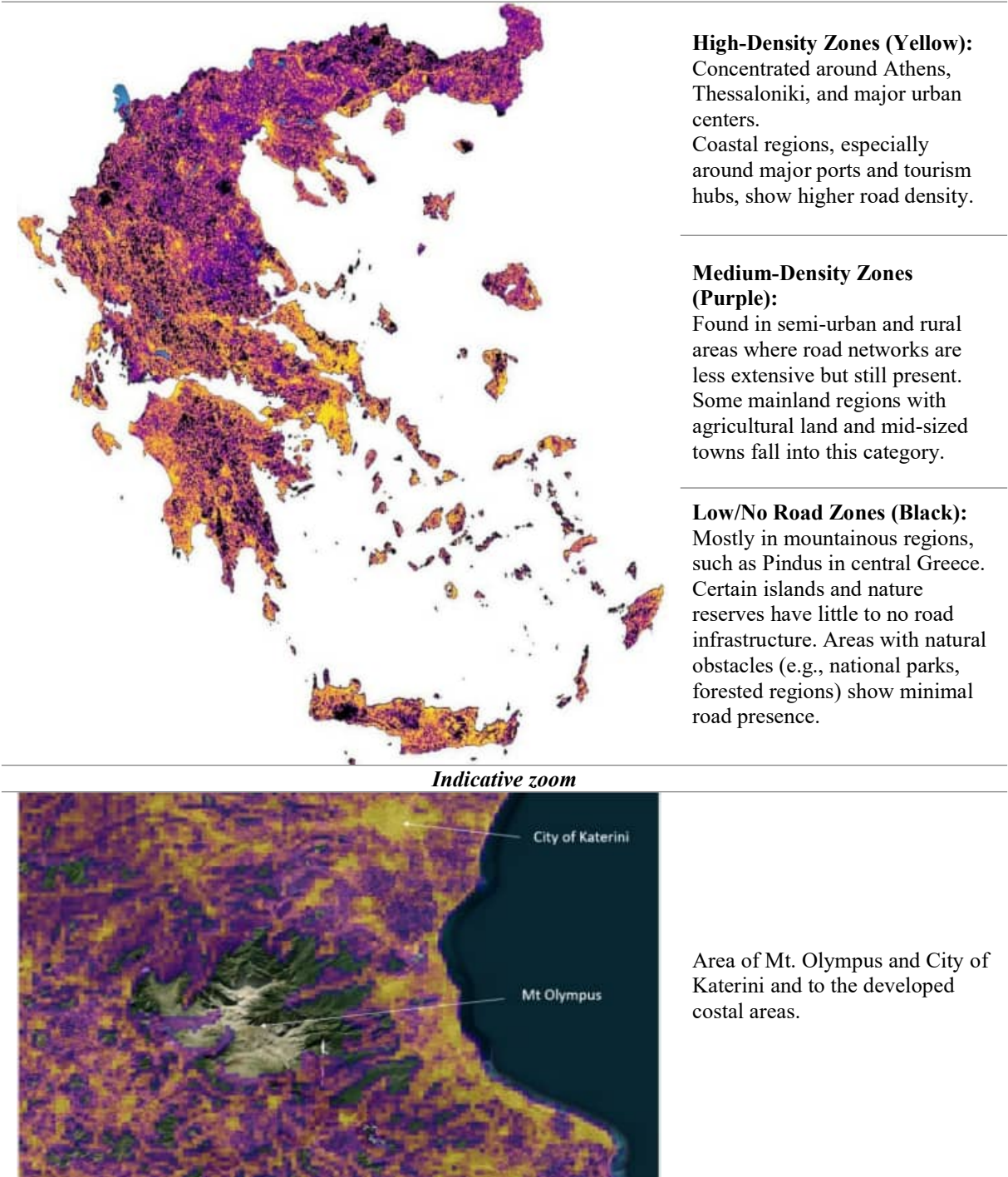
| Source                                                                                                                                                   | Categorization                                                                                                                                                                                      | Related mapping                                                                       |
|----------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|
| <b>OpenStreetMap (OSM) road data and Regions of Greece</b>                                                                                               | Roads with green color and Regions borders with black<br>Total road length in Greece: 416,701 km                                                                                                    |    |
| <b>Altitude zones (EU-DEM)</b><br>Each zone exhibits distinct characteristics that influence land use, including climate, topography, and accessibility. | 1. 0 - 300 m. coastal areas and lowland plains (yellow)<br>2. 300 - 800 m. maquis or phrygana shrubland (brown)<br>3. 800 - 1800 m. temperate forest zone (green)<br>4. >1800 m. alpine zone (grey) |   |
| <b>Corine 2018 database categorization (European Environment Agency)</b>                                                                                 | 1. Artificial Surfaces (grey)<br>2. Agricultural Areas (orange)<br>3. Forest and Seminatural Areas (green)                                                                                          |  |

## Results

The first geospatial analysis was a road network density heat map which is a visual representation that illustrates the concentration of roads in Greece. For the density calculation was used a square cell of 500 meters and the color gradients indicate the varying levels of

density. Table 2 shows the produced heatmap, the yellow color indicates high road density, the purple color medium road density and the black color are areas without roads.

Table 2: Road network density heat map



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The heatmap effectively highlights Greece's infrastructure distribution, with dense road networks in urban and economically significant regions, while rugged terrain and natural landscapes limit road expansion in other areas. The accessibility provided by road networks facilitates economic activities and population growth in the high-density areas.

The second geospatial analysis was the distribution of the road network which categorized by CLC classes across altitude zones of Greece. The results are presented in following Table 3. Moreover, a road network density analysis was also performed to identify the concentration of roads in Greece and the results are presented in Table 4.

**Table 3: Percentage of roads distribution in Greece**

| Corine Class                           | Altitude zones |         |          |        | Sum     |
|----------------------------------------|----------------|---------|----------|--------|---------|
|                                        | 0-300          | 300-800 | 800-1800 | >1800  |         |
| Class 1: Artificial areas              | 13.304%        | 2.262%  | 0.343%   | 0.005% | 15.914% |
| Class 2: Agricultural areas            | 40.061%        | 13.418% | 1.880%   | -      | 55.359% |
| Class 3: Forest and semi-natural areas | 8.596%         | 11.760% | 8.241%   | 0.130% | 28.727% |
| Greece's total                         | 61.961%        | 27.440% | 10.465%  | 0.134% | 100%    |

The above table highlights a clear pattern of human activity that is concentrated in lower altitudes, with natural areas more prevalent at higher elevations. The overall Greece's land distribution is mostly (61.961%) in the 0-300 m zone, while higher altitudes account for smaller proportions.

Specifically:

- Artificial areas: Highest percentage is in the 0-300 m zone (13.304%), gradually decreasing as altitude increases. Total: 15.914%.
- Agricultural areas: Dominant in the 0-300 m zone (40.061%) but decline significantly with altitude. Total: 55.359%.
- Forest and semi-natural areas: More evenly distributed, peaking in the 300-800 m zone (11.760%). Total: 28.727%.

**Table 4: Road network density in Greece**

| Corine Class                           | Altitude zones |         |          |       | Overall |
|----------------------------------------|----------------|---------|----------|-------|---------|
|                                        | 0-300          | 300-800 | 800-1800 | >1800 |         |
| Class 1: Artificial areas              | 16.53          | 12.04   | 11.24    | 8.61  | 15.54   |
| Class 2: Agricultural areas            | 4.69           | 4.08    | 4.06     | 0.00  | 4.50    |
| Class 3: Forest and semi-natural areas | 1.94           | 1.62    | 1.41     | 0.49  | 1.61    |
| Greece's total                         | 4.50           | 2.55    | 1.65     | 0.50  | 3.21    |

The data reveals patterns in road density across land cover types and altitude zones, providing insights into the relationship between human activity, topography, and road network development. In the following Table 5 the results are analyzed by category.

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**Table 5: Road network density patterns in Greece**

| Findings by Land Use                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Findings by Altitude Zones                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
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| <p><b><u>Class 1: Artificial Areas (Overall: 15.54 km/km<sup>2</sup>)</u></b></p> <p>Highest road density among all classes, reflecting intensive urban and industrial development.<br/>Road density decreases with altitude:<br/>0–300 m: 16.53 km/km<sup>2</sup> (highest density in urbanized flatlands).<br/>&gt;1800 m: 8.61 km/km<sup>2</sup> (lowest, as urbanization is minimal in high-altitude areas).<br/>Key Insight: Urban and industrial areas, concentrated at lower altitudes, demand extensive road networks for connectivity and infrastructure.</p> <p><b><u>Class 2: Agricultural Areas (Overall: 4.50 km/km<sup>2</sup>)</u></b></p> <p>Moderate road density, second to artificial areas, as agriculture requires roads for transportation and access.<br/>Minimal variation across altitude zones:<br/>0–300 m: 4.69 km/km<sup>2</sup> (slightly higher due to larger agricultural zones in flat areas).<br/>800–1800 m: 4.06 km/km<sup>2</sup> (stable density, as agriculture persists in hilly/mountainous areas).<br/>&gt;1800 m: 0.00 km/km<sup>2</sup> (no agriculture in high altitudes).<br/>Key Insight: Agricultural areas maintain consistent road density across altitudes, except in high altitudes where farming is infeasible.</p> <p><b><u>Class 3: Forest and Semi-Natural Areas (Overall: 1.61 km/km<sup>2</sup>)</u></b></p> <p>Lowest road density among all classes, reflecting limited human activity and development in these areas.<br/>Significant decline with altitude:<br/>0–300 m: 1.94 km/km<sup>2</sup> (roads provide access for forestry and tourism).<br/>&gt;1800 m: 0.49 km/km<sup>2</sup> (minimal road presence in remote, high-altitude forests).<br/>Key Insight: Forests and semi-natural areas are less accessible, with road density decreasing sharply as terrain becomes more challenging.</p> | <p><b><u>0–300 m (Overall: 4.50 km/km<sup>2</sup>)</u></b></p> <p>Highest road density, driven by:<br/>High density in artificial areas (16.53 km/km<sup>2</sup>) and agricultural areas (4.69 km/km<sup>2</sup>).<br/>Low-density forests (1.94 km/km<sup>2</sup>) contribute less but still align with human activity in lowlands.<br/>Key Insight: Flat, low-altitude areas dominate Greece's road network, reflecting urbanization and farming needs.</p> <p><b><u>300–800 m (Overall: 2.55 km/km<sup>2</sup>)</u></b></p> <p>Moderate road density, with:<br/>Roads supporting agriculture (4.08 km/km<sup>2</sup>) and semi-natural areas (1.62 km/km<sup>2</sup>).<br/>Key Insight: Transition zones (hilly areas) have less dense road networks than flatlands but still support mixed land uses.</p> <p><b><u>800–1800 m (Overall: 1.65 km/km<sup>2</sup>)</u></b></p> <p>Low road density, as:<br/>Roads primarily serve forests (1.41 km/km<sup>2</sup>) and agriculture (4.06 km/km<sup>2</sup> in limited areas).<br/>Key Insight: Higher altitudes see reduced road density, reflecting less intensive human use.</p> <p><b><u>&gt; 1800 m (Overall: 0.50 km/km<sup>2</sup>)</u></b></p> <p>Minimal road density, with:<br/>Sparse roads in forests (0.49 km/km<sup>2</sup>) and virtually none in agriculture.<br/>Key Insight: Very high altitudes are the least accessible, with roads limited to isolated or strategic purposes.</p> |



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The overall observations for road network density in Greece are:

- **Urban Dominance:** Artificial areas have the highest road density, emphasizing the concentration of infrastructure in urban regions, particularly at low altitudes.
- **Consistency in Agriculture:** Agricultural areas show stable road density across most altitudes (except  $> 1800$  m), supporting the essential role of road networks in rural areas.
- **Forests and Altitude:** Forests and semi-natural areas have the lowest overall road density, with a sharp decline at higher altitudes.
- **Altitude as a Limiting Factor:** Road density decreases consistently with altitude, reflecting the challenges of infrastructure development in mountainous terrains.
- **Greece’s Overall Road Density ( $3.21 \text{ km/km}^2$ ):** Reflects a mix of high-density urban areas and low-density rural and natural areas, balancing accessibility and conservation.

Pearson’s correlation is a measure of the linear relationship between two variables. It quantifies how strongly and in what direction the variables are related. If the data have positive correlation close to 1 it means that the one variable increases and the other also increases. If the data have negative correlation close to -1 it means that the one variable increases and the other decreases, and if the value is close to 0 there is no linear correlation. In the following Tables 6 and 7, the PCC for the road length (km) and land use ( $\text{km}^2$ ), as well as the road length (km) and altitude zones area ( $\text{km}^2$ ), are computed, respectively.

**Table 6: Pearson’s correlation for land use**

| Pearson<br>Correlation Coefficient -<br>Road length (km) & Area ( $\text{km}^2$ ) | Artificial<br>areas | Agricultural<br>areas | Forest and semi-<br>natural areas | Overall |
|-----------------------------------------------------------------------------------|---------------------|-----------------------|-----------------------------------|---------|
|                                                                                   | 0.98                | 0.98                  | 0.95                              | 0.90    |

The Pearson correlation coefficients between land cover type (area) and road length show the strength of association across different land use categories.

- **Urban and Agricultural Dominance:** The highest correlations are observed in artificial areas (0.98) and agricultural areas (0.98), underlining their importance in shaping road networks. These land types require extensive connectivity for economic activities and mobility.
- **Forested Areas Play a Secondary Role:** Although the correlation for forest and semi-natural areas is slightly lower (0.95), it remains very strong, showing the significance of maintaining access to these areas.
- **Overall Correlation Reflects Land Use Balance:** The overall correlation (0.90) confirms that road distribution is closely tied to the proportions of land cover types, with urbanization and agriculture being primary drivers.

**Table 7: Pearson’s correlation for Altitude zones**

| Pearson<br>Correlation Coefficient -<br>Road length (km) & Area ( $\text{km}^2$ ) | Altitude zones |         |          |         | Overall |
|-----------------------------------------------------------------------------------|----------------|---------|----------|---------|---------|
|                                                                                   | 0-300          | 300-800 | 800-1800 | $>1800$ |         |
|                                                                                   | 0.88           | 0.80    | 0.96     | 0.85    | 0.68    |



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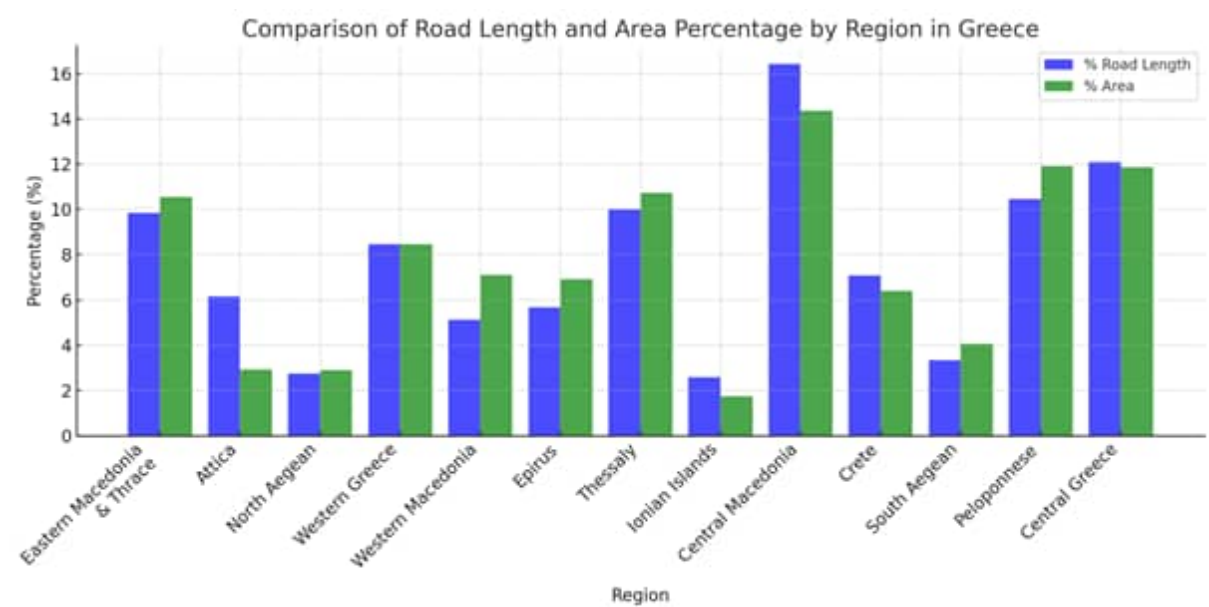
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These findings show that road distribution aligns strongly with human needs at lower altitudes while maintaining consistency at higher altitudes for connectivity and access.

- Highest correlation (800 – 1800 m): Suggests that forested and mountainous areas are particularly important in explaining the overall road distribution, possibly due to the connection of isolated regions or key infrastructure like highways cutting through mountainous terrain.
- Strong correlation in low-altitude zones (0 – 300 m): Highlights the dominance of urban and agricultural development in influencing road density.
- Consistent contribution across zones: Despite some variation, all altitude zones show a strong positive relationship, indicating a relatively uniform distribution pattern when viewed holistically.
- Overall alignment with human geography: Correlations reflect the interplay between human activity, topography, and road network development.

The third geospatial analysis was a road network analysis per region for Greece. The Figure 1 shows the comparison of the percentage of road length to the percentage of the area of each region of Greece. The Figure 2 shows the road length for land use class and altitude zones of each region of Greece. The Table 8 present the percentages of the data of Figure 2 in order to identify spatial patterns between the Regions of Greece.

**Figure 1: Comparison of percentages for road length and area of each region of Greece**



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Figure 2: Comparison of percentages for road length and area of each region of Greece

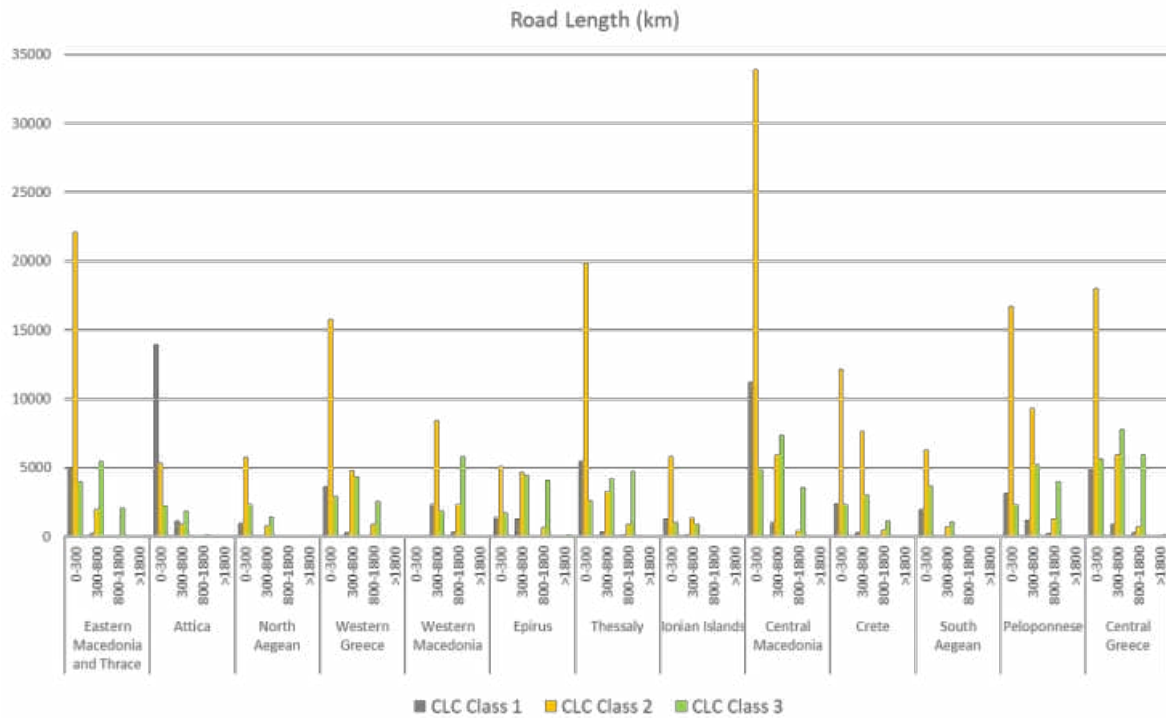


Table 8: Percentage of roads distribution in Regions of Greece

| Region                       | Corine Class | 0-300   | 300-800 | 800-1800 | >1800  | Sum      |
|------------------------------|--------------|---------|---------|----------|--------|----------|
| Eastern Macedonia and Thrace | 1            | 12.318% | 0.639%  | 0.067%   | 0.001% | 13.025%  |
|                              | 2            | 53.865% | 4.825%  | 0.152%   |        | 58.842%  |
|                              | 3            | 9.693%  | 13.340% | 5.079%   | 0.022% | 28.133%  |
|                              | Region Sum   | 75.875% | 18.804% | 5.298%   | 0.023% | 100 %    |
| Attica                       | 1            | 54.220% | 4.451%  | 0.045%   |        | 58.716%  |
|                              | 2            | 20.898% | 3.608%  |          |        | 24.506%  |
|                              | 3            | 8.944%  | 7.209%  | 0.626%   |        | 16.778%  |
|                              | Region Sum   | 84.062% | 15.268% | 0.670%   |        | 100.000% |
| North Aegean                 | 1            | 8.462%  | 0.422%  |          |        | 8.884%   |
|                              | 2            | 50.552% | 6.993%  | 0.076%   |        | 57.621%  |
|                              | 3            | 20.361% | 12.430% | 0.704%   |        | 33.495%  |
|                              | Region Sum   | 79.375% | 19.845% | 0.780%   |        | 100%     |
| Western Greece               | 1            | 10.341% | 0.822%  | 0.154%   |        | 11.317%  |
|                              | 2            | 44.675% | 13.666% | 2.552%   |        | 60.893%  |
|                              | 3            | 8.213%  | 12.235% | 7.299%   | 0.044% | 27.790%  |
|                              | Region Sum   | 63.228% | 26.723% | 10.005%  | 0.044% | 100 %    |
| Western Macedonia            | 1            | 0.000%  | 11.031% | 1.783%   | 0.030% | 12.845%  |
|                              | 2            | 0.253%  | 39.518% | 10.848%  |        | 50.619%  |
|                              | 3            | 0.087%  | 8.618%  | 27.373%  | 0.459% | 36.537%  |
|                              | Region Sum   | 0.340%  | 59.167% | 40.003%  | 0.489% | 100 %    |
| Epirus                       | 1            | 5.816%  | 5.664%  | 0.324%   |        | 11.804%  |
|                              | 2            | 21.488% | 19.952% | 2.716%   |        | 44.156%  |

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|                          |            |         |         |         |        |          |
|--------------------------|------------|---------|---------|---------|--------|----------|
|                          | 3          | 7.292%  | 18.826% | 17.372% | 0.549% | 44.039%  |
|                          | Region Sum | 34.597% | 44.442% | 20.412% | 0.549% | 100.000% |
| <b>Thessaly</b>          | 1          | 13.065% | 0.843%  | 0.342%  |        | 14.251%  |
|                          | 2          | 47.643% | 7.873%  | 2.194%  |        | 57.711%  |
|                          | 3          | 6.353%  | 10.157% | 11.406% | 0.123% | 28.039%  |
|                          | Region Sum | 67.061% | 18.873% | 13.942% | 0.123% | 100 %    |
|                          |            |         |         |         |        |          |
| <b>Ionian Islands</b>    | 1          | 12.362% | 1.162%  | 0.152%  |        | 13.676%  |
|                          | 2          | 54.263% | 13.079% | 0.222%  |        | 67.564%  |
|                          | 3          | 9.476%  | 8.350%  | 0.934%  |        | 18.760%  |
|                          | Region Sum | 76.101% | 22.591% | 1.308%  |        | 100%     |
|                          |            |         |         |         |        |          |
| <b>Central Macedonia</b> | 1          | 16.423% | 1.490%  | 0.119%  |        | 18.032%  |
|                          | 2          | 49.537% | 8.644%  | 0.604%  |        | 58.785%  |
|                          | 3          | 7.141%  | 10.733% | 5.230%  | 0.079% | 23.183%  |
|                          | Region Sum | 73.102% | 20.867% | 5.952%  | 0.079% | 100.000% |
|                          |            |         |         |         |        |          |
| <b>Crete</b>             | 1          | 7.996%  | 1.040%  | 0.100%  |        | 9.135%   |
|                          | 2          | 41.151% | 25.897% | 1.763%  |        | 68.812%  |
|                          | 3          | 7.894%  | 10.302% | 3.825%  | 0.032% | 22.054%  |
|                          | Region Sum | 57.041% | 37.239% | 5.687%  | 0.032% | 100%     |
|                          |            |         |         |         |        |          |
| <b>South Aegean</b>      | 1          | 14.409% | 0.426%  |         |        | 14.834%  |
|                          | 2          | 45.384% | 5.224%  | 0.005%  |        | 50.613%  |
|                          | 3          | 26.541% | 7.849%  | 0.164%  |        | 34.553%  |
|                          | Region Sum | 86.333% | 13.499% | 0.168%  |        | 100%     |
|                          |            |         |         |         |        |          |
| <b>Peloponnese</b>       | 1          | 7.211%  | 2.809%  | 0.628%  |        | 10.648%  |
|                          | 2          | 38.324% | 21.398% | 3.036%  |        | 62.757%  |
|                          | 3          | 5.389%  | 12.065% | 9.114%  | 0.027% | 26.595%  |
|                          | Region Sum | 50.923% | 36.272% | 12.778% | 0.027% | 100%     |
|                          |            |         |         |         |        |          |
| <b>Central Greece</b>    | 1          | 9.830%  | 1.780%  | 0.668%  | 0.024% | 12.302%  |
|                          | 2          | 35.811% | 11.742% | 1.403%  |        | 48.956%  |
|                          | 3          | 11.239% | 15.433% | 11.749% | 0.321% | 38.742%  |
|                          | Region Sum | 56.880% | 28.955% | 13.819% | 0.345% | 100%     |
|                          |            |         |         |         |        |          |

Analyzing the above data, it is observed that altitude dictates land use, lower altitudes are heavily dominated by artificial and agricultural areas, while forests and semi-natural areas dominate mid-to-high altitudes. The road distribution aligns with human activity and urbanized and agricultural regions have the most roads, while higher altitudes remain less developed. The Regional differences reflect geography with mountainous regions (e.g., Western Macedonia, Epirus) to have more roads at higher elevations, whereas coastal and island regions (e.g., Attica, South Aegean) focus on low altitudes. The regional pattern identification of roads distribution is presented in Table 9.

**Table 9: Regional pattern identification of roads distribution**

|                                  |                                                                                                                                                                                                                                                      |
|----------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Land Use (Corine Class) Patterns | Class 1 (Artificial Areas): Dominates in urbanized regions like Attica (54.220% in 0–300 m) and South Aegean (14.409% in 0–300 m). Class 1 presence sharply declines with altitude, as urban areas are concentrated in lower, flatter zones.         |
|                                  | Class 2 (Agricultural Areas): Most significant class overall, dominating road distribution in nearly every region and altitude: Accounts for 40–55% of roads in 0–300 m zones across most regions. Substantial even in mid-altitudes (300–800 m) for |

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|                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
|------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                        | <p>areas like Crete (25.897%) and Epirus (19.952%). Higher altitudes (&gt;800 m) show minimal agricultural activity, likely due to unsuitability of terrain.</p> <p>Class 3 (Forest and Semi-Natural Areas): Becomes prominent at mid-to-high altitudes, especially in regions like: Western Macedonia (27.373% at 800–1800 m). Epirus (17.372% at 800–1800 m). Peloponnese (9.114% at 800–1800 m). Lower altitudes (0–300 m) see limited road presence for this class, as forests are less common there.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| Altitude Zone Patterns | <p><b>Roads Concentrated at Low Altitudes (0–300 m):</b><br/>Across most regions, the majority of roads are concentrated in the 0–300 m altitude zone (e.g., 75–86% of roads in Eastern Macedonia, Attica, North Aegean, etc.). This reflects human activity being centered at lower altitudes, likely due to urban areas, agricultural activity, and flatter terrain.</p> <p><b>Mid-Altitudes (300–800 m) Are Secondary:</b><br/>Regions like Western Macedonia, Epirus, and Crete have substantial road coverage in mid-altitudes (25–45%), often due to hilly agricultural zones or smaller settlements.</p> <p><b>Minimal Road Coverage at Higher Altitudes (&gt;800 m):</b><br/>Regions above 800 m typically have less than 10% of roads, except in areas with mountainous terrain like Western Macedonia (40%), Epirus (20%), and Peloponnese (12%).</p> <p>These patterns suggest that higher altitudes are less developed, with roads mostly serving forested or semi-natural areas.</p> |
| Regional Patterns      | <p><b>Regions With Heavy Low-Altitude Focus:</b> Attica, South Aegean, North Aegean, Central Macedonia: Over 75% of roads are in the 0–300 m zone, often linked to dense population centers or islands with limited high-altitude terrain.</p> <p><b>Regions With Balanced Distribution:</b> Crete, Western Greece, Peloponnese: Significant roads in both 0–300 m and 300–800 m zones, reflecting mixed land use (agriculture, settlements, and semi-natural areas).</p> <p><b>Regions With High-Altitude Dominance:</b> Western Macedonia and Epirus: Stand out for substantial road presence in 300–1800 m zones, with forests and semi-natural areas being a key focus.</p>                                                                                                                                                                                                                                                                                                                   |

The fourth geospatial analysis done in order to focus to the third land use category to the forest and semi-natural areas. The road network length in 3<sup>rd</sup> CLC category is 119,706 km (28.7%) but the area is that the 3<sup>rd</sup> CLC category covers in Greece is 74,207 km<sup>2</sup> (57.21%). The Table 10 presents the percentage of road length and the Table 11 presents road density in forest and semi-natural areas of Greece.

**Table 10: Road length percentage in forest and semi-natural areas of Greece**

| Corine Class            | Altitude zones |         |          |        | Sum     |
|-------------------------|----------------|---------|----------|--------|---------|
|                         | 0-300          | 300-800 | 800-1800 | >1800  |         |
| 311 Broad-leaved forest | 2.329%         | 8.421%  | 6.297%   | 0.022% | 17.070% |
| 312 Coniferous forest   | 3.092%         | 2.789%  | 5.692%   | 0.012% | 11.586% |

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|                                     |                |                |                |               |                |
|-------------------------------------|----------------|----------------|----------------|---------------|----------------|
| 313 Mixed forest                    | 2.300%         | 3.667%         | 3.298%         | 0.001%        | 9.266%         |
| <b>31 Forest Total</b>              | <b>5.595%</b>  | <b>14.082%</b> | <b>15.702%</b> | <b>0.123%</b> | <b>35.501%</b> |
| 321 Natural grassland               | 4.049%         | 4.591%         | 3.554%         | 0.221%        | 12.417%        |
| 322 Moors and heathland             | 0.007%         | -              | 0.431%         | 0.075%        | 0.514%         |
| 323 Sclerophyllous vegetation       | 12.357%        | 13.160%        | 3.457%         | 0.018%        | 28.992%        |
| 324 Transitional woodland/shrub     | 4.372%         | 7.512%         | 5.112%         | 0.015%        | 17.010%        |
| <b>32 Shrubs Total</b>              | <b>18.139%</b> | <b>25.666%</b> | <b>15.208%</b> | <b>0.809%</b> | <b>59.821%</b> |
| 331 Beaches, dunes, and sand plains | 0.677%         | 0.067%         | 0.029%         | -             | 0.772%         |
| 332 Bare rock                       | 0.018%         | 0.022%         | 0.049%         | 0.010%        | 0.099%         |
| 333 Sparsely vegetated areas        | 0.636%         | 0.579%         | 0.767%         | 0.076%        | 2.059%         |
| 334 Burnt areas                     | 0.085%         | 0.130%         | 0.002%         | -             | 0.217%         |
| <b>33 Open spaces</b>               | <b>1.123%</b>  | <b>1.074%</b>  | <b>1.919%</b>  | <b>0.561%</b> | <b>4.678%</b>  |
| <b>Greece's total</b>               | <b>29.922%</b> | <b>40.938%</b> | <b>28.688%</b> | <b>0.452%</b> | <b>100%</b>    |

**Table 11: Road density in forest and semi-natural areas of Greece**

| Corine Class                        | Altitude zones |                 |                 |                 | Sum             |
|-------------------------------------|----------------|-----------------|-----------------|-----------------|-----------------|
|                                     | 0-300          | 300-800         | 800-1800        | >1800           |                 |
| 311 Broad-leaved forest             | 1.73549        | 1.607511        | 1.556236        | 0.743673        | 1.601722        |
| 312 Coniferous forest               | 2.906565       | 1.934227        | 1.479344        | 0.329159        | 1.812818        |
| 313 Mixed forest                    | 2.165038       | 1.789255        | 1.792725        | 0.148468        | 1.868227        |
| 321 Natural grassland               | 1.731014       | 1.59756         | 1.35669         | 0.658418        | 1.519887        |
| 322 Moors and heathland             | 1.185433       | 0.110489        | 1.334237        | 0.794083        | 1.205309        |
| 323 Sclerophyllous vegetation       | 1.736661       | 1.426831        | 1.117803        | 0.948333        | 1.490562        |
| 324 Transitional woodland/shrub     | 2.450132       | 1.971177        | 1.507211        | 0.287356        | 1.881978        |
| 331 Beaches, dunes, and sand plains | 3.843237       | 1.506916        | 4.116315        |                 | 3.396236        |
| 332 Bare rock                       | 0.577061       | 0.839703        | 0.410441        | 0.129423        | 0.388112        |
| 333 Sparsely vegetated areas        | 1.419158       | 1.086627        | 0.72264         | 0.28379         | 0.890497        |
| 334 Burnt areas                     | 2.086565       | 2.080223        | 1.137046        |                 | 2.064416        |
| <b>Greece Total</b>                 | <b>1.94185</b> | <b>1.617696</b> | <b>1.409688</b> | <b>0.488108</b> | <b>1.613125</b> |

Analyzing the road data in forest and semi-natural areas of Greece, it is observed that there is lowland dominance. The roads are concentrated in the 0 – 300 m (29.92%) and 300 – 800 m (40.94%) altitude zones, where most human activities like agriculture, settlements, and semi-natural land use occur. The most roads are in areas with sclerophyllous vegetation, this class accounts for 28.99% of total road length, emphasizing its role in Greece's semi-natural and rural infrastructure. About the forest areas with broad-leaved, coniferous, and mixed forests collectively contribute 38% of road length, highlighting the role of forestry-related infrastructure. Also, there is minimal high-altitude infrastructure in the >1800 m zone there is only 0.45% of road length, indicating limited accessibility in mountainous regions.

Moreover, the altitude impact on the road density is identified. The road density consistently declines with altitude, peaking at 0 – 300 m (1.94 km/km<sup>2</sup>) and reaching its lowest at >1800 m (0.49 km/km<sup>2</sup>). This trend aligns with terrain challenges and reduced human activity at higher elevations. The broad-leaved forest (1.60 km/km<sup>2</sup>) is the most

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balanced forest class in terms of density across altitude zones and in bare rock ( $0.39 \text{ km/km}^2$ ) there is minimal infrastructure investment, reflecting its remote nature. The dominant road density classes are transitional woodland/shrub ( $1.88 \text{ km/km}^2$ ) and sclerophyllous vegetation ( $1.49 \text{ km/km}^2$ ) which contribute significantly to the road network in natural areas.

The road network in Greece aligns closely with land use and altitude. Sclerophyllous vegetation and forested areas dominate road coverage, highlighting the importance of rural and natural land infrastructure in the country. The road network density in Greece is highest in low-altitude areas (0 – 300 m) and decreases with elevation. The densest networks are found in beaches, transitional woodland/shrub, and burnt areas, reflecting intensive human and economic activity in these regions. Forested areas and semi-natural landscapes exhibit moderate densities, supporting rural and forestry-related activities. Sparse and bare lands, particularly at higher altitudes, have the least road infrastructure.

## Conclusions

The road network distribution in Greece reflects the interplay between human activity, land use, and topographic constraints. The density of roads varies significantly across different land cover types and altitudes, highlighting the country's diverse landscape and socioeconomic patterns.

About the altitude zones and road density, it is observed that the low-altitude areas (0 – 300 m) are the most densely covered, driven by urban centers, agricultural zones, and coastal tourism infrastructure. Road density sharply declines with altitude, with the least-developed road networks found in high-altitude areas ( $> 1800 \text{ m}$ ) due to rugged terrain and limited human settlement.

On the subject of the Land Cover Types and Distribution, it is noticed that artificial Areas with urban and developed zones (e.g., cities, towns) have the highest road density across all altitude zones, reflecting the concentration of economic and social activities in these regions. The agricultural areas have moderate road density that supports agricultural activities, primarily in low- and mid-altitude zones. The forest and semi-natural areas have lower road density but they still maintain networks to support forestry, rural access, and tourism. The most roads in of the 3<sup>rd</sup> CLC category are in transitional woodland/shrub and sclerophyllous vegetation and for this reason these areas used to connect 1<sup>st</sup> and 2<sup>nd</sup> CLC categories.

Also, specific patterns show that Regions like Attica, Crete, and Central Macedonia perform high density road networks, corresponding to high population density and economic activity, and remote regions such as Western Macedonia and Epirus feature lower road densities, especially at higher altitudes, due to challenging terrain and lower population density.

Greece's road network has economic and tourist influences, the coastal and island regions, especially in the Ionian Islands, South Aegean, and Crete, show high road density in proximity to beaches and tourist hubs. The road network in Greece is highly concentrated in low-altitude urban, coastal, and agricultural areas, driven by population distribution and economic activity. In contrast, higher altitudes and sparsely populated areas have sparse road infrastructure, reflecting the natural limitations of the terrain and reduced human impact. This



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distribution mirrors Greece's dual character as both a center of modern urbanization and a country with vast, rugged landscapes that remain relatively untouched.

The impact of road network altitude zones on land use patterns in Greece is profound. Understanding these dynamics is crucial for informed policy-making and fostering sustainable development.

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# EVALUATION OF LANDSLIDE PREVENTIVE MEASURES ON ROADSIDE SLOPES

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## Abstract

Landslides of road slopes stand for phenomena resulting in minor to even catastrophic consequences, with impact on road infrastructure and road users. Moreover, properties next to the road may be affected as well. Nowadays, these phenomena occur more and more frequently and their impact becomes more and more higher, due to climate change and forest fires. Thus, adequate preventive measures, are of utmost importance in the context of safety guarantees.

The present paper defines and analyses criteria, such as implementation cost and ease of establishment, implementation range and effectiveness, for appraising measures of landslide prevention, conducting an analytical hierarchy process scheme. A thoughtful set of the appraisal criteria is considered to be a cornerstone for correct and comprehensive evaluation. The preventive measures are selected from most common ones, such as slope change, drainage infrastructures and planting. Results may vary according to special characteristics of each potential landslide field. Evaluation of each criterion may also vary according to the climatic and economic environment in which the appraisal is conducted. In this frame, a measure which is indicated as optimal for a certain study area may be inadequate for another area.

Given the aforementioned, the results show fruitful and interesting findings, attributing scores to the examined measures, in terms of overall and each criterion evaluation. The appraisal methodology presented, may be used as a tool for road operators and competent authorities, so as to assess the most effective preventive measures, with respect to inherent and general characteristics that apply in each case.

**Key words:** Roadside slopes, landslides, appraisal, preventive measures, evaluation

## Introduction

Road slopes are arranged along the entire length of each road infrastructure and their integrity is directly linked to the proper functioning of the road axes, as their deformation or destruction leads to traffic problems, for commercial, professional and tourist purposes. Therefore, it is the duty of road network managers to ensure their maintenance or formation and to take preventive measures for this purpose.

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Roadside slope landslides are a phenomenon that may occur due to natural causes, such as heavy rainfall, snowfall, natural disasters (e.g. earthquake) or to anthropogenic causes (e.g. tunnel construction) or felling of trees on the slope (Figure 1).

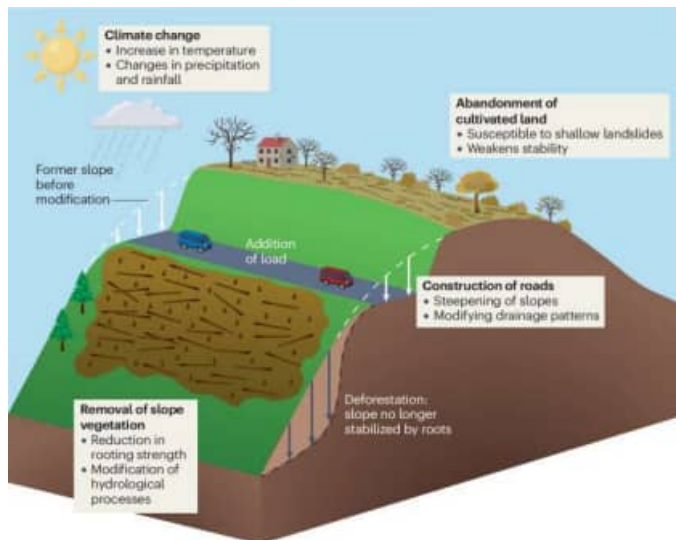


**Figure 1: Consequences of slope deforestation** (Hill et al., 2024)

The effects of landslides can be very significant, such as the interruption of traffic or even the complete destruction of part of the road network in an area (Figure 2), resulting in the hard movement of vehicles. Secondary consequences include difficulties in traffic, which may be devastating for the economic activity of the area and in other cases, may even pose a risk to the lives of residents, as access to health facilities becomes difficult or impossible, depending on the case and the magnitude of the landslide. Erosion of the slope can even cause dangerous situations for the buildings in the area (Alamanis et al., 2020; Ecoslopes, 2004), since it can lead to erosion and movement of the soil (Figure 1). In our time, landslides are more frequent due to intense or extreme climatic phenomena and forest fires.



**Figure 2: Landslide hazards** (<https://www.climatechangepost.com/news/on-a-global-scale-landslide-hazard-doesnt-seem-to-be-increasing-due-to-climate-change/>)

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Landslide prevention measures on road slopes can lead to the avoidance or reduction of these unpleasant effects. For this reason, their implementation before the occurrence of a landslide is of utmost importance.

An important issue that needs to be examined is the effectiveness and cost of implementing these measures. In other words, is it scientifically correct to implement a landslide prevention measure that does not adequately ensure what it was designed for? In addition, the economic aspect of each prevention measure should be examined, as the amount of human and financial resources required is not unlimited and in some cases is quite restrictive.

Taking the above into account, this study presents a methodology for evaluating three of the most common landslide prevention measures, namely terraced slopes (Figure 1), drainage infrastructure (Figure 2) and planting (Figure 3). Thus, the goal is to find the optimal choice, taking into account the specific characteristics and economic environment of each case.



**Figure 3: Terraced slopes** (<https://en.jardineriaon.com/how-to-make-sloping-terraces.html>)



**Figure 4: Drainage infrastructure** (Hearn and Hunt, 2011)



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**Figure 5: Planting** (<https://landscapearchitecturemagazine.org/2018/04/24/slope-style/>)

Considering the above, a tool, meaning a concise methodology for selecting the optimal measure for landslide prevention, is necessary for road operators, so as they can conclude, which is the best preventive method for preventing catastrophic consequences on the road network, without spending excessive or useless resources. This is exactly what the present study deals with, by proposing a simple and comprehensive optimal choice selection methodology for road operators and constructors.

### Methodology

The proposed methodology for the evaluation of alternative measures to prevent landslides on road slopes is that of the Analytical Hierarchy Process (AHP) (Saaty, 2006; Saaty, 2008). This method was chosen in order to take into account the specific characteristics of each case during the evaluation, as relevant studies for engineering tasks have demonstrated (Papageorgiou, 2020; Papageorgiou, 2022; Papageorgiou et al., 2019; Papageorgiou et al., 2020). For example, a road slope that is rocky is very different from another that is clayey, both in terms of the ease of implementing a prevention measure and the cost of implementation. At the same time, each alternative measure requires different amounts of human resources, equipment, materials and project machinery.

To conduct the evaluation using the AHP method, five criteria were used, namely implementation cost, ease of application, versatility, effectiveness and environmental adaptation. Thus, the evaluation scheme is presented in Figure 6.



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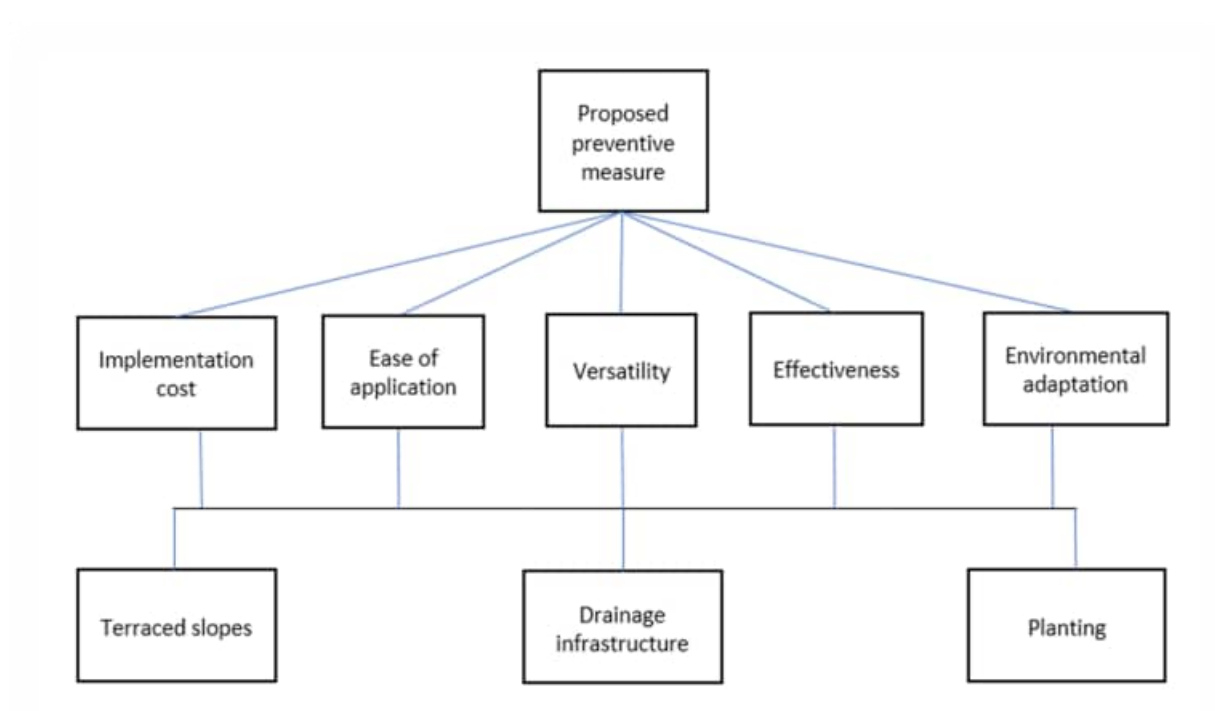


**Figure 6: Evaluation scheme**

In order to carry out the evaluation, a clear description of the evaluation criteria is shown in Table 1. The description was drawn up with the aim of including as fully as possible all the factors that influence the implementation of such a project, as well as its impact to the natural and anthropogenic environment.

**Table 1: Description of evaluation criteria**

| Appraisal criteria              | Description                                                                                                                                               |
|---------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Implementation cost</b>      | Cost of application, including machinery, personnel, timeline and required resources, considering location, time and special characteristics of each case |
| <b>Ease of application</b>      | Availability of equipment and materials, range of laying temperatures, familiarity with the technique and possible or current rates of application        |
| <b>Versatility</b>              | Field of its application, the range of geological and slope segments targeted (e.g. high differentiation of slope values, rock, clay, sandy ground)       |
| <b>Effectiveness</b>            | Expected engineering result of the implemented technique, the slope performance after operations                                                          |
| <b>Environmental adaptation</b> | Effects on the environment and degree of adaptation in the natural landscape                                                                              |

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A clear description of the criteria is important so that the evaluation can be carried out within a specific and clear framework. Furthermore, it includes all the important elements that must be taken into account so that the resulting result is reliable and holistic, i.e. takes into account the specific characteristics and the available budget.

### Results

The three alternative landslide prevention measures examined in this study are evaluated for their adequacy in the criteria that have been established, following a search in the literature and relevant applications (Guzzetti et al., 2015; Pérez-Maqueda, 2019; Capobianco et al., 2025; Maes et al., 2017; Alcántara-Ayala and Sassa, 2023; Schuster and Highland, 2011; Alexiou et al., 2020; Neumann and Calliari, 2016; Lan et al., 2020; Zacharof, 2011). The results of this research are shown in Table 2.

**Table 2: Evaluation of preventive measures**

| PREVENTIVE MEASURE             | IMPLEMENTATION COST                            | EASE OF APPLICATION                                                                               | VERSATILITY                                             | EFFECTIVENESS                                            | ENVIRONMENTAL ADAPTATION                                       |
|--------------------------------|------------------------------------------------|---------------------------------------------------------------------------------------------------|---------------------------------------------------------|----------------------------------------------------------|----------------------------------------------------------------|
| <b>Terraced slopes</b>         | <b>Low / Fair</b><br>(low construction budget) | <b>Very good</b><br>(Simple equipment, various techniques of application, fast construction time) | <b>Good</b><br>(not applicable in rocky or loose soils) | <b>Good</b><br>(reduced function in certain cases)       | <b>High</b><br>(minimum intervention in the natural landscape) |
| <b>Drainage infrastructure</b> | <b>High</b><br>(costly materials and works)    | <b>Good</b><br>(Complex equipment, specialized personnel, slow application rate)                  | <b>Very good</b><br>(applicable in most cases)          | <b>Very good</b><br>(long-term reliability)              | <b>Low</b><br>(major intervention in the landscape)            |
| <b>Planting</b>                | <b>High</b><br>(costly plants, tasks and care) | <b>Good</b><br>(Large number of specialized personnel, slow application rate)                     | <b>Very good</b><br>(applicable in most cases)          | <b>Very good</b><br>(immediate restoration of stability) | <b>Excellent</b><br>(environmental enrichment)                 |

Assessing different evaluation methods through comparative analysis is certainly a challenging endeavor. However, there are specific distinct differences that illustrate the advantages and disadvantages of each method in relation to the others.

Based on the findings of the above research, the application of the AHP method with pairwise hierarchy was carried out. The results are shown in Table 3.

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**Table 3: Pairwise comparison of alternatives with respect to the evaluation criteria**

| <b>Implementation cost</b>      | Terraced slopes | Drainage infrastructure | Planting | <b>Priority</b> |
|---------------------------------|-----------------|-------------------------|----------|-----------------|
| Terraced slopes                 | 1               | 3                       | 4        | 0.625           |
| Drainage infrastructure         | 1/3             | 1                       | 2        | 0.238           |
| Planting                        | 1/4             | 1/2                     | 1        | 0.137           |
| <b>Ease of application</b>      |                 |                         |          |                 |
| Terraced slopes                 | 1               | 3                       | 3        | 0.600           |
| Drainage infrastructure         | 1/3             | 1                       | 1        | 0.200           |
| Planting                        | 1/3             | 1                       | 1        | 0.200           |
| <b>Versatility</b>              |                 |                         |          |                 |
| Terraced slopes                 | 1               | 1/3                     | 1/3      | 0.143           |
| Drainage infrastructure         | 3               | 1                       | 1        | 0.429           |
| Planting                        | 3               | 1                       | 1        | 0.429           |
| <b>Effectiveness</b>            |                 |                         |          |                 |
| Terraced slopes                 | 1               | 1/3                     | 1/3      | 0.143           |
| Drainage infrastructure         | 3               | 1                       | 1        | 0.429           |
| Planting                        | 3               | 1                       | 1        | 0.429           |
| <b>Environmental adaptation</b> |                 |                         |          |                 |
| Terraced slopes                 | 1               | 5                       | 1/4      | 0.231           |
| Drainage infrastructure         | 1/5             | 1                       | 1/9      | 0.060           |
| Planting                        | 4               | 9                       | 1        | 0.708           |

The alternative prevention measures present different priorities, with regard to implementation cost, ease of application, versatility, effectiveness and environmental adaptation.

Then, a comparative ranking is made in pairs for the evaluation criteria, as shown in Table 4. The effectiveness of the appropriate measure is considered the most important criterion. They follow in hierarchical order, implementation cost, versatility, effectiveness and environmental adaptation and lastly ease of application is ranked. It is crucial to recognize that the significance of each criterion and the assessment of every prevention measure should be determined by qualified engineering professionals, taking into account the unique characteristics of each situation along with the budget and any additional limitations. If specific insights must be derived from the roadside slope, the methods that meet or do not meet the desired outcomes should be appropriately assigned relative importance weights.

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**Table 4: Pairwise comparison of the evaluation criteria**

| Evaluation criteria      | Implementation cost | Ease of application | Versatility | Effectiveness | Environmental adaptation | Priority |
|--------------------------|---------------------|---------------------|-------------|---------------|--------------------------|----------|
| Implementation cost      | 1                   | 3                   | 1           | 1/5           | 1                        | 0.129    |
| Ease of application      | 1/3                 | 1                   | 1/3         | 1/7           | 1/3                      | 0.051    |
| Versatility              | 1                   | 3                   | 1           | 1/5           | 1                        | 0.129    |
| Effectiveness            | 5                   | 7                   | 5           | 1             | 5                        | 0.563    |
| Environmental adaptation | 1                   | 3                   | 1           | 1/5           | 1                        | 0.129    |

The overall weights of the prevention measures are listed in Table 5 and the results of the overall evaluation are shown in Figure 7. First is the Planting measure, second is Drainage and third is Terraced slopes. According to each scenario, adequate pairwise comparison weights should be attributed.

**Table 5: Overall weights of preventive measures**

| Preventive measure      | Priority with respect to |                     |             |               |                          | Overall priority / score |
|-------------------------|--------------------------|---------------------|-------------|---------------|--------------------------|--------------------------|
|                         | Implementation cost      | Ease of application | Versatility | Effectiveness | Environmental adaptation |                          |
| Terraced slopes         | 0.080625                 | 0.0306              | 0.018447    | 0.080509      | 0.029799                 | 0.23998 (~24%)           |
| Drainage infrastructure | 0.030702                 | 0.0102              | 0.055341    | 0.241527      | 0.00774                  | 0.34551 (~34.5%)         |
| Planting                | 0.017673                 | 0.0102              | 0.055341    | 0.241527      | 0.091332                 | 0.416073 (~41.5%)        |

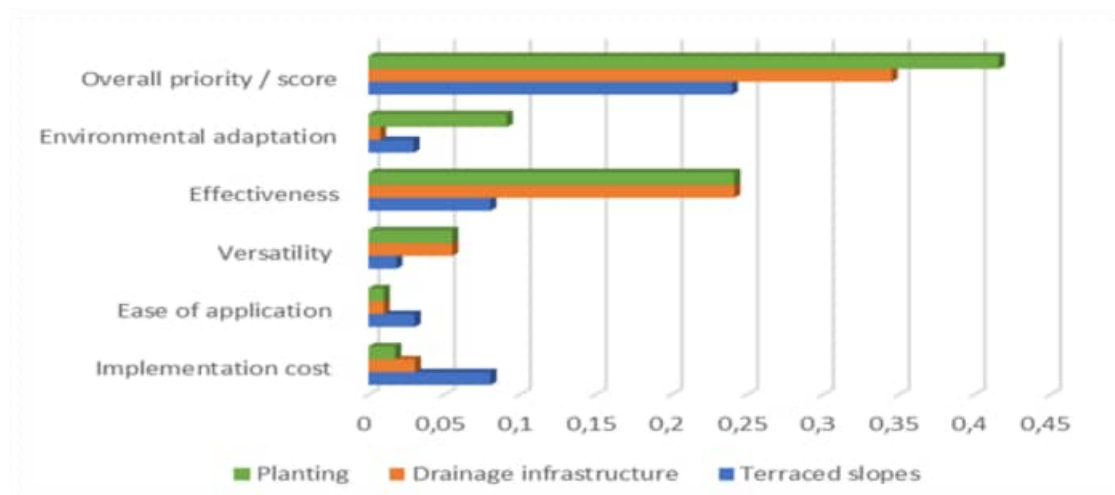


**Figure 7: Evaluation priorities / scores**

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As can be easily seen from Figure 7, the Planting measure outperforms the other two in the overall evaluation of the evaluation criteria, although it clearly outperforms only one criterion, that of environmental adaptation. In terms of effectiveness and versatility, it ranks equal to Drainage and presents the highest implementation cost.

### Sensitivity Analysis

All of the above applies in the case where there are no restrictions on the budget for the implementation of each measure. In the opposite case, that is, when financial resources are limited, then the same procedure is followed and its results are differentiated with regard to the comparative ranking of the criteria per pairs (Table 6) and finally, the optimal choice and the alternatives with their adequacy with respect to the evaluation criteria are shown in Table 7 and Figure 8.

**Table 6: Pairwise comparison of the evaluation criteria (budget constraints)**

| Evaluation criteria      | Implementation cost | Ease of application | Versatility | Effectiveness | Environmental adaptation | Priority |
|--------------------------|---------------------|---------------------|-------------|---------------|--------------------------|----------|
| Implementation cost      | 1                   | 7                   | 5           | 1             | 5                        | 0.384    |
| Ease of application      | 1/7                 | 1                   | 1/3         | 1/7           | 1/3                      | 0.041    |
| Versatility              | 1/5                 | 3                   | 1           | 1/5           | 1/3                      | 0.074    |
| Effectiveness            | 5                   | 7                   | 5           | 1             | 5                        | 0.384    |
| Environmental adaptation | 1/5                 | 3                   | 3           | 1/5           | 1                        | 0.118    |

**Table 7: Overall weights of preventive measures (budget constraints)**

| Preventive measure      | Priority with respect to |                     |             |               |                          | Overall priority / score |
|-------------------------|--------------------------|---------------------|-------------|---------------|--------------------------|--------------------------|
|                         | Implementation cost      | Ease of application | Versatility | Effectiveness | Environmental adaptation |                          |
| Terraced slopes         | 0,24                     | 0,0246              | 0,010582    | 0,054912      | 0,027258                 | 0,357352 (~36%)          |
| Drainage infrastructure | 0,091392                 | 0,0082              | 0,031746    | 0,164736      | 0,00708                  | 0,303154 (~30%)          |
| Planting                | 0,052608                 | 0,0082              | 0,031746    | 0,164736      | 0,083544                 | 0,340834 (~34%)          |

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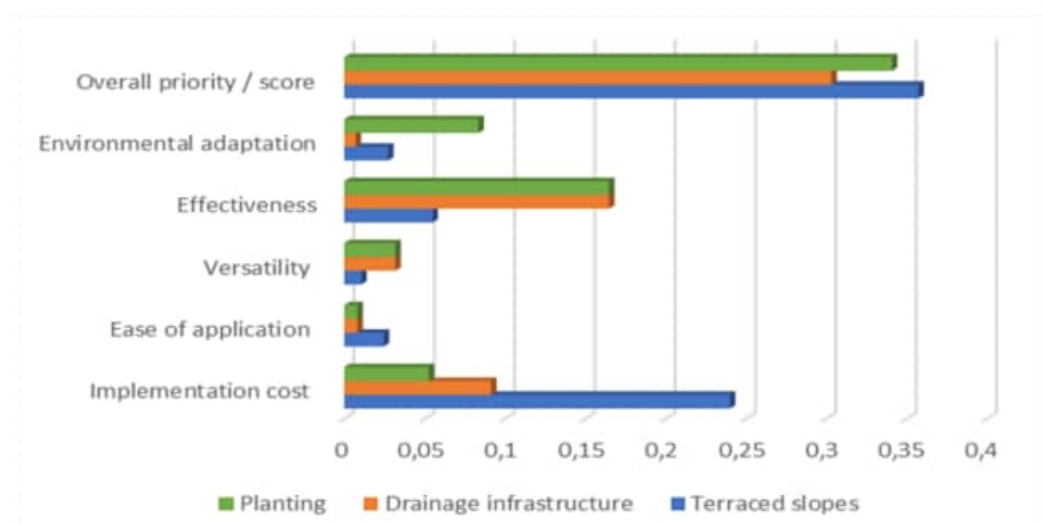


**Figure 8: Evaluation priorities / scores (budget constraints)**

In contrast to the results of the evaluation when there are no financial constraints, in the case where they exist, the most appropriate landslide prevention measure is demonstrated to be Terraced slopes, with Drainage coming close to the evaluation. Terraced slopes clearly excel in the criteria of implementation cost and ease of implementation, while in the rest it is far from the ideal choice.

As it is easily perceptible, the optimal result after conducting the proposed method, depends on the special characteristics and of each case and may differ from case to case. The authorized engineers of the road operator can use the proposed method as a tool to find the best alternative for the roadside slopes under inspection, so as to ensure slope stability and safety.

## Conclusions

By applying the proposed method, a specific and overall picture of the options available is created. Thus, it is relatively easy to evaluate all alternatives for decision-making. Choosing the best measure is not a one-dimensional decision, but depends on many factors.

The proposed appraisal results in an analysis of preventive measures with regards to specific criteria and helps decision makers to conclude to the optimal choice according to their priorities and potentials. The optimal choice may differ according to special characteristics of each case examined.

The common practice adopted by road managers of consistently applying the same prevention measure over the years, disregarding any flaws or resource limitations, is likely to yield inaccurate results due to insufficient implementation processes related to the evaluation procedure. The purpose of this evaluation is to highlight the overall framework within which existing methods should be assessed and is intended to serve as a comprehensive tool for road professionals to conduct alternative assessment while also considering the resources available.



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In conclusion, each measure presents its own benefits and drawbacks, which vary based on desired outcomes and financial constraints. To confidently choose the most appropriate one for landslide prevention, the approved personnel must thoughtfully consider the previously mentioned factors relevant to each situation evaluated.

Future research may be conducted in the frame of artificial intelligence integrated in the evaluation procedure, so as all special characteristics of each case will be considered thoroughly.

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## PROCEEDINGS

*2nd Open-Air Cities International Conference “Local & Regional Sustainable Development and Urban Reconstruction”, Harokopio University of Athens, February 14-16, 2025*

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**Special session:**  
**CULTURE AND SUSTAINABLE URBAN DEVELOPMENT OF THE CITY**  
*powered by the **Foundation for Mediterranean Studies - MeDiterrate***

Coordinator:  
**Antonis Papagiannidis**  
*Economia Group*  
*Foundation for Mediterranean Studies - MeDiterrate*

### Abstract and Topics

This special session seeks to unravel the intricate connections between cultural heritage, urban identity, and the political economy of sustainable development. It emphasizes the critical role of culture as both a resource and a framework in fostering resilient and inclusive urban environments. Cities, as complex systems of social, economic, and political interactions, provide a fertile ground for examining the interplay between cultural dynamics and the imperatives of sustainability.

The session delves into how cultural norms, historical legacies, and socio-economic transitions shape urban governance, spatial planning, and public policy. It critically examines the urbanisation processes that disrupt traditional socio-economic structures and introduce new modes of production, consumption, and social behaviour. Particular attention is given to the pressures of rural-to-urban migration, which often entails the coexistence of diverse cultural paradigms and the challenge of integrating these into a cohesive urban framework. The session also interrogates the commodification of cultural heritage within urban economies, exploring its dual potential to drive economic growth while risking homogenisation and loss of authenticity.

The political economy dimension is central to this discussion, as the session evaluates how governance models, institutional structures, and public policies influence the allocation of resources and the distribution of opportunities in urban settings. By reflecting on both historical and contemporary examples, it highlights the potential of culturally attuned strategies to address issues of inequality, social exclusion, and environmental degradation. The session positions cities as arenas where cultural identity intersects with economic imperatives, offering a roadmap for reconciling economic growth with social equity and environmental integrity.

Through this lens, the session aims to contribute to a nuanced understanding of the role of culture in shaping urban political economies, advancing a vision of cities as spaces of sustainable coexistence and dynamic cultural exchange. This perspective encourages policymakers, researchers, and practitioners to rethink the urban experience as one that is not only economically viable but also culturally enriching and socially inclusive.

Building on the above, this session’s key areas of focus are:

- Urban Identity
- Sustainable Governance
- Healthy Cities
- Tourism and Urban Economy
- Social Cohesion
- Rural-Urban Dynamics
- Political Economy of Cities
- Public Spaces
- Cultural Resilience

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### ATHENS: A CITY WITHOUT AN "URBAN" CULTURE

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#### **Abstract**

The concentration of population in Athens has led to numerous challenges affecting daily life and overall quality of living. Between 1950 and 1980, the population of the Athens urban complex more than doubled, increasing from 1.4 million to 3 million as 1.6 million people migrated from rural areas across Greece. Although the rural migration to Athens slowed in subsequent decades, it continued, and today (2024), 3.6 million people reside in the wider urban complex.

The uncontrolled expansion of Athens resulted in inadequate urban planning, causing adverse effects on transportation, construction, the social fabric, and green spaces. Natural resources have been significantly depleted, creating an unlivable urban environment. The social, economic, and environmental problems arising from urbanization, alongside the decline of rural areas, have been extensively studied. However, the behavioral patterns of people migrating to Athens—bringing their "rural" cultural norms (habits, attitudes, and perceptions) into a vastly different urban environment—remain insufficiently explored.

This analysis aims to explore the extent to which the blending of "rural" cultural norms with the fragile "urban" cultural model contributes to the behaviors observed in Athens today. These behaviors include indifference toward public spaces, urban planning disorder, transactional political engagement, varying degrees of lawlessness in an impersonal and sprawling city, as well as family solidarity, religiosity, and distrust of institutions.

**Key words:** Urbanisation, cultural transition, social behaviour, socioeconomics

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### THE CONCEPT OF "SYSPONDIA"

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#### **Abstract**

The term 'sympolity' denotes a benevolent bond among partner-members working toward the greater good of their shared organization. Derived from the word 'libation' (spondē), it symbolizes the communal connection formed among members of an association dedicated to a mutual and beneficial purpose, fostering a symbiotic and lasting co-evolution. This presentation draws inspiration from the ancient Greek associations of city-states, or 'sympolities,' of the Classical and Hellenistic periods. It aims to articulate the essential quality of the communal bond, as well as the constitutional foundations and implications of such associations in the contemporary context of the European Union as both a polity and a collection of polities.

Specifically, it frames the modern European Union as a political form of 'union of constitutional co-evolution,' proposing a structured collective legal and political order that, over time and through the lens of constitutional liberty, can shape its own self-recognizable 'demos' and distinctive—though unconventional compared to classical confederal unions and contemporary sovereign federal states—constitutional identity. Overall, the presentation seeks to conceptualize the European Union as a 'sympolity of late modernity,' capable of systematically developing its own framework for public coexistence among partner-members, thereby constituting a complex political entity that transcends traditional international interpretations of unions.

**Key words:** Sympolity, European Union, constitutional co-evolution

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### THE PROTECTION OF THE PHYSIOGNOMY OF CITIES AND GREEN PUBLIC PROCUREMENTS

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#### **Abstract**

Public Authorities are the main consumers in Europe, spending around 2 billion euros, that is the 14% of the European Union's GDP. They procure goods (e.g. structural elements, vehicles, equipment for public spaces in cities, etc.) and services (e.g. building maintenance, transport services, cleaning services, etc.), while at the same time implementing projects, which as a whole or individually may have potentially significant environmental impacts. With this specific condition, it becomes absolutely clear that Public Authorities maintain an important, perhaps even dominant, role in the promotion and use of Green Public Procurement. In other words, they can play an important role in reducing environmental impacts and the environmental footprint, by promoting the procurement of "greener" products, services and projects from the market.

Today, Green Public Procurement, although considered as a voluntary tool, are widely understood conceptually, but has not yet been universally implemented by Public Authorities. Nevertheless, it has been recognized that it constitutes a smart contracting. In any case, they imply an improvement in the performance of the public contract and at the same time the use of the power of the public market in order to achieve very significant environmental benefits mainly at the local level, including the protection or preservation of the city's physiognomy. In other words, they are a particularly dynamic tool for shaping the character of cities on the basis of sustainable standards, but also an excellent means for achieving local objectives and initiatives for the environment and human health. In any case, Green Public Procurement can be an effective tool for addressing urban problems at source, ensuring a high quality of life for city residents.

Considering the value of Green Public Procurement as a tool for protecting the environment and shaping sustainable and healthy cities, Member States need to be encouraged to develop their own national Action Plans for the “greening” of public procurement. Among other things, the coming years should be years of political commitments at international, European and national level.

In Greece, the first provisions on Green Public Procurement appeared in 2010 with Law 3855/2010 (Government Gazette 95 A'), but the first substantial step was taken a decade later, in 2021, when the national Action Plan for Green Public Procurement was approved with Joint Ministerial Decision 14900/2021 (Government Gazette 466 B'). However, national Public Authorities, and especially the Municipalities of our country, which constitute perhaps the largest purchasing power in goods, services and projects and the greatest shapers of the physiognomy of cities, still seem to lack significant experience and knowledge in the issues of Green Public Procurement. Therefore, highly coordinated efforts, support from the Ministries and certainly reorganization and training of the executives of the relevant Municipal Services are required, in order for the already encouraging results of the even limited use of this specific tool to find greater application for the benefit of environmental protection and the improvement of the quality of life of residents, especially of large urban centers.

**Keywords:** Green Public Procurement, city's physiognomy, sustainable and healthy cities, environmental protection



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## HEALTHY CITY

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### Abstract

The Athenian city, as noted by the 4th-century BC Attic writer Melanthius, has endured through history largely because of the diversity of opinions among its orators. This variety of perspectives ensured that no single view went unchallenged, allowing individuals to freely express their thoughts and, in doing so, counterbalance potentially harmful ideas. This ethos of debate underpins the grandeur of Greek civilization, epitomized by its greatest contributions: philosophy, tragedy, and democracy - each reaching its zenith in 5th-century Athens.

At the heart of philosophy, tragedy, and democracy lies the principle of dialogue: the ability to express one's thoughts while acknowledging the irrevocable right of others to disagree. Philosophy thrived in schools where members were not bound to accept the teacher's beliefs or conform to others' views. Instead, they were free to either embrace or question ideas through discussion. In fact, the greatest critics of leading philosophers were often their own students - Anaximander questioned Thales, Cratylus critiqued Heraclitus, and Aristotle challenged Plato.

Similarly, in tragedy, the characters do not merely tell stories; through their actions on stage, they engage in dialogue, sometimes converging and at other times diverging in their views. Likewise, democracy established a system of governance rooted not in power or ancestry, but in dialogue among citizens, adopting the majority's views while safeguarding the minority's right to dissent.

**Key words:** Dialogue, civilisation, democracy

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# CULTURAL HERITAGE AND SUSTAINABLE URBAN TRANSFORMATION: A CONTINUUM FROM ANTIQUITY TO MODERNITY

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## Abstract

The historical and cultural heritage of the Elliniko – Argyroupolis Municipality constitutes an integral element of its identity, stretching from antiquity to modern times. In ancient Athens, the local population fostered a progressive culture rooted in arts and philosophy, with theaters and public gatherings serving as cornerstones of collective and intellectual activity. Elliniko – Argyroupolis Municipality, established as refugee settlements by Pontic Greeks, preserved this rich cultural lineage. Over recent decades, the city’s history has been interwoven with the operation of the international airport in Elliniko, a landmark that catalyzed regional development. Today, this area is undergoing a transformative redevelopment project of iconic significance.

In the present era, this cultural legacy underpins the municipality’s commitment to sustainable urban development, balancing respect for historical traditions with contemporary progress. The municipality actively integrates environmental conservation with artistic endeavors through projects aimed at enhancing the quality of urban life. These include the regeneration of public spaces, preservation of the natural environment -particularly the Hymettus mountain range- connection to the coastal front, and initiatives promoting recycling, energy efficiency, and cultural festivals. Collectively, these efforts position Elliniko - Argyroupolis Municipality as a model of harmonized cultural preservation and sustainability.

A notable innovation is the municipality's commitment to sustainable urban mobility, exemplified by the deployment of Greece's first electric municipal transportation network. Featuring a fleet of electric vehicles, seven transit stations, and 44 electric bicycles -including an accessible model for individuals with disabilities- this initiative pioneers environmentally friendly transportation solutions. Complementary actions include public awareness campaigns on sustainable mobility, efforts to minimize ecological footprints, and strategies supporting climate neutrality.

Elliniko - Argyroupolis Municipality is also the sole municipality in Attica participating in the "Living Streets" program, alongside six other European cities. This initiative allows residents, particularly younger generations, to experience a more human-centered and neighborhood-focused urban environment.

**Key words:** Cultural heritage, Sustainable development, Urban regeneration, Green mobility, Community engagement

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### URBAN ENVIRONMENT: A STRATEGIC APPROACH TO CLIMATE RESILIENCE

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#### **Abstract**

Cities are increasingly bearing the brunt of climate change, as evident in the rising frequency of extreme weather events, prolonged heat waves, sea level rise, and escalating risks to food and water security. These phenomena exacerbate existing social and economic inequalities. While urban areas are significant contributors to climate change, accounting for nearly three-quarters of global emissions, they also serve as hubs of innovation and sustainable practices. Cities can play a pivotal role in reducing emissions and enhancing resilience through climate investments, ambitious urban planning, and robust policy frameworks.

Drawing on examples from the Municipality of Nea Smyrni, which aims to achieve climate neutrality by 2030, this commentary highlights a strategic approach to climate adaptation, proposing an integrated yet autonomous climate action plan that incorporates climate risk into all urban and sectoral planning policies. Initiatives for green and resilient infrastructure include, among others, enhancing urban green spaces to mitigate urban heat island effects, improving building energy efficiency, promoting low-carbon transport, and advancing sustainable waste management. These efforts not only address climate challenges but also improve quality of life, foster social equity, and promote democratic governance.

The adaptation process must avoid fragmented solutions and instead adopt a holistic planning framework to prevent the transfer of risks from one sector or activity to another. A comprehensive approach, grounded in local conditions, ensures that existing vulnerabilities are addressed effectively and equitably.

**Key words:** climate change, climate neutrality, urban resilience, Municipality of Nea Smyrni, green policies

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**Special session:**  
**CULTURAL SUSTAINABILITY *IN PRAXIS*:**  
**DIGITAL TRANSFORMATION AND GREEN INNOVATION**

Coordinators:

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In recent years, culture has been dynamically linked to the concept of sustainability. On the one hand, European Union policies relate the cultural sector to economic progress and the needs of the markets. On the other hand, the ongoing digital transformation, the demand for modern skills and the need for green innovations are broadening and enriching the field of cultural actions and developing good practices with a focus on social support and progress. In this context, universities, research institutes, museums, businesses, social bodies, etc. are looking to European funding and international cooperation to develop modern research and good practices that respond to real problems and needs.

The special session will focus on the sustainable development of cultural sector with emphasis in local, regional and urban level and more specifically at the following key topics:

- Climate change and digital media
- Cultural industries and social needs
- Digital communication and learning skills in the working environment
- Digital health and social development
- Digital tools and vulnerable groups
- Gender in the digital world
- Green solutions in urban environments
- Humanities and digital transformation
- Local and Regional Development and Green innovation
- Sustainability and European-funded projects
- Urban Reconstruction and cultural sector

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# CREATIVE INDUSTRIES AND DIGITAL TRANSFORMATION OF TOURISM: ONLINE GAMES AS 'THIRD SPACES' OF COMMUNICATION AND INTERACTION

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## Abstract

Culture is an important pillar of development for every country. In addition, the link between cultural heritage and tourism is, according to Anholt, a distinct dimension of the “nation brand hexagon”, an important element of place and destination brands. Creative Industries (CIs) as a modern cultural field include production units that focus on human talent, individual craftsmanship and the ability to create original products that can lead to a comparative economic advantage. The link between CIs and the tourism industry is eloquently reflected in modern forms of alternative tourism, such as cultural and creative tourism, where visitors come into contact with cultural resources and/or interact with the inhabitants of the destination. At the same time, the digital transformation of tourism is taking place, which is progressively linked to the -perhaps more robust- field of CIs, digital games. The importance of this field is recognised by the EU, which, by establishing and adopting legislation and conducting international surveys (2023, 2024), is attempting both to regulate the sector and to highlight the economic, social and cultural dimension of digital games.

This study is based on a broad literature review. It utilises classification, analysis and interpretation of secondary data to outline the emerging relationship between tourism and digital, online games. Massively Multiplayer Online role-playing games (MMOs) have been described as harbingers of the metaverse as they offer a first insight into the future fully functional cross-platform reality. The dimension of the metaverse as a 'meeting place' between the physical and digital worlds is familiar to gamers, who spend a lot of time in game fora. In these 'third places', communities of players meet, connect, communicate and develop social practices, laying the foundations of so-called metaverse gaming. International surveys (2021, 2023) on MMOs and popular platforms (Roblox, Fortnite, Minecraft) have shown that 60% of players participate in parallel activities (not directly related to the game itself): meeting new people, watching videos, participating in live events, going on tours, organising trips to the virtual or real world, attending educational programmes, etc. Recent research concludes that both the choice of tourist destinations and the enhancement of experiences and perceptions of these destinations are linked to the activity of the player and the types of games used. Other studies focus on the development of digital games in tourism destinations, with an emphasis on interactive entertainment, sport and educational experiences. Finally, it is considered that the development of the relationship between the tourism industry and the digital games sector can benefit the industry, on the one hand by the emergence of new business models and the promotion of the tourism product, but also by expanding the possibilities to reach larger audiences - especially young people - and by the consequent development of (digital) accessibility.

**Key words:** creative industries, culture, tourism, digital online games, metaverse gaming

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### **BRIDGING THE GENDER DIGITAL DIVIDE: STRATEGIES FOR INCLUSIVE TECHNOLOGY ADOPTION IN MARGINALIZED COMMUNITIES IN UGANDA**

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#### **Abstract**

Digital divide continues to pose notable challenges among marginalized communities in Africa, with a notable gender disparity, in countries like Uganda. This disparity has impeded both social and economic development within communities. This study aims to explore the primary factors driving the gender digital divide, examine barriers to technology adoption faced by women in marginalized communities, assess the influence of cultural norms and gender roles on the gender digital divide, and evaluate strategies for fostering inclusive and user-friendly technology adoption. The research seeks to contribute to the theoretical and conceptual discourse on gender equity in technology adoption, and women's empowerment. The study will be grounded in Kabeer's empowerment framework and the theory of change. It will employ a mixed-methods approach, integrating both qualitative and quantitative research methods. The qualitative component will include focus group discussions, interviews with key informants, observations, and photography-based techniques for data collection. The quantitative aspect will utilize structured questionnaires to gather relevant data. The findings will inform policy recommendations and provide actionable insights for the marginalized communities and key stakeholders. Specifically, the study will emphasize the active participation of marginalized communities in technology adoption decision-making processes and the development of strategies that prioritize inclusivity. Additionally, it will propose community-based training initiatives based on the theory of change to address gender-specific barriers to digital literacy to ensure sustainability.

**Key words:** Gender, digital divide, technology



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### **THE ROLE OF UNIVERSITY - INDUSTRY R&D COLLABORATIONS: DRIVING TO INNOVATION AND SUSTAINABILITY IN DEVELOPING COUNTRIES (GOVERNANCE AND GROWTH MODEL)**

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#### **Abstract**

This research thesis investigates the role of academia-industry collaboration in research and development (R&D) as a critical driver for addressing economic challenges and fostering innovation and sustainable economic growth, with a focus on Albania and Kosovo. Both countries, emerging from transitional economies, face significant challenges in maintaining sustainable economic growth, addressing high unemployment rates, and fostering innovation.

The study explores how partnerships between universities and industries can bridge the gap between academic research and industrial needs, with a focus on sectors critical to regional development. By leveraging the research capacities of academic institutions and the practical, market-oriented knowledge of industry, such collaborations can drive innovation, boost competitiveness, and contribute to socio-economic development.

The study explores how partnerships between universities and industries can bridge the gap between academic research and industrial needs, with a focus on sectors critical to regional development. By leveraging the research capacities of academic institutions and the practical, market-oriented knowledge of industries, such collaborations can drive innovation, boost competitiveness, and contribute to socio-economic development.

Findings from this research will provide recommendations for strengthening academia-industry ties, enhancing R&D capacities, and informing policy initiatives aimed at creating a sustainable innovation ecosystem in the Western Balkans. This thesis ultimately aims to contribute to the broader discourse on the role of knowledge economies in fostering regional development and resilience in transitioning markets

**Key words:** academia-industry collaboration, research and development, innovation, economic challenges, sustainable growth, WB, leverage research.

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# ANALYZING HEALTH-RELATED QUALITY OF LIFE AND PROFESSIONAL QUALITY OF LIFE AMONG MIGRANT POPULATIONS IN URBAN SETTINGS: A SYSTEMATIC REVIEW

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## **Abstract**

Migration to urban centers is becoming increasingly common as individuals seek better quality of life, improved job opportunities, and greater access to urban infrastructure. In this context, the World Health Organization (WHO) highlights the importance of addressing the health of migrants and refugees as a critical aspect of public health. This review examines the Health-Related Quality of Life (HRQoL) and Professional Quality of Life (ProQOL) of migrants living in urban settings across the European Union. It emphasizes the implications for migrant integration, public health policy, and urban planning. Following the PRISMA guidelines for systematic reviews, the research reveals a complex relationship between migrant status, incomplete integration, and various socioeconomic and health-related challenges that affect both HRQoL and ProQOL. Existing literature indicates that language and cultural barriers significantly hinder social integration, exacerbating vulnerabilities and limiting migrants' ability to navigate their new environments. As a result, many migrants experience increased marginalization and discrimination from local populations, who may perceive them as competitors for limited resources. This negative perception diminishes the

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quality of life for migrants and restricts their access to essential urban services such as housing, healthcare, and employment opportunities. Evidence suggests that many migrants find themselves trapped in precarious, low-status jobs characterized by inadequate pay and job insecurity. This situation heightens their susceptibility to health-related issues and undermines their ProQOL. The analysis underscores how these dynamics create ethno-racial hierarchies of exclusion, complicating the integration process and reinforcing cycles of disadvantage. In response to these findings, the review calls for targeted public health strategies and policy interventions to address the diverse challenges faced by migrant populations. The ultimate goal is to improve their HRQoL and ProQOL in urban areas. This paper underscores the urgent need for comprehensive policies that consider the distinct health and social determinants impacting migrants.

**Key words:** migrants, Health-Related Quality of Life, Professional Quality of Life, integration, exclusion, cities

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# GREEN ROOFS CONCEPT REVIEW: STRATEGIC COMMUNICATIONS FOR TECHNICAL AND ENVIRONMENTAL SUSTAINABILITY

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## Abstract

Green roofs have emerged as a pioneering solution to numerous environmental challenges, reshaping urban landscapes across Europe. In recent years, Europe has witnessed a surge in the adoption of green roofs, driven by a confluence of factors including the pressing need to mitigate climate change, enhance urban biodiversity, improve air quality, and manage stormwater runoff. This eco-friendly roofing innovation involves the installation of vegetated systems atop buildings, effectively transforming barren rooftops into thriving ecosystems. While the concept of green roofs traces back to ancient times, modern advancements in technology, materials, and design have propelled Europe to the forefront of this green revolution.

At the heart of the international Erasmus+ GREENO2 Project (“*Green Roofs in higher education institutions as sustainable cEnters for research, participation, ENvironmental consciousness and O2 generation*”) lies the imperative to amplify its impact and reach through several tools. Among them, the use of strategic communications principles for high-quality and effective communication of GREENO2 Project partners with student and teaching communities is very important. Strategic communications guide and coordinate efforts to engage with key stakeholders and the large public, to whom the results of this project are addressed. Strategic communications contribute to a deep understanding, encourage active participation and, ultimately, stimulate actions towards sustainable development and implementation of green roof technologies. Through joint initiatives, educational programmes and transparent strategic communications, the GREENO2 Project aims to create a cohesive community focused on the development of green infrastructure and promoting environmentally responsible urban development.

In this study we defined a technical review on the state of art of green roofs. By actively communicating with project participants, students, faculty members and university staff, we also described a green roof prototype developed by researchers at the Nello Lupori Educational and Experimental Farm of the University of Tuscia in Viterbo (Italy) in the frame of the GREENO2 Project.

**Key words:** green roofs review, technical aspects, strategic communications, sustainability, environmental challenges

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# DIGITAL SKILLS AND PROFESSIONAL DEVELOPMENT: BUILDING BRIDGES BETWEEN ACADEMIC EDUCATION AND DIGITAL LABOR MARKET

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## Abstract

The world of work is rapidly changing, driven by the relentless march of digitalization. Even before the COVID-19 pandemic threw everything into overdrive, employers were struggling to keep pace, searching for ways to upskill their workforce for emerging technologies and new business models (Cedefop, 2021). This situation has made it crystal clear that our education systems need to step up and better prepare students for a digital-first work environment, equipping them with the skills they need to thrive.

Another key trend is the growing popularity of freelance and “gig” work, much of it facilitated by digital platforms. Over the past decade, more and more workers, including many bright young graduates, have been drawn to freelancing or self-employment, attracted by the promise of flexibility and control over their careers. Europe’s freelance workforce is estimated at around twenty million people, representing roughly 8–9% of the total workforce (Talent Monitor). While this share has remained fairly stable recently, younger folks under 30 still make up only a small slice of the freelancer pie (Talent Monitor). Many new graduates hesitate to jump into freelance careers right after university, and it’s not hard to see why. They face barriers like a lack of business know-how, limited professional networks, and uncertainty about how to find clients. However, encouraging entrepreneurial ventures and freelancing among young people is seen as a way to spark innovation and tackle graduate unemployment.

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So, ensuring that graduates possess both the digital skills and the entrepreneurial savvy to succeed as independent workers is becoming a vital goal for higher education.

To reduce the gap between what’s taught in classrooms and what’s needed in the digital labor market, we need new and fresh approaches to pedagogy, curriculum design, and career development services. Universities are increasingly expected to team up with businesses and policymakers to make sure learning outcomes match real-world skill needs. Universities are tackling this challenge through work-integrated learning, industry projects, and targeted training courses in digital and professional skills. The European Commission's Digital Skills and Jobs Coalition emphasizes that all sectors (public, private, educational) should work together to upscale skill development, promoting multi-stakeholder partnerships to close the digital skills gap.

The Digital Freelancing (DiFree) idea originated in exactly this environment. Under co-funding by the Erasmus+ program (2022–2025), DiFree is a transnational initiative including Italian, Spanish, Greek, Portuguese universities and research partners. Emphasizing freelancing and self-employment especially, DiFree seeks to "build bridges" between academic knowledge and the skills needed in the digital labor market. Stated differently, it aims to give recent graduates and students the targeted skill development chances they need to flourish in the realm of digital freelancing. The results of the DiFree program are presented in this paper together with an examination of its approach in the larger framework of digital skills and professional development. Analyzing DiFree's goals, programs, and outcomes can help us to find practical means of bringing digital technologies and entrepreneurial skill-building into higher education.

This paper is organized as follows: We will first give a synopsis of pertinent policy background and literature including digital skills development, entrepreneurial education, labor market changes, the function of creative hubs and career services. We will then discuss our approach, stressing how data from the DiFree software and associated sources were compiled and examined. We will then highlight important findings from the DiFree case study—the objectives of the program, the tools and resources it produced, and how it affected graduates and active participants. These findings will be examined in view of the body of current research, and we will derive policies and educational practice recommendations. At last, the conclusion will list the salient features and provide recommendations for next research and initiatives meant to close the gap between academic knowledge and the expectations of the digital labor market.

**Key words:** digital skills, european programme, education and training, labor market

## Literature Review

### *Digital Skills Development and Gaps*

Apart from swift technological development, the demand for digital skills in the job market is continually growing. Now considered as fundamental as reading or arithmetic is digital literacy, the ability to boldly use computer tools and services. Surveys frequently illustrate



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how vital digital skills are to recent graduates, even in fields unrelated to conventional IT. For example, a recent corporate study noted that among the most important skill shortages noted in recent graduates entering digital contexts are communication and teamwork (Tee et al., 2024). Studies usually rank digital content production, safety (cybersecurity awareness), digital communication and collaboration, digital information and data literacy, and problem-solving as the most important digital skills. Creating engaging digital content, including video, is also becoming more crucial and calls both media literacy as well as technical knowledge (Kaperonis, 2021).

The rapid development of artificial intelligence is further complicating things by changing how businesses connect with their consumers. This underlines how basic artificial intelligence literacy should be based on digital capability. Kaperonis (2024) underlines that awareness of how AI is altering the User Experience in Digital Marketing is very crucial since AI-driven solutions are used for personalized content, automate marketing duties, and deliver important, data-driven insights. If digital marketers are to remain competitive, they have to keep up with novel ideas include using AI for search engine optimization, social media marketing and content creation (Dwivedi et al., 2023).

Reflecting the five competency areas set by the DigComp framework of the EU, these categories offer a shared basis for what it means to be digitally competent. Although "communication and collaboration" are expected to become even more important in the near future, a study in an Industry 4.0 environment indicated that "information and data literacy," "digital content creation," and "problem-solving" are currently the most sought-after digital abilities. It's worth noting that the largest skills gaps identified were in those "soft" digital skills. Employers reported that graduates often lacked strong communication and collaboration skills, as well as sufficient digital safety awareness. These findings suggest that educational programs need to go beyond simply teaching technical ICT skills. They must also cultivate the soft skills and digital mindset required to effectively use technology in teams and business processes. The European Digital Competence Framework (DigComp) has been widely adopted to guide digital skill development initiatives, outlining a progression of proficiency levels (from foundational to advanced) across key competencies. However, implementing such frameworks in higher education can be challenging. Many university programs still seem to assume students will pick up digital skills on their own, which may not be enough to meet the demands of the labor market.

The COVID-19 pandemic dramatically highlighted both the importance of digital skills and the potential consequences of skills gaps. With the sudden shift to remote learning and remote work, students and workers who were digitally savvy were able to adapt much more easily, while those lacking digital skills faced significant challenges. The pandemic accelerated the demand for digital skills in many occupations, even those outside of traditional IT (Cedefop, 2021). Teachers, office workers, and professionals in various fields had to quickly improve their digital tool usage to keep things running during lockdowns. As a result, educational institutions are now integrating digital competencies more explicitly into their teaching, with a stronger emphasis on digital skills certification for students, investments in educational technology, and teacher training in digital pedagogies.

Despite this progress, disparities persist. Digital skill levels often vary significantly by region, age group, and socioeconomic background (Cedefop, 2021). This means that any

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solution to the skills gap must be inclusive, ensuring that everyone has opportunities to develop these vital competencies. For universities, this could involve offering extra digital skills workshops for students in non-technical fields and providing personalized support to those who may have lower initial proficiency.

### ***Entrepreneurship Education and Self-Employment***

Along with digital skills, entrepreneurship education has grown in importance in academia as teachers try to equip their students for a constantly shifting professional path. Entrepreneurship education is the instruction in knowledge, skills, and attitudes required to start and run new businesses or to be entrepreneurial inside current companies. Training in opportunity assessment, company planning, financial literacy, innovation, and fundamental soft skills including creativity and leadership is also quite important.

Encouragement of entrepreneurship in higher education serves two primary purposes. First of all, developing an entrepreneurial attitude helps graduates to be more generally employable. Companies highly reward initiative, adaptability, and problem-solving even if they do not launch their own companies. Second, formal entrepreneurship education helps students who select self-employment or startup routes increase their odds of success and inspire more to investigate these choices. In areas suffering significant youth unemployment, where enabling young people to start their own businesses becomes a strategic focus, this is especially pertinent.

Empirical research consistently supports the positive impact of entrepreneurship education. A meta-analysis of 36 studies (involving nearly 30,000 students) found that participation in entrepreneurship education is significantly associated with higher entrepreneurial intentions among college students. In other words, students who receive entrepreneurship training are more likely to plan to start their own businesses or pursue self-employment, particularly in environments where such careers are supported. The meta-analysis noted that the strength of this effect can vary from country to country, but the overall relationship is still a positive one. This indicates that well-designed educational interventions can indeed foster an entrepreneurial spirit and motivate more graduates to pursue innovative ventures or freelance careers.

The European Commission’s EntreComp framework provides a broad definition of entrepreneurship competence as the ability to act upon opportunities and ideas to create value for others, whether that value is social, cultural, or economic. EntreComp breaks this down into 15 key competencies (such as spotting opportunities, mobilizing resources, taking initiative, and learning through experience) across the areas of Ideas & Opportunities, Resources, and Into Action. The framework is intentionally holistic, emphasizing that entrepreneurship is not just about business creation but also about creativity, problem-solving, and the ability to mobilize others. For higher education, EntreComp provides a useful blueprint for curriculum development. Courses and programs can align learning outcomes with EntreComp competencies to ensure that students are developing the relevant skills.

To encourage students to create entrepreneurial enterprises, many colleges have added entrepreneurship classes, innovation laboratories, incubator programs, and mentoring initiatives. Experiential learning elements, such as starting a company in a capstone project,

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advising for a real small firm, or participating in hackathons, often find their way into these programs. Such practical exercises allow students to engage in controlled risk-taking and creative expression. Involving business leaders and entrepreneurs as mentors or guest speakers also provides students with valuable insights and relatable role models. Entrepreneurship education can be particularly valuable for graduates seeking freelancing jobs, as they are essentially independent entrepreneurs offering their skills and services. Freelancers need to market themselves, handle client relationships, manage legal and financial matters, and constantly find innovative ways to deliver their services. These tasks reflect many facets of running a small business. While traditional entrepreneurship classes might not specifically focus on freelancing, the core entrepreneurial skills are equally applicable to independent professionals and gig economy workers. Understanding how to identify market needs, build a personal brand (analogous to a corporate brand), manage project finances, and leverage networks can be incredibly helpful for a freelancing graphic designer or software developer.

### ***Digital Labor Market Trends and Higher Education Response***

The digital transformation of the economy has introduced new labor market dynamics that universities need to consider. One major trend is the increasing importance of continuous learning and upskilling throughout one's career. The “half-life” of technical skills is shrinking. Technologies can become obsolete in a matter of years, so workers need to regularly acquire new skills to stay relevant. This reality is prompting a shift in how we view higher education, moving away from a one-time preparation for a lifelong career and toward the foundation for lifelong learning. Universities are gradually incorporating more emphasis on learning agility and digital learning skills (for instance, knowing how to independently pick up new software or a new programming language). Some institutions are establishing alumni upskilling programs and micro-credential courses, so graduates can return and update their skill sets.

The labor market is also experiencing a blurring of boundaries between traditional employment and self-employment. Many professionals now pursue mixed careers, starting in a salaried job and then moving to freelancing, or vice versa, at different points in their lives. Recent research has noted that the proportion of self-employed workers in the EU hasn't really increased over the past decade. In fact, it slightly declined from 15.4% to 13.7% between 2010 and 2022 (Eurofound, 2024). This indicates that, while interest in freelancing and gig work is definitely there, structural challenges and uncertainties might be limiting growth in this area. These changes call for career guidance and professional development training that are versatile and able to support individuals through career transitions.

For young graduates, entering the workforce can be particularly challenging if they're aiming to join the freelance economy. As we mentioned earlier, relatively few new graduates immediately start their own businesses or work as freelancers. However, a supportive ecosystem can definitely make a difference. Universities are increasingly partnering with industries and creating freelancer support programs, such as freelancing workshops, career services tailored to independent work, and networking events that connect students with freelance professionals. These efforts strive to demystify freelancing as a career option and provide students with the tools and contacts they need to get started. Early intervention can

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build confidence, and individuals who receive entrepreneurial training and mentoring often feel more capable of starting their own ventures.

### ***Creative Hubs and Career Services in Higher Education***

A notable development in this evolving ecosystem is the emergence of creative hubs and the transformation of university career offices into modern career development hubs. Creative hubs broadly refer to spaces (physical or virtual) that facilitate collaboration among creative and entrepreneurial professionals. Digital freelancing, as part of the creative economy, is strongly related to hubs, under whatever title they bear: co-working spaces, studios, incubators, accelerators, districts, quarters or zones, to name but a few. Pratt, Virani and Gill (2019, p. 2) notice that despite the widespread credo in the importance of creative hubs, academic research about them is scarce while “there exists a kind of unquestioned faith in hubs – despite – or more tellingly perhaps because – their meaning is not always clear.” They are immersed into the everyday working practices (including networking) of cultural workforce including (digital) freelancers, due to the structural and organizational changes in those sectors since the 1990s. In several cases, universities operate creative hubs to facilitate industry-academia collaboration. Examples include the Digital Creativity Labs at the University of York and the CoAST Research Group at Canterbury Christ Church (Ashton and Comunian 2019).

On the other hand, career services in higher education have undergone significant transformations over the 20<sup>th</sup> century, shaped by socioeconomic changes, technological advancements, and generational shifts. From vocational guidance in the early 1900s to job placement initiatives in the post-WWII decades and career counseling in the 1970s and 1980s, each phase reflected the evolving needs of students, employers, and institutions. Since the 1990s, career services evolved from the traditional job placement model into networking hubs that integrate employer engagement, digital tools, and community-based career development (Dey and Cruzvergara 2014). During this period, career services transitioned from being a primarily advisory function to proactively engaging with corporate recruiters, alumni networks, and external stakeholders.

The 2008 global financial crisis intensified debates about the return on investment (ROI) of higher education. Universities faced increased pressure from students, parents, policymakers, and employers to demonstrate tangible career outcomes. This era also saw career services expand beyond transactional services (e.g., job postings, career fairs) to relationship-based engagement through employer partnerships, mentoring, and experiential learning opportunities. The traditional career office model – where students passively sought help with résumés and job applications – became outdated. The 2010s and early 2020s ushered in the career hub model, which emphasized community-based career support networks, where students, alumni, faculty, and employers interact in structured ways; career services as facilitators rather than direct job matchmakers; Personalized career pathways, using AI-driven career advising tools; Lifelong career support, expanding services to alumni long after graduation.

In this new model, career services became embedded into the university’s culture rather than existing as an isolated office. Universities such as Stanford, University of Chicago, and

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Wake Forest led the shift by rebranding career services into integrated career ecosystems. The concept of hubs represents a network-centric model where career centers facilitate connections rather than merely providing information. Thus, the hub-based model aligns with the changing job market, where career paths are nonlinear, interdisciplinary, and reliant on lifelong learning. Even more, it is expected that university career centers will become lifelong career partners, providing continuous upskilling and reskilling services, as well as career services for life.

### ***Combining Hubs and Career Services in Higher Education: The DiFree physical and digital Hub***

The DiFree project<sup>7</sup> proposed – among others – the creation of a specialized Freelance Hub, where the target groups will find accurate and reliable information, guidance, mentoring programs, opportunities for life-long training, upskilling and reskilling. It was expected to focus on transversal competencies and soft skills providing students and graduates with a space to meet, share knowledge, organize gatherings and events, invite personalities from the freelance community, etc. In other words, the vision was incorporating the framework envisioned for the future of higher education career offices, organizing an ecosystem where exchange of experience and experiential learning would proliferate, and technology would play a pivotal role.

The Hub is installed physically within Panteion University’s career office, adding value to its services to students and recent alumni, as well as to the students and alumni of the University’s Lifelong Learning Center, and opening it to an external public interested in freelancing. It also adds value to the services provided to stakeholders such as companies and organizations of the private and public sectors. It is complemented by a digital Hub,<sup>8</sup> offering access to the project’s outcomes such as an e-book on Freelancing in the partners’ countries, online courses on freelancing, or a self-evaluation and self-vocational online assessment tool developed by the Universidad de Cádiz. It is also providing links to resources regarding freelancing in the participant countries, as well as the opportunity to arrange either in-person or online counseling by Panteion University’s career office.

## **Conclusion**

As the pace of digital skills requirements in career development is evolving, educational institutions and especially Higher Education Institutions face new challenges. They include the introduction of entrepreneurship and ‘soft’ digital skills into the curriculum and providing opportunities to their students to get familiar with a changing vocational ecosystem. In this ecosystem career offices may contribute by providing information and mentorship, not only to their traditional inner publics, but also to external publics as well, leading to extrovert functions and services, opening up the Higher Educations to their corresponding communities. DiFree has created a model Hub, both physical and digital, to support such functions. Its

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<sup>7</sup> See <https://www.difree-project.it/> (last visit 31/3/2025)

<sup>8</sup> See <https://difree-hub.eu/> (last visit 31/3/2025).



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outcomes in the next months or years will provide insights on its viability, as well as on improvements needed.

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### **DIGITAL LITERACY AND COMBATING MISINFORMATION AS CRITERIA FOR THE SUSTAINABILITY OF PUBLIC HEALTH**

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#### **Abstract**

The European Union considers misinformation and fake news as a serious threat to democracy and social cohesion, especially in times of elections, health crises (e.g. pandemics) and more generally, in terms of understanding crucial phenomena (climate change, migration). To meet this situation, coordinated action by Member States, institutions and the media is needed. Against this challenge, the EU has developed a number of initiatives to manage the phenomenon. Among other things, a Transparency centre for monitoring the content of online platforms (such as Facebook, Twitter, etc.) and an independent observatory (European Digital Media Observatory-EDMO) have been set up to tackle misinformation online and protect users from false information.

More specifically, however, misinformation in health becomes a major threat, as it affects people's trust in science, undermines public health but also endangers the personal well-being of the individual. False claims about diseases or treatments can lead to dangerous practices or avoidance of scientifically based solutions (e.g. vaccines). The EU promotes the fight against these phenomena by supporting transnational projects aimed at reducing misinformation as well as increasing transparency on digital platforms.

The purpose of this paper is twofold. At a first level, it attempts to draw data from the ERASMUS+ PROJECT and CORDIS EU RESULTS platforms and to outline the 'landscape' of European funding with regard to programmes that address health misinformation, strengthen health literacy and contribute to the sustainability of public health. On a second level, it presents the results of the integrated European programme, FATOS2U, which aims to train young people to identify and evaluate reliable sources of information, especially in times of social and health crises. This programme enhances young people's participation in society by promoting critical thinking and responsible use of digital media, providing an integrated learning programme, multifunctional digital resources and tools, thus helping to protect public health.

Finally, the present effort highlights the need for cooperation between public and private bodies, scientific organisations and companies to ensure the provision of accurate and reliable information to citizens on the one hand and to develop initiatives to combat false or misleading health news through the development of digital literacy skills for all citizens on the other.

**Key words:** misinformation, sustainability, public health, digital health literacy

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### Introduction

One of the biggest challenges of the digital age is the spread of misinformation and fake news. With the speed of Internet dissemination, these phenomena affect democracy, social inclusion, and public health. Health Literacy is crucial because it is the key to understanding and using health information correctly. Without it, people cannot make informed decisions about their health. According to Bitzer and Ernstmann (2019), “Health literacy is the extent to which individuals are able to find, process and understand from educational, social and/or health systems health information relevant to making appropriate health-related decisions.” However, digital literacy in health is very important because all information is now available online. If we don't know how to evaluate sources, misinformation can seriously impact our health. According to Law and Woo (2018), “Digital literacy is the ability to access, manage, understand, integrate, communicate, evaluate and create information securely and appropriately through digital technologies for employment, decent jobs and entrepreneurship. It includes competencies variously referred to as digital literacy, ICT literacy, information literacy and media literacy.”

Recent studies emphasize that health-related fake news on social media continues to be a significant threat to both individual health and public trust. According to Melchior and Oliveira (2022), the majority of misinformation spreads through platforms like Twitter, YouTube, and Facebook, highlighting the urgent need for better tools and strategies as well as stronger engagement by health professionals online. In parallel, Vasist and Krishnan (2023) note that fake news also hinders sustainability-focused innovations, making it more difficult to promote and implement effective solutions in health and environmental contexts.

Beyond policy measures, technological solutions are also being explored. For instance, Lara-Navarra et al. (2020) proposed a semi-automated system for detecting fake health-related news, using user behavior analysis from Twitter and dynamic knowledge graphs. This approach illustrates the potential of AI-driven tools to support public health efforts by enabling more accurate tracking and validation of online information. Recent literature also highlights the role of explainable AI in fake news detection. Yuan et al. (2023) emphasize the need for human-centered models that combine insights from AI, communication science, psychology, and linguistics. Their approach promotes a more sustainable and transparent way of managing digital content, highlighting the value of interdisciplinary cooperation.

### European Union Initiatives and Policies

The European Union has developed several initiatives to combat disinformation. These actions aim to improve digital literacy, strengthen cooperation between organizations, and create guidelines for a safer digital environment. The Digital Education Action Plan (2021–2027) was launched in 2020 and includes guidelines to empower teachers in cultivating digital literacy and combating misinformation, with a special focus on health (European Commission, 2023). The Action Plan against Disinformation focuses on strengthening the EU's capacity and cooperation to fight misinformation (European Union, 2018). The Communication - Tackling online disinformation: a European approach presents tools to counter the spread of misinformation and safeguard EU values (European Commission, 2018). The Action Plan for

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European Democracy includes guidelines on the obligations and accountability of online platforms in the fight against misinformation (European Commission, 2020).

The European Digital Media Observatory (EDMO) is an independent observatory bringing together fact-checkers and academic researchers with expertise in online disinformation, social media platforms, journalist-driven media, and media literacy. Since early 2023, six new national and regional hubs of EDMO have been operating, covering countries such as Bulgaria, Germany, Estonia, Greece, Croatia, Cyprus, Latvia, Lithuania, Hungary, Malta, Austria, Romania, and Slovenia (European Commission, 2024a). The 2022 Code of Practice on Disinformation brings together a wide range of actors to engage in voluntary actions to counter misinformation (European Commission, 2025). The European Declaration on Digital Rights and Principles includes commitments to fight misinformation and promote a safe digital environment (European Commission, 2022). Lastly, Global Media and Information Literacy Week (2024) is a campaign taking place from 24 to 31 October, aiming to strengthen critical thinking and media literacy among citizens (European Commission, 2024b).

The European Union has no direct responsibility for health policies or for the organisation and delivery of health services. However, it plays a complementary role by supporting the national policies of the Member States and promoting cooperation in the field of public health (European Council, 2024).

European programs play a significant role in informing citizens and combating misinformation. A clear example of this is the FATOS2U project, which was completed a few months ago. The following section presents the project's content and outlines its main outcomes.

### **The EU-funded project FATOS2U**

FATOS2U -Media Education and News Literacy to yoUth against Fake news reception and implicatiOnS- is an Erasmus+ KA2 project approved by the Portuguese National Agency with an implementation period of 24 months, between 01/05/2022 - 31/10/2024 (<https://fatos2uproject.eu/>). The project was carried out by a consortium of 5 organizations: ASDPESO, MVNGO, XENIOSPOLIS, GRIPEN EUROPE, NGO Nest Berlin from 5 European countries Portugal, Italy, Greece, Greece, Romania and Germany

FATOS2U promoted critical thinking and literacy in Media and news among young people, with the aim of strengthening democracy and combating manipulation, propaganda and fake news.

The target group of the project included young people aged 18-25 years old, youth leaders and trainers active in relevant training programs, as well as other stakeholders such as representatives of NGOs and civil society organizations, media literacy experts, staff of public services and members of youth councils.

The objectives of the project focused on supporting young people to be able to critically and ethically manage the information they receive from the media and make more informed decisions. At the same time, the project sought to raise awareness about fake news and misinformation, to strengthen critical thinking about media content, and to provide

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educational tools to combat these phenomena. Finally, it also aimed to identify the role and responsibilities of young people in navigating the digital environment.

The project produced three project results (PR) which are presented below.

### **PR1: Curriculum & Learning Materials Toolkit**

Research and benchmarking was conducted on a) youth perceptions, attitudes and concerns about fake news and misinformation, interaction rates, level of engagement, etc., b) any youth training models for developing skills and knowledge related to identifying/challenging misinformation, and training schemes across partner countries. Partners collected data from various sources (literature review, focus groups, questionnaires among target group members and data analysis). The data provided the partnership with essential context and parameters on the design and implementation steps.

The FATOS2U curriculum was then developed which includes 5 modules. Each partner developed one module each. These are the following: MODULE 1 - Media Literacy and Awareness for key principles as vital tools to address the spread of fake news online. MODULE 2 - Disinformation, Fakes News, and Propaganda as means of manipulation and threats to democracy. MODULE 3 - Youth as the most vulnerable group to Fake News and disinformation. MODULE 4 - Fake News / Disinformation & Societal Crisis (e.g. COVID healthcare crisis, migration). MODULE 5 – Fake News / Disinformation, Politics in European context & International Tension. More information about the PR can be found on the following website: <https://fatos2uproject.eu/pr1-fatos2u-curriculum-and-learning-materials-toolkit/>.

### **PR2: Multifunctional Digital Resources**

#### **FATOS2U Multifunctional and Interactive Platform**

The first part includes the multifunctional and interactive educational platform, which integrates all the educational material. The educational material is available in all the partnership languages: Portuguese, Greek, Romanian, Italian, German, and English, ensuring broad accessibility and understanding for all participants. The educational platform can be found at the following link: <https://fatos2uproject.eu/fatos2u-modules/>.

#### **FATOS2U Mobile Application (Android, iOS)**

As part of the project's digital tools, the FATOS2U mobile application was developed for Android and iOS platforms. This app was designed to enhance the users' educational experience by offering easy and immediate access to the project's educational content and interactive tools. The application can be downloaded via the website <https://fatos2uproject.eu/>.

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### PR3: Training Guidelines Handbook

The FATOS2U Training Guidelines Handbook provides clear instructions to organizations, youth leaders, and educators on how to use the FATOS2U online platform in their daily educational activities.

It includes guidance on:

- Integrating the platform into youth education
- Coaching techniques and differentiated instruction
- Methods for educating young people aged 18–25 to make informed decisions in today’s media environment

The goal is to help young people develop analytical and critical thinking skills to identify fake news, respond appropriately, and adopt an ethical approach to consuming information—thereby protecting democracy and its values.

As part of PR3, model scenarios were developed for identifying fake news (message – sender – receiver, language, semantics) in specific contexts (e.g., COVID-19 information and updates, migrants in society, etc.), including steps such as recognition, rejection/reflection, and feedback.

Based on the module they had already created, partners were invited to develop their own short model scenario. These scenarios serve as teaching proposals for youth trainers, enabling them to teach parts of each module’s content in a more effective and engaging way. More information about PR3 in all consortium languages from the link below: <https://fatos2uproject.eu/pr3-training-guidelines-handbook/>.

On the occasion of FATOS2U, we conducted our research to explore the link between literacy, disinformation and health in relation to sustainability and the digital environment. We conducted research on EU-funded projects on literacy, misinformation and health, with a focus on sustainability and the digital environment. Data from ERASMUS+ and CORDIS EU RESULTS databases were analyzed, exploring the link between these topics and health.

### Methodology

#### Research in the ERASMUS+ PROJEC and CORDIS EU RESULTS databases

More specifically the research was conducted in the early days of 2025 in the databases of European Union-funded programs. The research followed two directions. At the first level, the ERASMUS+ PROJECTS<sup>9</sup> database was studied. These are programs with small to medium funding, focused on education, training, youth, and sports. At the second level, the CORDIS EU RESULTS<sup>10</sup> database was explored, which mainly concerns large-scale funding programs and the development of transnational research and cooperation, such as HORIZON, ERC, and others. In both cases, the research focused on the connection between literacy, misinformation, and health in relation to sustainability and the digital environment.

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<sup>9</sup> ERASMUS+ PROJECT RESULTS <https://ec.europa.eu/programmes/erasmus-plus/projects>

<sup>10</sup> CORDIS EU RESULTS Search | CORDIS | European Commission (europa.eu)



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In the ERASMUS+ database, two keyword searches were conducted. The first combined the terms “literacy”, “misinformation”, and “health”, while the second used “sustainable”, “digital”, “disinformation”, and “health”. In the CORDIS EU Results database, a single search was performed using the keywords “sustainable”, “digital”, “disinformation”, and “health”.

The results of this investigation are discussed in the following section.

### Results

For ERASMUS+ programs, the search was carried out by keywords on the total number of funded programmes (274,090 programmes). Searching for the combination of the words “literacy”, “misinformation”, “health”, 69 programs were found, as illustrated in **Figure 1**. All were conducted in the last 7 years (2017-2024).

**Figure 1. Map of 69 European funded projects regarding “literacy”, misinformation, health” (2017-2024)**



Annex 1. [ErasmusPlus\\_Projects\\_Search\\_Results \(69\).xls](#)



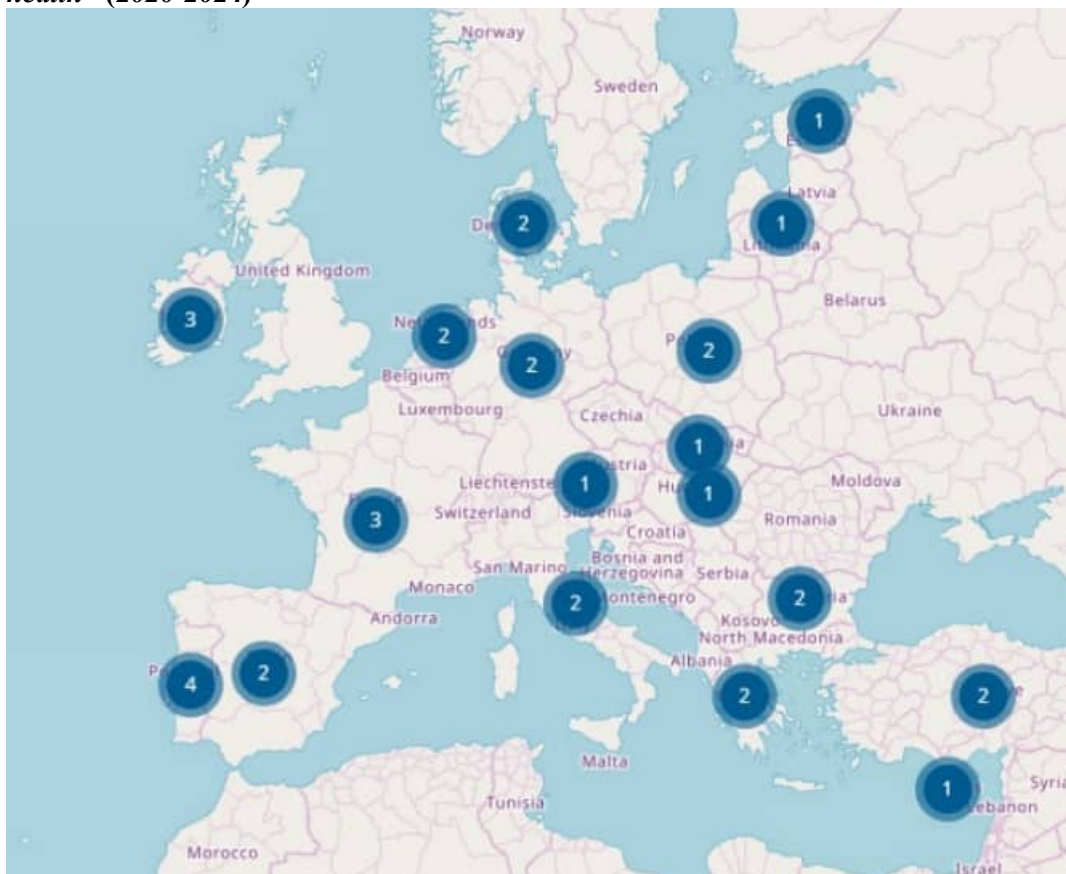
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Searching for another combination of the words "sustainable", "digital", "disinformation", "health", 35 cases of funded projects appeared. In this case all were conducted in the last four years (2020-2024), as illustrated in **Figure 2**.

**Figure 2. Map of 35 European funded projects regarding “Sustainable, digital, disinformation, health” (2020-2024)<sup>11</sup>**



Annex 2. [ErasmusPlus Projects Search Results \(35\).xlsx](#)

More specifically, of the funded programs that appeared in the search with the combination of the words "sustainable", "digital", "disinformation", "health", these concern the mobility programs KA1: Learning Mobility of Individuals (27 in total) and KA2: Partnerships for cooperation and exchanges of practices (8 in total).

The funded programs span a wide array of thematic areas, reflecting both recurring priorities and more specialized or emerging topics. The most prominent themes include media literacy and tackling disinformation, as well as digital skills and competences, which collectively account for a significant share of the projects. Other frequently addressed areas include European identity, youth inclusion, well-being, and the use of digital technology. A number of projects also focus on democratic participation, refugee integration, equality, and

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<sup>11</sup> Although the map shows 4 coordinated projects for Portugal, the accurate number is 5, as confirmed by paper records (Annex 2) and presented in Table 2. The discrepancy is attributed to a visualization error.

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environmental sustainability. Additionally, several topics—such as active ageing, rural inclusion, and entrepreneurship—were represented by only one project each, underlining the breadth and diversity of the funded initiatives, as illustrated in **Table 1**.

**Table 1: Distribution of Projects by Thematic Category**

| <b>Thematic Category</b>                                                     | <b>Number of Project</b> |
|------------------------------------------------------------------------------|--------------------------|
| Media literacy and tackling disinformation                                   | 20                       |
| Digital skills and competences                                               | 9                        |
| European identity and values                                                 | 5                        |
| Inclusion of marginalized young people                                       | 5                        |
| Awareness about the European Union                                           | 5                        |
| Physical and mental health, well-being                                       | 5                        |
| Digital content, technology and practices                                    | 5                        |
| ICT -new technologies- digital competences                                   | 4                        |
| Creativity and culture                                                       | 3                        |
| Inclusion – equity                                                           | 3                        |
| Integration of refugees                                                      | 3                        |
| Quality and innovation of youth work                                         | 3                        |
| Democracy and inclusive democratic participation                             | 3                        |
| Reaching the policy level/dialogue with decision markers                     | 2                        |
| Green skills                                                                 | 2                        |
| Bridging intercultural, intergenerational and social divide                  | 2                        |
| Digital youth work                                                           | 2                        |
| Creativity, arts and culture                                                 | 2                        |
| Inclusion, promoting equality and non-discrimination                         | 2                        |
| Digital safety                                                               | 2                        |
| Environment and climate change                                               | 1                        |
| Health and wellbeing                                                         | 1                        |
| Key Competences (incl. mathematics and literacy) – basic skills              | 1                        |
| New innovative curricula/educational methods/development of training courses | 1                        |
| Youth (Participation, Youth Work, Youth Policy                               | 1                        |
| Entrepreneurial learning – entrepreneurship education                        | 1                        |
| Migrants’ issues                                                             | 1                        |
| Key competences development                                                  | 1                        |
| Preventing racism and discrimination                                         | 1                        |
| Reception and integration of refugees and migrants                           | 1                        |
| Information and communication technologies (ICT)                             | 1                        |
| Green transport and mobility                                                 | 1                        |
| Tackling geographical remoteness and involving rural areas                   | 1                        |
| Activeageing                                                                 | 1                        |

It is observed that the majority of the projects concern media literacy and tackling disinformation, digital skills and competencies, as well as European identity and values.

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Finally, the research identified these programs as being developed within the following categories: Youth (26 projects), School Education (4 projects), Adult Education (3 projects), Vocational Education and Training (2 projects), Higher Education (0 projects).

It is noteworthy that there is a lack of development of relevant programs in higher education, as well as a limited presence in vocational and primary/secondary education, in contrast to their significant growth in the field of youth.

The coordination of 35 projects was distributed across multiple countries, with the highest number attributed to Portugal. Further details on the distribution can be found in **Table 2**.

**Table 2. Distribution of Coordinated Projects by Country**

| Country     |                            | Number of Projects |
|-------------|----------------------------|--------------------|
| Portugal    | EU Member                  | 5                  |
| France      | EU Member                  | 3                  |
| Ireland     | EU Member                  | 3                  |
| Bulgaria    | EU Member                  | 2                  |
| Germany     | EU Member                  | 2                  |
| Denmark     | EU Member                  | 2                  |
| Greece      | EU Member                  | 2                  |
| Spain       | EU Member                  | 2                  |
| Italy       | EU Member                  | 2                  |
| Netherlands | EU Member                  | 2                  |
| Poland      | EU Member                  | 2                  |
| Austria     | EU Member                  | 2                  |
| Cyprus      | EU Member                  | 1                  |
| Estonia     | EU Member                  | 1                  |
| Hungary     | EU Member                  | 1                  |
| Lithuania   | EU Member                  | 1                  |
| Slovakia    | EU Member                  | 1                  |
| Turkey      | Third Countries associated | 2                  |

In the CORDIS EU RESULTS database, the search was also conducted using keywords across all funded programs. A total of 9 results were found based on the search terms “sustainable”, “digital”, “disinformation”, and “health”. Most of these projects were carried out in the last decade (2016–2024). An overview of the results by funding programme is presented in **Table 3**.

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**Table 3. Number of Relevant Projects Found per EU Framework Programme**

| Framework Programme         | Number of projects |
|-----------------------------|--------------------|
| Horizon Europe 2021-2027    | 1                  |
| Horizon 2020                | 8                  |
| Framework Programme 7 (FP7) | 0                  |

All eight projects presented in Figure 3 were **coordinated by organizations based in the respective countries**, within the Horizon 2020 framework. The distribution spans several European countries and years, as follows: Greece (2018–2021), Belgium (2020–2023), Sweden (2018–2021), Italy (2020–2024 and 2021–2024), Finland (2019–2022), Estonia (2016–2019), and Germany (2020–2024).

In contrast to the eight projects identified under Horizon 2020 (**Figure 3**), only one project matching the same criteria was found under Horizon Europe, coordinated by Slovakia (2022–2025) (**Figure 4**).

**Figure 3. Map of 8 European funded projects regarding “Sustainable digital disinformation health” (Horizon 2020)**



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**Figure 4. Map of 1 European funded project regarding “Sustainable digital disinformation health” (Horizon Europe 2021-2027)**



Annex 3. List of 9 EU-funded projects with the keywords “sustainable”, “digital”, “disinformation”, “health” [cordis-search-results \(9\).csv](#)

**Table 4. Coordinated Projects Under Horizon 2020 And Horizon Europe**

| Framework Program        | Country  | Implementation period |
|--------------------------|----------|-----------------------|
| Horizon Europe 2021-2027 | Slovakia | 2022-2025             |
| Horizon 2020             | Greece   | 2018-2021             |
| Horizon 2020             | Belgium  | 2020-2023             |
| Horizon 2020             | Sweden   | 2018-2021             |
| Horizon 2020             | Italy    | 2020-2024             |
| Horizon 2020             | Italy    | 2021-2024             |
| Horizon 2020             | Finland  | 2019-2022             |
| Horizon 2020             | Estonia  | 2016-2019             |
| Horizon 2020             | Germany  | 2020-2024             |

**Table 4** presents the projects identified under the Horizon 2020 and Horizon Europe (2021–2027) frameworks, in which the listed countries acted as project coordinators. The projects focus on themes related to “sustainable digital disinformation health”, and their implementation periods range from 2016 to 2025. The analysis of the data reveals that issues related to sustainability, digital transformation, misinformation, and health remain at the forefront of research and continue to receive funding under the new framework program, Horizon Europe.

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### Conclusions

This paper highlighted the importance of digital literacy and the ability to recognize misinformation as critical tools for protecting public health. The spread of false or misleading information, especially on health-related issues, poses a serious threat to social cohesion and individual well-being. The need for informed and critically thinking citizens is becoming increasingly urgent, as the flow of information on the internet is often accompanied by inaccuracies or ulterior motives.

The European Union actively supports health improvement through policies and financial assistance, but it does not replace the role of individual states, each country remains responsible for its own healthcare system.

The FATOS2U program stands out as a prime example of a successful non-formal educational initiative aimed at empowering young people. Through innovative tools and multilingual educational materials, it supports the development of skills that enable participants to recognize fake news, identify reliable sources, and actively engage in public discourse with responsibility and critical thinking.

The research conducted in the ERASMUS+ and CORDIS databases revealed a significant number of projects linking digital literacy with health and misinformation. However, limited activity was observed in higher education and large-scale research programs, indicating the need for further investment and strategic focus in these areas.

In this context, it is worth noting that the limited presence of relevant projects under the Horizon Europe program (2021–2027), compared to the strong activity observed during Horizon 2020, highlights the need for further investment and support for research initiatives focused on sustainability, digital transformation, misinformation, and health. Today’s pressing challenges—such as managing digital information, promoting sustainability, and strengthening public health through innovative solutions—demand transnational approaches. The European Union has the opportunity to bridge existing gaps by encouraging greater collaboration, broader geographic participation, and new research initiatives that harness the power of digital technologies to build sustainable and resilient societies.

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### Annex

- Figure 1. Map of 69 European funded projects regarding "literacy", misinformation, health" (2017-2024) [Search \(69\) - Erasmus+.pdf](#)
- Annex 1. List 69 of European funded programmes with the keywords "literacy", "misinformation", "health"[ErasmusPlus Projects Search Results \(69\).xls](#)
- Figure 2. Map of 35 European funded projects regarding “Sustainable, digital, disinformation, health” (2020-2024) [Search \(35\) - Erasmus+.pdf](#)

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Annex 2. List of 35 European funded programmes with the keywords "sustainable", "digital", "disinformation", "health" [ErasmusPlus Projects Search Results \(35\).xlsx](#)

Annex 3. List of 9 EU-funded projects with the keywords “sustainable”, “digital”, “disinformation”, “health” [cordis-search-results \(9\).csv](#)

Figure 3. Map of 8 European funded projects regarding “Sustainable digital disinformation health” (Horizon 2020) [Search \(8\) - CORDIS EU RESULTS](#)

Figure 4. Map of 1 European funded project regarding “Sustainable digital disinformation health” (Horizon Europe 2021-2027) [Search \(1\) - CORDIS EU RESULTS](#)

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# CULTURAL TOURISM AND LOCAL SUSTAINABLE DEVELOPMENT: THE CASE OF THE DIGITAL GAMES IN THE MUSEUMS

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## Abstract

Cultural tourism, as one of the fastest growing sectors of the tourism industry, plays a key role in promoting sustainable development by strengthening the economy while contributing to the preservation and enhancement of cultural heritage. At the local level, cultural tourism contributes to the economic vitality of communities and the various social, age and professional groups, but also strengthens their cohesion and their members' identity. It also serves as an empowerment tool, enabling local populations to actively participate in the management of their cultural heritage and to benefit from it. In this context, museums - as a key pillar of cultural development and tourist attraction - are re-shaping their strategy and digitally transforming their services. In fact, museums are exploring dynamic ways to connect the general public with cultural heritage, using technology to create interactive experiences that promote immersive storytelling and expand accessibility. Therefore, as museums invest in attracting and engaging the public, they cannot screen out the commercial development, social acceptance and mass use of the digital games sector. This study demonstrates the introduction of digital games in museums over the last decades and explores their role. According to cutting-edge research, digital games potentially promote cultural heritage, raise awareness of their importance and encourage users to visit museums (more often). In addition, the use of this medium motivates population groups (e.g. the so-called digital natives/users) to (re)connect with museum sites and cultural events. In recent years, the use of augmented, and virtual reality (VR) games in museums and exhibitions has significantly increased. In particular, 'serious games' appear to have a variety of educational benefits in heritage environments. Last, apart from being a tool for highlighting the exhibits and involving the public in cultural activities, digital games are also included as a complementary or as basic museum exhibition objects.

**Key words:** cultural tourism, sustainable development, cultural heritage, digital games, museums

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### CHALLENGES OF INTERNATIONALIZATION PROCESS OF UNIVERSITIES IN ALBANIA

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#### **Abstract**

Internationalization in the higher education institutions in Albania has been for some time the center of discussions and initiatives from the main education authorities and HEIs themselves. Internationalization also comes as an imperative from the law “On Higher Education in the Republic of Albania 80/2015” right from the start, Chapter I, Article 1, paragraph e) states: Higher Education is a public responsibility and service whose mission is to support international cooperation in the field of higher education.

Following the fall of the communist regime in the early 90s, the entire landscape of higher education started to change. New universities were formed and they were faced with the immense task of applying standards required. While in 2007, Albanian universities became part of the Bologna Process. One of the challenges they were faced with was the internationalization. Lack of experience and many other elements are the key factors why universities are struggling regarding internationalization.

Despite some efforts undertaken to cooperate with universities abroad, the real sense of internationalization came through the Erasmus+ program back in 2014. Universities in Albania were part of the exchange programs but with limited numbers in the beginning and with an outgoing tendency while the numbers of incoming students remain low due to lack of programs in English.

**Keywords:** internationalization, law, higher education institution, Erasmus+, students, programs

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### **DIGITAL GAMES AND SUPPORT FOR CHILDREN WITH LEARNING DIFFICULTIES: RESEARCH AND PEDAGOGICAL APPLICATIONS**

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#### **Abstract**

In contemporary juncture digital games prove themselves as a versatile developing field with a variety of dimensions and applications. More specifically, however, the teaching and learning that focus on digital games seem to cultivate the ability to represent the real world while it contributes into the development of mental abilities and contemporary digital skills as well, something that is a priority of the European Union politics. Actually, digital games gain ground more and more every day as differentiated teaching implements, too, while initiatives and good practices for the support of children who face specific learning difficulties develop progressively.

The objective of the present study is double. In the first instance, the role of digital games into the development of communicative and learning skills of children with learning difficulties {dyslexia, dyscalculia, misspelling, attention deficit hyperactivity disorder (ADHD) etc.} is examined. Based on the review of contemporary international bibliography, it is deduced that the ability to personalize, the interactivity and the attractive nature of digital games have a positive effect both on children's frame of mind and social behavior and on their cognitive empowering as well.

In the second instance good practices are studied which show that digital games succeed learning through multiple channels, enforcing remarkably phonological awareness, reading and writing skills, understanding mathematical concepts and emotion recognition too, in children with dyslexia, autism or attention deficit hyperactivity disorder (ADHD). At the same time, the use of digital tools that incorporate playful techniques instigate significant improvement in measures of attention performance as well as in the improvement of self-organization and self-regulation in students with ADHD and specific learning difficulties.

Finally, gamification and serious games approaches also appear to lead to improved motivation, engagement and self-confidence in children with dyslexia. On the one hand this study opens a dialogue on the dynamics of digital games in supporting children with learning disabilities and on the other hand on the optimization of existing or the creation of new applications in the context of interdisciplinary collaborations.

**Key words:** digital games, learning difficulties, skills, good practices

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# DIGITAL ENTREPRENEURSHIP AND SUSTAINABLE DEVELOPMENT: THE DISTANCE LEARNING OF GREEK AS A FOREIGN LANGUAGE EXAMPLE

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## Abstract

At a time of multicultural and multilingual societies and constant digital transformation, a nation's language is not only a major cultural element, but also a communication tool as well as a necessary condition for personal and professional advancement. The subject of this paper is the study of synchronous and asynchronous distance learning of Greek as a foreign language and its contribution to the digital sustainability of business and related activities.

The interactive educational platform Greek Talk is presented in the study. The project was developed in accordance with the European models of communication and digital skills development and offers lessons in Greek as a foreign language in a modern, digital educational environment. The content is based on original speech and the principles of personalization and personal freedom. At the same time, pedagogical purposes are connected with Modern Greek culture thus motivating active learning while becoming the foundation of cultural awareness.

The study aims to explore teaching foreign languages with the use of digital tools as a business venture and its efficacy within a constructive learning frame. The structural parts of Greek Talk, along with the supportive digital media, the digital books and the teaching activities in use, the accomplished results and the data outline the users' profiles. Finally, the business development potential of the certain field as well as the application, are discussed.

**Key words:** Greek language, distant education, digital media, sustainable business development



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# CULTURAL HERITAGE AND URBAN RESILIENCE: REVIVING TOBACCO WAREHOUSES IN NORTHERN GREECE

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## Abstract

Traditionally, heritage has been viewed as a “passive victim” of rapid urbanization, facing threats to its survival rather than being recognized for its potential to actively contribute to the sustainable development of cities. But it is a fact that cities could benefit from the protection of its heritage. It is well known that conserving historic buildings provides significant economic, cultural and social benefits.

Within this context, it is necessary to redefine how cultural heritage nowadays is understood and which role could play for the city’s resilience. In the ever-evolving landscape of urban development, the preservation of architectural and industrial heritage stands as a testament to collective history and identity.

So, in this framework, and by having in mind from one hand that “heritage is dynamic, as it links the past, the present and the future” and from the other hand that heritage protects and enhances collective historical memory, this presentation concerns on two recent research programs on the regeneration, revitalization and integration of architectural heritage of tobacco warehouses in contemporary urban environment of three different cities of northern Greece: Drama, Kavala and Xanthi.

By analyzing two tobacco warehouses as case studies, the aim was to include all the necessary stages - from documentation to restoration good practices - in order for the buildings to be integrated into the urban fabric, as well as the whole socioeconomical city network for its urban resilience. Focusing on the adaptive reuse of tobacco warehouses in these Greek cities, the paper explores strategies that not only safeguard the cultural significance of these structures but also contribute to sustainable urban futures.

Through an in-depth analysis of two tobacco warehouse case studies, the research aims to encompass all crucial stages from documentation to the implementation of effective restoration practices. These efforts seek to ensure that these significant structures are seamlessly woven into the urban fabric and contribute meaningfully to the socio-economic vitality of their respective cities.

**Key words:** cultural heritage, urban resilience, tobacco warehouses, historical urban landscape

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# **HISTORICAL MEMORY AND SUSTAINABLE DEVELOPMENT WITHIN AN URBAN CULTURAL LANDSCAPE. THE CASE OF THE OLD MUNICIPAL HOSPITAL OF THE UPPER TOWN OF PATRAS (OLD PATRAS).**

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## **Abstract**

The dominant objective of a modern state is the achievement of development in the three productive sectors of the Gross Domestic Product: primary (production of raw materials), secondary (processing of raw materials) and tertiary (providing services). Basic parameters of development are social processes and practices, interpersonal communication, economic, political and cultural partnerships, as well as active strategic management policies. Development is a “whole” that requires “total quality management” in order to be properly managed, protected and promoted. The management of cultural heritage and cultural tourism must take into account and pursue “sustainable development”, which meets the needs of the present, without compromising the ability of future generations to meet their own needs. Appropriate, feasible and effective cultural management promotes economic, social, cultural and environmental sustainability in a national and local context. The Old Municipal Hospital in the Upper Town area of Patras (Old Patras) is a tangible example of the utilization and promotion of the local cultural capital through the process of its reuse and return to society. Being characterized as a “newer monument” by the Ministry of Culture, it receives permanent protection and cultural exploitation.

**Keywords:** development, sustainability, historical memory, place-landscape, Upper Town area of Patras, Old Municipal Hospital.

## **Introduction**

The paper focuses on the concept and importance of cultural heritage and sustainable urban development as pillars of an effective cultural policy. It also examines the role of local organizations with cultural action, which -through their principles, objectives, policies and actions- save and promote cultural heritage, but also design urban sustainability programs. The case study investigates the historical physiognomy, use, management and development perspective of the Old Municipal Hospital of Patras as a monument-landmark of the Upper Town area of Patras in relation to the sustainable development and promotion of the historical urban area in question.

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### **Definition and characteristics of “development”, “sustainability” and “landscape”**

The main objective of a modern state is to achieve development in the three productive sectors of the Gross Domestic Product: primary (production of raw materials), secondary (processing of raw materials) and tertiary (provision of services). “Development” is defined as a better balance of social and human relations and systems of land use, production, employment, distribution and consumption, in accordance with the values and choices of the forces in power, as they militantly coexist and interact in the natural environment, with the specific social dynamics and the average social consciousness (Πόκος 2001). One understands that development parameters are created by social processes and practices, interpersonal communication, economic, political and cultural partnerships, as well as active strategic management policies. Development is a “whole” that requires “total quality management” in order to be properly managed, protected and promoted. “Total quality management” is defined as the modern management philosophy for improving the quality and effectiveness of organizations by systematically considering planning, administration, organization, strategy, interaction and evaluation at each stage of development of goods (products and services) (Δερβιτσιώτη 1993).

The management of cultural heritage and cultural tourism must seek “sustainable development”, while it can also be rendered as “supportable development” (Ανδριώτης 2008, 38). According to the World Commission on Environment and Development (WCED) (1987, 43) “sustainable development is that which meets the needs of the present without compromising the ability of future generations to meet their own needs. It is a process of transformation, where the exploitation of wealth-producing resources, the direction of investments, the orientation of technological development and the adjustments to the institutional framework are harmonized and elevate the current and future possibilities, in order to satisfy human needs and aspirations”.

The European Union of Historic Cities and Regions is also based on the previous definition of sustainable development through the “Guidelines for Sustainable Cultural Tourism in Historic Towns and Regions” (European Association of Historic Towns and Cities 2009, 1). The Association highlights the need for cultural tourism to respect cultural and natural heritage, to promote cultural exchanges between people, to inspire intercultural dialogue and to create spatial investments and jobs for all productive social groups. Additionally, it is recognized that the essence of the concept of “sustainability” must take into account the following factors: a. Visitors (the satisfaction of their needs, expectations and in general their quality stay in the reception areas), b. Businesses (the safeguarding of the need for small, medium and large tourism businesses to be profitable and long-lasting by offering authentic experiences to their visitors), c. Local Communities (the respect for their values, needs and overall quality of life, so that local identities are maintained and authentic local cultural assets are protected), d. Environment (the effort to protect and preserve the cultural and natural environment, local peculiarities and the image-feeling of each place-landscape). In fact, in the new “Guidelines for Sustainable Cultural Tourism”, in addition to the concept of “sustainability”, the concept of “resilience” has also been provided for, which is defined as “the ability of cultural tourism to recover from situations of challenges and crises”, such as the Covid-19 pandemic (European Association of Historic Towns and Regions 2009, 9• <http://www.historic-towns.org/wp-content/uploads/2020/07/Guidelines-for-Sustainable-Cultural-Tourism-2020-1.pdf>).

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In the Greek legislative framework, Law 4447/2016 (Chapter A, Article 1) defines the concept and characteristics of “sustainable development” as follows: “sustainable development is development that combines social, economic and environmental objectives with the aim of: a. achieving sustainable economic growth by creating a strong productive base and emphasizing innovation and increasing employment, b. territorial and social cohesion, fair distribution of resources and lifting exclusions, c. protection of the natural and cultural environment, biodiversity, landscape and the sustainable use of natural resources”. Regarding the first pillar, economic sustainability, it is envisaged to spread the economic positive effects to all productive classes, to strengthen economic stability and to upgrade the role of the “creative economy” through the efficiency of economic figures and changes in the way of thinking and acting for the benefit of the quality of life (Florida 2008).

The modern concept of sustainable development could become “integrated” with: a. understanding the dynamic and indivisible wholeness of nature, society and culture, b. interpreting and evaluating development as quality of life within the structured and unstructured environment, in which man actively participates as a subject and accepts the results of his interventions as an object of development. “Empathy” as self-awareness and other-awareness, as well as the collective production process, create economic, technological, social, cultural and environmental progress. The culmination of the concept, essence, characteristics, principles, goals and implementation practices of “sustainable development”, as well as a model for establishing sustainability rules, is the United Nations, which in 2015 adopted the “2030 Agenda for Sustainable Development” with the establishment of 17 ambitious global goals. UNESCO also played an active role in this event, determining that sustainable development is not understood if it is not implemented by people for people. The 17 goals include the following (UN 2015, 14):

1. Eradicate poverty
2. Eradicate hunger
3. Ensure good health and well-being
4. Ensure quality education
5. Achieve gender equality
6. Ensure clean water and sanitation
7. Ensure affordable and clean energy
8. Ensure decent work and economic growth
9. Ensure innovation and industrial infrastructure
10. Achieve social inclusion
11. Ensure sustainable cities and communities
12. Ensure responsible consumption and production
13. Achieve climate action
14. Achieve life below sea
15. Achieve life on land
16. Achieve peace, justice and strong institutions
17. Achieve partnerships for the goals.

Specifically for “Culture”, UNESCO confirms that its role will be recognized in most of the above goals, extending from cultural heritage to contemporary culture and cultural and creative industries. Culture is the animating and guiding factor of the economic, social and

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environmental dimensions of sustainable development. Goal No. 11 places the cultural dimension of sustainability within urban development by protecting and promoting urban cultural heritage worldwide. In cities local identities of diverse communities of people are developed and organized, which need to be preserved and promoted, because they promote cultural diversity and intercultural approach through intercultural dialogue. The “city” is a historical, cultural, natural creation, that is, a creation of the partnership of art and nature. The respective strategic and operational development and promotion planning differentiates its image in the globalized “becoming” and generates a competitive advantage over other cities. This national planning must take into account the concept, essence and policy of “landscape”, as it plays an important role of public interest from an economic, social, cultural, ecological and environmental perspective and whose protection and management require special care, contributing to the creation of jobs and promoting creativity and innovation. One understands, therefore, that a simple geographically defined place or space, natural or urban, unstructured or structured, becomes a “landscape” when “it is shaped in such a way that building structures and natural elements are combined in order to cover in a complex way all social requirements” (Μωραΐτης 2016, 30). Therefore, the landscape is characterized by functional and aesthetic harmony, by cultural, historical and natural demarcation, as well as by the development of economic and social activities. Thus, the simple place-space as a geographical dimension or physical surface is organized into an intentional multidisciplinary unity in structure and content, acquiring “cognitive, material and emotional contexts [...], which are susceptible to transformation and change” (Tilley 1994, στοΓιαλούρη (επιμ.) 2017, 219). According to this approach, the urban place, the city and urban areas should be considered as the “place of place(s)”, as multifunctional human activity develops and is organized in them (Μωραΐτης 2016, 38).

The term “landscape” and its perception composes a meaning-giving system, which is related to statements and connotations, literal and symbolic elements, which generate ideology, identity, culture and coexist within the image of a city or urban area. According to Τερκενλή (1996, 18) “all landscapes are symbolic, that is, expressions of cultural values, social behavior and personal individual action in certain spatial locations, over a period of time. Therefore, cultural landscapes can be considered as repositories/reservoirs of meanings and concepts, originating from the social groups that currently occupy them or occupied them in the past”. They are directly or indirectly linked to the process of memory both at the level of recalling memories of the past and at the level of their practical, functional and symbolic utilization in the environment of the present. In this way, every landscape -natural or anthropogenic, structured or unstructured, referential or symbolic- creates in collective memory the bases for the genesis of identities. The symbiotic societies of every era, whether natural or conventional, were defined racially, linguistically, religiously, culturally, and guild-wise by the characteristics of the place and landscape in which they were part of, which is why they differentiated “us” from “the others”. The determination of local or national identity with its above-mentioned sub-definitions requires the process of memory and, at the same time, its interpretation. The past is transformed into an experience when it is inscribed in the cognitive and interpretive background of the community within a certain and fully understood place-landscape. This view carries the risk of a local-regional determinism, as in the past space and landscape were considered axes of pure racial identity and in complete



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opposition to the identity of the “other”. Today, however, “[...] the view that considers culture as a means of adapting man to nature in the general context of questioning the “man-nature” dichotomy has been overcome and a holistic approach is being promoted, where culture and environment are treated as parts of a continuum, as inseparable elements of a single process. [...]. These new identities are in no way understood as homogeneous and static, nor as “rooted” in a place, as national ideology wants them to be and as social sciences largely treated them until recently.” (Νιτσιάκος 2003, 28, 97-98). The phenomenon of urbanism-urbanization at the state level and the phenomenon of globalization-transnationality at the transnational level contributed to the relaxation of the strict interconnection of the place-landscape with the pure local or national identity of its inhabitants. Thus, today, we are in a position to say that as a global society we have largely overcome an autopathic, isolating and self-oriented framework, towards a heteropathic-allopathic, socio-universal framework, oriented towards the “other” and the world. The interaction of communities through the contribution of inherent identity elements ensures the continuity and democracy of the landscape. Therefore, according to the anthropologist Geertz (2003, 347-348), “the progress towards humanity -that gradual development of higher intellectual capacities, which Rousseau called “perfectibilité”- was destroyed by cultural provincialism, armed with an immature science. Cultural universalism, armed with a mature science, will set it in motion again”.

The United Nations’ “New Urban Agenda” (2017) envisages the integration of the 17 sustainability goals in the field of cities and urban development policy. Cities today, although they geographically constitute only 2% of the world’s land area, contribute 70% to the Gross Domestic Product, 60% to global energy consumption, 70% to greenhouse gas emissions and 70% to global waste (<https://habitat3.org/the-new-urban-agenda/>). From the above data it is clear that modern cities, with the activities they develop and their spatial planning, must serve development prospects, with the aim of their local, national and international visibility. This is why the collaboration of many “interest groups” (“stakeholders”) involved in urban upgrading, such as public and private services, special scientific groups and local communities, is required, in order to give a special “local color” and to ensure a competitive advantage in the international cultural and tourist scene. A tangible example of creative policy within an urban landscape is the planning of a multifaceted reopening and reuse of the Old Municipal Hospital of Patras.

### **Old Municipal Hospital of Patras**

#### ***A. Historical context***

It was built in 1857 constituting a remarkable and representative example of neoclassical architecture and a historical urban landmark for both the Upper Town area of Patras and the entire city of Patras. The neoclassical building by the Danish architect Hans Christian Hansen operated as a hospital for 101 years, from 1872 to 1973, while today it is considered a cultural center of the city (<https://www.e-patras.gr/el/axiotheata>). On October 15, 1857, the foundation stone of the building was laid by King Otto in the presence of his wife, Queen Amalia.

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The surface area of the site is 3,650m<sup>2</sup>. The plan was drawn up by the Danish architect Hansen. Construction began immediately under mayor Venizelos Roufos and ended in 1871 under mayor Georgios Roufos. Its administrators in turn (and until the beginning of the 20th century) were: I. Giannopoulos, Th. Efstathopoulos, K. Papastathopoulos, H. Koryllos. The latter, taking over the administration in 1890, excavated the basement of the building and installed the pharmacy, outpatient clinics, kitchens and warehouses there. During the Balkan Wars and World War I, the hospital treated soldiers, while during World War II it was occupied by the Italians and the Germans (Τριανταφύλλου 1980, 269). During the first decades of its operation it had a surgical, pathological, obstetric and radiological department, while it had a microbiological laboratory and an autopsy room. Within the premises a church of St. Charalambos was built in 1914, on whose image many vows were hung. Until 1958 it operated under the supervision of the Municipality, when it was nationalized. It is the third oldest hospital in Greece after those of Nafplio and Athens.

The monumental identity of the declared modern monument of the Old Municipal Hospital of Patras, according to the Ministry of Culture, is the following ([http://listedmonuments.culture.gr/monument\\_print.php?code=2545](http://listedmonuments.culture.gr/monument_print.php?code=2545) • [https://www.arxaiologikoktimatologio.gov.gr/el/monuments\\_info?id=157636&type=Monument](https://www.arxaiologikoktimatologio.gov.gr/el/monuments_info?id=157636&type=Monument):

### Monument Identity

#### Monument Name

Building complex of the Old Municipal Hospital of Patras on Panagouli, Papadiamantopoulou, Koryllou streets and Koryllou square in Patras, prop. of the Municipality of Patras

#### Prefecture / Municipality / District / Settlement

ACHAIAS / PATREON / PATREON / Patras

#### Location

Panagouli, Papadiamantopoulou, Koryllou Streets and Koryllou Square

#### Type of Declaration

Newer Monument

#### Type of Monument

Urban Buildings, Public Utility Buildings

#### Time Period

Modern Hellenic

#### Ancient/Historical Name

### Protection

#### Protection Body, Headquarters of the Protection Body

YNMTE of Western Greece, Patras

#### Ownership Status

Local Government

### Proclaims

#### Ministerial Decision Number

Ministry of Culture and Tourism/DILAP/G/4600/6544/3-2-1998

#### Official Gazette Number

Government Gazette 164/B/25-2-1998

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### ***B. Development and sustainable perspective interventions***

It consists of building complexes, which have been constructed in six different time periods from 1871 to 1934. The actions and projects concern the exploitation of the cultural heritage through the use of new technologies and the development of a digital strategy for the tourist promotion and promotion of Patras. Through reuse the space will be able to function as a lever for the development of the region at the historical, social, cultural, educational and economic levels, but also contribute to the development of thematic tourism. The core of the actions includes the creation of a permanent structure for the collection, preservation, study, documentation, digitization, projection and promotion of the Audiovisual Heritage of the city and the wider region of Achaia, in order to promote the preservation of the memory of the cultural evolution of the region (ΔήμοςΠατρέων 2016, 178-180). The new zoning of the building's functions provides for the following uses (ΔήμοςΠατρέων 2017<sup>a</sup>, 1-2• ΔήμοςΠατρέων 2017<sup>b</sup>):

- ✓ the ground floor western part of the Hansen wing remains as a space for periodic exhibitions and activities,
- ✓ in the corresponding underground western part of the same wing, instead of the Medical Museum, artistic creation workshops and offices are located,
- ✓ the eastern underground and ground floor part of the Hansen wing and the eastern and northern wings of the complex are transformed into a Digital Audiovisual Heritage Center of the city,
- ✓ in the northwestern wing the dining area remains and is expanded into the elevated two-story building of the western wing with the function of a café-restaurant,
- ✓ the ground floor hall of the western wing is formed into a small conference center with multiple uses combined with the other spaces,
- ✓ auxiliary spaces, administrative offices and other supporting functions are provided in the remaining spaces of the building complex.

More specifically, the Digital Audiovisual Heritage Center will focus on aspects of the cultural evolution and history of the city and the wider region, as they have been captured in various forms and various material carriers of audiovisual records, namely moving images, photography and sound recordings. It will have the following structures organized in the respective spaces, as reflected in the architectural plans (ΔήμοςΠατρέων 2016, 180-18• ΔήμοςΠατρέων 2017<sup>a</sup>, 3-4):

- a) Exhibition Space: a versatile exhibition space with the greatest possible flexibility in terms of its conversion possibilities depending on the needs of each exhibition.
- b) Archive Space: a repository of the city's memory with conservation laboratories and storage areas for documents under the appropriate conditions.
- c) Digitization Space: digitization of the center's collections and any other archival documents with which they will be enriched, in accordance with technological standards and best international practices.
- d) Research and Documentation Area: organization, maintenance, classification of materials that have already been recorded, as well as detection of any relevant material that is missing from the research. The area will function as a hub for attracting and gathering archival documents. Furthermore, as an autonomous research unit, it will be

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able to gradually expand its activities to the primary creation of audiovisual documents, which will contribute to the recording of the history and development of the city and the wider region.

- e) Study Area: in this, researchers, students, pupils, citizens and any other interested party will be able to have open access to all the documents. The possible interconnection of the relevant computer systems with the data of the Municipal Library of Patras and the Library of the University of Patras will offer multiplier benefits.

The indicative budget for the project and the individual actions amounts to €5,000,000, while the target groups benefiting include 214,000 residents of the city of Patras and 50,000 annual visitors. The Beneficiary and Operating Body is the Municipality of Patras.

Indicative actions and events for the utilization and reuse of the space are the following:

1. During the 2019-2020 school year, the Cultural Organization of the Municipality of Patras, in collaboration with the Department of Secondary Education of Achaia, organized an educational program at the Folk Art Museum for students of Primary and Secondary Education. The Museum was inaugurated on June 20, 2013 and is housed in the Hansen Hall of the Old Municipal Hospital of Patras. The Museum's archival material is composed of various sections, which document a significant part of the cultural heritage of the region with collections relating to:

- ✓ the cultivation of the land and the making of bread,
- ✓ the cultivation of vines, the making of wine and tsipouro,
- ✓ livestock farming,
- ✓ household items,
- ✓ the processing of wool and weaving with a traditional loom,
- ✓ the presentation of material from traditional weaving, printing, hat making, wax making, shoemaking workshops.

According to the educational program the Museum welcomes students every Tuesday and Thursday from October 15, 2019, during the morning hours, with organized tours for groups of students up to 25 people together with accompanying teachers. For the proper planning of the action, an application for participation from each school is attached and telephone contact with the program manager from the Municipality is provided (ΔήμοςΠατρέων 2019• Δ/νσηΔ/θμιαςΕκπ/σηςΑχαΐας2019, 1-2).

2. On August 22, 2021, in the atrium of the Old Municipal Hospital of Patras, the award-winning classical guitarist and composer Panagiotis Margaris presented his new musical performance entitled “Prelude to Love” with pieces-arrangements of wonderful musical compositions by Ennio Morricone, Nino Rota, Mikis Theodorakis, Manos Hadjidakis, Sting, Beatles, Rolling Stones and himself. The performance was part of the events under the title “Full Moon Days”, dedicated to the full moon of August. The “Prelude to Love” marks an artistic mysticism full of notes and tones, a beautiful and timeless journey towards the soul, passion, love, inner turmoil, peace and emotional integration (<https://pelop.gr/patra-meres-panselinou-me-ton-p-margari/>). Admission was free for the public and this proves both the social sensitivity of the Municipality and the need for cultural and spiritual cultivation of the citizens.

3. Within the framework of its responsibilities the Cultural Organization of the Municipality of Patras organizes the “International Patras Festival” every summer with the

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aim of “cultivating the soul and the mind, which gives new impetus and depth to the daily struggle of citizens” ([http://www.patrasculture.gr/?section=1917&language=el\\_GR](http://www.patrasculture.gr/?section=1917&language=el_GR)). The atrium of the Old Municipal Hospital of Patras was used for the performance of the Association - Choir “Anticho” with the title “Three Composers in the Hospital” on September 18 and 19, 2021, at 21:30 ([http://www.patrasculture.gr/managed\\_images/diethens-festival-patras-2021-programma.pdf](http://www.patrasculture.gr/managed_images/diethens-festival-patras-2021-programma.pdf)). The work was inspired by the world of hospitals, which, especially in the era of the pandemic, has highlighted them as places of continuous struggle, where the full range of human emotions unfolds. The texts, that were selected, approached this broad thematic axis in different ways with an emphasis on human pain and healing. Poems by Vizyenos, Souris, Livaditis, Varveris, Kosmopoulos, Brecht, Markopoulos, Karellis, etc. were heard. Special mention was made of the Hospital and its place in the history of the city (<https://gnomip.gr/2021/09/15/treis-sunthetes-sto-nosokomeio/>).

4. Additionally, for the 77th anniversary of the liberation of Patras from the German occupation troops, the Cultural Organization of the Municipality organized the screening of the 2017 documentary film “Hitler vs. Picasso” in the atrium of the Hospital on October 6, 2021, at 20:30. This is a landmark film, as it reveals works of art hidden, looted, condemned by the Nazis, which come to light by projecting on the big screen the Nazi obsession with “degenerate art”, as they characterized it, which was banned, expelled and condemned. The Italian actor Toni Servillo tells the true story of such artistic masterpieces by Picasso, Matisse, Renoir, Chagall, etc.

([https://www.patrasculture.gr/?section=637&page1552=2&language=el\\_GR&itemid1541=4436&detail1541=1](https://www.patrasculture.gr/?section=637&page1552=2&language=el_GR&itemid1541=4436&detail1541=1)).

## Conclusions

The scope and variety of the previous projects and actions demonstrate, on the one hand, the effort of local bodies for holistic cultural management and cultivation, and on the other hand, the need and desire of the people of Patras to get to know the cultural-historical sites and to engage in a fruitful “discussion” with them, creatively experiencing the cultural and artistic events. The financial contribution of both the local community and visitors from neighboring municipalities or other cities is also considered a positive impact, which upgrades the image of the Upper Town area of Patras and contributes to the improvement of its infrastructure. In any case, more fruitful and effective partnerships between local bodies and with the local community are required, an effort to complete the regeneration projects within a specific time frame, but also a more intense communication initiative and promotion through the printed and electronic press at local, regional, national and international level.

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### **MATERIAL AND IMMATERIAL CULTURE AND SUSTAINABLE DEVELOPMENT (HISTORIC CITIES, MONUMENTS, CUSTOMS). THE CASE STUDY OF THE MINOR ASIA REFUGEES IN AITOLIA-AKARNANIA, GREECE.**

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#### **Abstract**

Culture, material and immaterial, is one of the main pillars of Urban and Regional Development. The Greeks of Minor Asia had created a high level culture that led to an upgrade of their quality of life. This quality of life was dramatically changed after the Minor Asia Catastrophe in 1922, a fact that forced them to abandon their homeland and find a new place to settle. Almost 9.000 refugees were located to the prefecture of Aitolia and Akarnania. From the moment of their arrival brought with them their dialects, their traditions and their customs, creating a vibrant mosaic of different cultures due to their diverse origin.

The present paper investigates the culture elements that still remain in use by descendants of these people. The establishment of the cultural associations in the 80's proves the will of the maintenance of their ancestors' culture. The research is based on the study of the documents that exist in these associations and furthermore, in the General State Archives of Greece.

The culture wealth of these groups can be leveraged through innovative practices that aim at sustainable development. The promotion of traditional Minor Asia elements such as cuisine, dance and music through festivals, can attract tourists and boost the local economy.

Furthermore, the establishment of museums and culture centers dedicated to the history and the heritage of the Minor Asia refugees, contributes to the educational procedure and encourages the transmission of knowledge from generation to generation.

**Key words:** Material and immaterial culture, sustainable development, Aitolia-Akarnania

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### THE UNDERWATER CULTURAL HERITAGE AS MANAGEMENT FACTOR OF THE MEDITERRANEAN LANDSCAPE

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#### **Abstract**

The importance of the underwater landscape plays a significant role in the cultural heritage of a region, a fact that was recognized at the international level with the signing of the Convention for the Protection of the Underwater Cultural Heritage in Paris on 2 November 2001 by the General Conference of UNESCO Member States. This international approval was carried out with the prospect of improving the protection measures for the underwater heritage as a reserve of the cultural monumental history of a place. This international agreement is a continuation of the agreement signed on December 10, 1982 by the United Nations Organization on the Law of the Sea and the UNESCO Convention of November 16, 1972 concerning the Protection of the World Cultural and Natural Heritage.

The climate crisis, which has greatly altered the flora and fauna of the Mediterranean underwater areas, as well as the lack of financial resources in order to develop specialized underwater research in the Mediterranean seabed where there are finds of cultural wealth from antiquity, is rapidly making it difficult the correct implementation of the UNESCO agreement and environmental protection.

The UNESCO Convention on the protection and management of the underwater cultural heritage as well as the NATURA2000 network of the European Union which focuses on the protection of fragile marine and underwater areas are international synergies which have the sole purpose of protecting the landscape in environmental, economic and cultural terms level.

This paper highlights the importance of this collaboration of international agreements and emphasizes their interrelated importance with case studies located in the Mediterranean area.

**Key words:** cultural heritage, sustainable tourism, underwater landscape

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### **WORLD HERITAGE MONUMENTS AND THE CITY: SOME PRELIMINARY REMARKS ON THE MANAGEMENT OF THE MONUMENTS OF THESSALONIKI, GREECE**

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#### **Abstract**

The World Heritage Monuments (WHM) and sites constitute a special category of monuments. Being selected for inscription on the World Heritage List on the basis of certain criteria, they are considered of outstanding universal value. According to the World Heritage Convention each State Party shall endeavor “to adopt a general policy which aims to give the cultural and natural heritage a function in the life of the community and to integrate the protection of that heritage into comprehensive planning programmes”. In this way, Sustainable Development is introduced as the main axis for the protection and management of WHM, while improving the everyday life of the community is considered as a main goal of the implemented policy.

“Palaeochristian and Byzantine Monuments of Thessalonika”, inscribed on World Heritage List since 1988, is a group of monuments, which includes secular, military and mainly religious ones, an important number of fine churches scattered throughout the historic centre of the modern city. These monuments could be the main touristic attraction for the city, especially in the context of cultural tourism, while they continue to function regularly as places of worship.

The present paper aims to investigate the role of WHM in the economic and social life of the city of Thessaloniki and the degree to which they have contributed in improving the quality of citizens’ everyday life. For this purpose, a survey was conducted with questionnaires which address to certain groups, as well as semi-structured interviews with persons involved in the management of the city’s Unesco monuments. The survey is still in progress. The first results combined with a study of Unesco’s relevant documents as well with onsite investigation show that the impact of the WHM on the city’s life is not analogous to their international status. In this context, some preliminary remarks regarding the current management system are uttered and a proposal for a different approach is made, in view of the drafting of the site’s management plan.

Key words: management of World Heritage Monuments, Thessaloniki, Sustainable Development

**Key words:** management of world heritage monuments, Thessaloniki, cultural tourism, everyday life

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### 1.Introduction-Historical Outline.

Thessaloniki, the second largest Greek city, after the capital Athens, is located in Northern Greece and belongs to the geographical region of Macedonia (in the Administrative Region of Central Macedonia). It is built at the cove of Thermaikos Gulf, in a strategic position for communication and trade, controlling the trade routes from the Balkans to the Aegean Sea and from the eastern coast of Asia (Asia Minor - modern Turkey) back to the Balkans, but also, via the sea, to the Adriatic Sea and the West. Apart from a strategic port, a fertile plain is formed to the west of the city, at the mouth of four rivers (Axios, Loudias, Gallic , Aliakmonas). In addition, the city 'touches' on Mount Chortiatis, while two lakes (Megali and Mikri Volvi) are located in the wider area to the east. These advantages of its geographical position and geomorphology were probably the criterion for its foundation during the Hellenistic period (315 B.C) by Alexander the Great's general and later king of the kingdom of Macedonia, Kassandros, and the basis for its economic and cultural development in the following years. They were, probably, also the reason why during its long history and despite the periods of decline, the city was never abandoned.

During the Roman period, the city flourished and became the seat of the eastern province of Macedonia and later the capital of the part of the empire (the system of tetrachy) ruled by Caesar Galerius (Trakasopoulou-Salakidou 1986, 40-42, Veleni 2009, 63-65). Testimonies of this glorious period of the city, the buildings erected by Galerius, remnants of which are more or less preserved to our days: the palace, the Hippodrome, the triumphal arch (Kamara) and probably the mausoleum of Galerius (Rotunda) (Veleni 2009, 74-75).

The prosperity of the city continued during the Byzantine period. The 5th century was a milestone in the history of the city, during which the defensive fortification of the city was constructed and magnificent temples were erected, typical examples of Byzantine temple architecture (Papazotos 1985, 9). The next great cultural heyday would come in the 14th century, when historical circumstances would allow Thessaloniki to play a leading role in this last period of the Byzantine Empire. This splendour would be reflected in the elaborate architecture of the temples of the period and the impressive paintings that adorned them, which would have a significant influence on the art of neighboring states (especially Serbia) (Papazotos 1985,14).

After the fall of the city to the Turks, its position in the region will continue to be important, as a main port of the Ottoman Empire. The Muslim monuments, secular or religious, erected at that time testify with their size and their grandeur the great importance and prestige of the city. A turning point in the 15th century was the arrival and settlement of a significant Jewish population (coming from Spain after the persecutions launched by Ferdinand and Isabella of Spain) which changed the composition of the population (Mazower 2005,47-49) and left its own imprint on the city's building stock. The multicultural Thessaloniki would continue its course through periods of prosperity and decline as a city of the Ottoman Empire until the beginning of the 20th century, when the Balkan wars would bring Thessaloniki into the territory of the Greek state and gradually eliminate its multi-ethnic character. The fire of 1917, which destroyed a significant part of the centre of the Ottoman city and its buildings (Mazower 2005,318-321) and the redesign of the city according to

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European standards<sup>12</sup>, had a decisive influence on the city's building stock and its subsequent form.

A second major natural disaster that would affect many buildings, including the city's monuments, occurred towards the end of the 20th century, in 1978, when a strong earthquake hit the city. In the meantime, the Greek-Jewish population of the city was exterminated by Nazis during the Second World War.

In 1988<sup>13</sup> (almost 37 years ago)<sup>14</sup> the majority of the monuments belonging to the prosperity phases of the Byzantine era, were inscribed on the UNESCO World Heritage List under the title “Palaeochristian and Byzantine Monuments of Thessalonika”, on the basis of specific criteria (i,ii,iv)<sup>15</sup>. This international recognition of the historical and artistic importance of Thessaloniki's monuments created many opportunities for the monuments and the city of Thessaloniki but also many obligations for the administrative bodies and eventually for the Greek state to fulfil regarding their protection and management.<sup>16</sup>

### **2.Thessaloniki's World Heritage Monuments-some observations.**

Thessaloniki's World Heritage Site comprises fifteen (15) monuments dating back to the Early Christian and Byzantine periods, from the 4th to the 15th century. Most of them are Byzantine churches<sup>17</sup>, while the secular buildings are limited to the Byzantine fortifications

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<sup>12</sup>The new design of Thessaloniki was made by Ernest Hebrard with the responsibility of a state appointed Committee consisting of Greek, French and British experts (Mazower 2005, 324, Yerolympos 2007).

<sup>13</sup>The World Heritage Convention was ratified by law in 1981 (Law 1126/1981) and the first Greek inscription on the list took place in 1986. It was an ancient Greek temple of the classical period, the temple of Apollo Epicurius at Bassae of Figaleia (Peloponnese).

<sup>14</sup> We cannot fail to mention the article of Demetrios Zygomalas ( Zygomalas 2023) which also deals with the WHM of Thessaloniki and the impact of their status but sets different axis of examination.

<sup>15</sup>Criterion (i): The mosaics of the Rotunda, Saint Demetrius and Hosios David's (Latomou Monastery) are among the great masterpieces of Early Christian art. Criterion (ii): The influence of the Thessalonian churches on the development of the monumental arts was considerable first in the Byzantine and later the Serbian world, whether in the Early Christian period, the Middle Byzantine era or the Palaeologan Renaissance. Criterion (iv): The Christian monuments of Thessalonika are outstanding examples of churches built according to central, basilical and transitional architectural types over a period going from the 4th to the 15th century. For this reason, they constitute a series which is a typological point of reference.

<sup>16</sup>The engagement with this topic is in the context of a PhD thesis on the policies for the protection and management of UNESCO Sites in Greece that I am working on at the University of Macedonia, Department of Balkan, Slavic and Oriental Studies.

<sup>17</sup>Church of Acheiropoietos, Church of Saint Demetrios, Latomou Monastery, Church of St. Sofia, Church of Panagia Chalkeon, Church of St. Panteleimon, Church of the Holy Apostles, Church of St. Nicholas Orphanos, Church of St. Aikaterini, the Transfiguration of the Saviour, the Katholikon (main church) of the Vlatadon Monastery, Church of Prophitis Ilias.



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(the 4km long city walls and the Acropolis fortress called “Heptapyrgio”), the emblematic monument of Rotunda (Roman construction with Early Christian mosaics), probably originally a funerary building (see above), and a Byzantine bath unique to the period<sup>18</sup>.

The World Heritage Monuments (WHM) of Thessaloniki have some specific characteristics:

1. First of all their great number. Thessaloniki with its fifteen WH monuments is one of the European cities with the greater concentration of Unesco monuments<sup>19</sup>.

2. Secondly, the great dispersion of the monuments throughout the urban fabric. Unlike the historic city centres or other Unesco designated groups of monuments that form ensembles<sup>20</sup>, the World Heritage Monuments of Thessaloniki are scattered within the boundaries of the so-called “historic centre”, the commercial heart of the modern city. This area, bounded by Pavlou Mela Street to the east, Kassandrou Street to the north, the Western City Walls and the old port to the west, and the seaside promenade (Palia Paralia) and the White Tower to the south, is designated as “historical place”<sup>21</sup>.

A second area with important density of WH monuments is Ano Polis (the Upper Town), the traditional settlement developed during the Ottoman occupation on the slopes of a hill, (now at the outskirts of the periurban forest of Seih-Sou) and defined by Olympiados street to the south and by the outline of the Byzantine City Walls to the other three sides. This separate entity with medieval characteristics (Vyzantiadou and Selevista 2019, 719) has also been designated since 1979 as “traditional settlement”<sup>22</sup> and enjoys a special protection status.

The way the Unesco monuments have been integrated in the urban fabric of these two separate areas varies<sup>23</sup>. The space around the WH monuments is not always treated in the same way<sup>24</sup>. In some cases, the monuments are the centre of shaped squares (Rotunda,

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<sup>18</sup> For extensive historical information and archaeological documentation on the WHM see: “I Thessaloniki kai ta mnimeia tis”, Ephoreia Byzantinon Archaioiton, 1985, Thessaloniki, Kourkoutidou-Nikolaidou and Tourta 1997, Tzevreni 2013.

<sup>19</sup> The serial property “Early Christian Monuments of Ravenna”, Italy, consists of eight (8) monuments.

<sup>20</sup> For example, Historic Centres of Rome or Florence in Italy or the Old City of Rhodes in Greece and ensembles like the Piazza del Duomo, Pisa.

<sup>21</sup> Ministerial Decision YPPO.DILAP/C/73046/51009/1994 (FEK 833/B/1994): Designation of the historical centre of Thessaloniki as “Historical Place”.

<sup>22</sup> G.G.I. Designation of Ano Poli Area of Thessaloniki as Traditional Settlement. 197/D/2-4-1979. 1979, pp. 2323–2325.

<sup>23</sup> The Committee, responsible for the replanning used the churches as a starting point for the new layout, in order to highlight them, according to the architect and member of the Committee K. Kitsikis Kostantinos, Kitsikis, I ktiriologiki apopsis tou Neou Shediou Thessalonikis, Athens: Blazoudakis, 1919, p.12. (Amygdalou 2014, 154 footnote 308). This plan reflects the ideological and political choice of the planners to promote the byzantine past of the city (Yerolymou 2007 7-9)

<sup>24</sup> Only in few of the monuments there is a designated buffer zone and wherever has been delimited, is defined on the basis of the existing enclosure of each monument (Unesco, State of Conservation of World Heritage properties in Europe, Section II, Greece, Palaeochristian and Byzantine Monuments of Thessalonika, par.2, 2006)

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Acheiropoiitos, St. Sofia., St. Demetrius), in others are surrounded by gardens that form an oasis of greenery and tranquility in the bustling concrete city-centre (St. Panteleimon, Panagia Chalkeon) or in the picturesque labyrinth of Upper Town (St. Nicholas Orphanos, Moni Latomou, St. Aikaterini)<sup>25</sup>. In some cases, there is no free space at all around the monuments. The reasons for this variation go back to the replanning of the city after the great fire of 1917, where some of the byzantine churches were used as starting points of the new layout (Yerolympos 2007 7-9, Amygdalou 2014, 154 footnote 308). The plan was only partly implemented for a variety of reasons (Yerolympos 2007, 14-16). For the rest of the monuments their surrounding area was formed accidentally and gradually by modern building activity. In the case of the Byzantine Walls, parts of the Unesco monument had been incorporated into the Minor Asia refugees' small houses, “castroplika”, some of which have been chosen to be preserved and enhanced together with the walls, while others were demolished in order to develop a green zone around the walls (Tokmakidou and Kaltapanidou 2015, 28,30). As to the churches, many of them appear unexpectedly and suffocatingly intertwined with the contemporary multi-storeyed buildings (polykatoikies) of the decades 60's and 70's. Often, there is no free space enough for their enhancement, there is no surrounding area and in most of the cases there is no buffer zone. The Transfiguration of the Saviour and the Byzantine Bath are two of the most characteristic examples where the byzantine Unesco monuments constitute the small stone garden for the massive apartment buildings.

As a consequence of their integration in the modern urban web, the monuments suffer from all the problems of a modern Greek city such as excessive and anarchic building, lack of open spaces, air pollution, noise pollution, vehicle traffic, accumulation of large amounts of waste, graffiti, etc.

On the other hand, this spatial proximity has created a special relationship between the residents and the monuments (Loukaki 1996,66). Through intimacy cultivated by everyday contact the monuments continue to be invested with memories and emotions and to demand a role in the life and imaginative of the inhabitants. For the visitor of the city, they are-at least some of them- like hidden secrets intriguing him to discover, difficult to find sometimes, but when he does, they offer him a pleasant surprise and a relief from the concrete modern city.

3.A third characteristic of Thessaloniki's WH Monuments is the coexistence with other monuments within the boundaries of the urban units mentioned above, which are also designated, as “historical place” and “traditional settlement” respectively. The Unesco monuments coexist with other architectural monuments of various periods and various cultures (roman, other byzantine monuments not included in the World Heritage List, ottoman and modern ones), remnants and material testimonies of the rich history of the city and the uninterrupted habitation around the same core since its foundation. This range of monuments and sites comprises roman palaces and forums, arches, byzantine churches, ottoman baths and mosques, markets and commercial galleries, fountains, imposing jewish mansions and houses of eclectic architecture of 19<sup>th</sup> and early 20<sup>th</sup> centuries and early industrial buildings, like the

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port and its depots. Sometimes, the WH Monuments and the ones that are not listed as Unesco form part of the same architectural ensemble, as in the case of Rotunda and Galerius palace.

As a result, a special urban landscape has been formed, anarchic but rich in architectural variety, historical references and memories, a landscape with which the UNESCO monuments are inextricably intertwined.

4. A fourth characteristic of Thessaloniki's WHM is the religious use of the majority of them. The byzantine churches, as they preserve their original use, belong to the so-called "living cultural heritage" (Poulios 2014,115) and are associated with intangible elements, spiritual content and worship practices.

The secular monuments (the Byzantine Walls, Rotunda<sup>26</sup> and the Byzantine Bath) are used occasionally for cultural events (concerts, exhibitions), while the fortress of Heptapyrgion houses nowadays<sup>27</sup> the premises/offices of the Ephorate of Antiquities of Thessaloniki City (the competent for the protection of the monuments service of the Ministry of Culture) and it is also open to visitors.

5. As a result of Monuments' great insertion in the urban tissue and their use, there is a large number and variety of users: residents, visitors-tourists, the members of the Greek-orthodox community, the employees of the Ministry of Culture, the audience of the cultural events and also some special categories of visitors like scholars and the members of the educational community (students and teachers of the city's schools and Universities who visit the monuments for educational purposes). We could also add other categories of involved stakeholders like the businessmen in the surrounding area of the monuments and the property owners.

6. In the same way, there is also a great number of authorities involved in the protection and management of the WH Monuments: Firstly, the ministries and services competent for the supervision of the "historical place" of the historic centre and for the "traditional settlement" of the Upper Town. Respectively, these services are: the Ephorate of Modern Monuments and Technical Works, Ministry of Culture, also responsible for the protection of listed individual buildings of the modern era in the surroundings of Unesco monuments<sup>28</sup> and the Department of Traditional Settlements and Listed Buildings of the Ministry of the Interior, with further competencies in the protection of some of the modern buildings which sometimes overlap with the competencies of the Ephorate of Modern Monuments (Vyzantiadou and Selevista 2018,724), as there are designation decisions of both ministries. This overlapping of competencies has a negative impact on the protection of all listed monuments.

Secondly, the two different municipalities, in the area of which the WHM are located. The majority of them are found within the limits of the Municipality of Thessaloniki, while

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<sup>26</sup> Rotunda functions also as a church for the limited number of twelve liturgies (one per month) every year.

<sup>27</sup> The fortress was converted into a prison at the end of the 19th century by the Ottoman administration. After 1912 and the liberation of the city it was used by the Greek administration for the same purpose. Its operation as a prison was interrupted after complaints and judicial tensions in 1989, and afterwards the Heptapyrgio was assigned to the Ministry of Culture, Eptapyrgio: The Acropolis of Thessaloniki (2001), Exhibition catalogue, 9th Ephorate of Antiquities of Thessaloniki, Thessaloniki

<sup>28</sup>Presidential Decree 4 FEK A' 7/22.01.2018 Organization of the Ministry of Culture and Sports

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the northern-eastern part of the Byzantine Walls falls within the boundaries of the Neapolis-Sykies Municipality. Moreover, responsible for the operation of the monuments in the context of their regular religious use are the Ecclesiastic authorities, mainly the Holy Metropolis of Thessaloniki and secondly the Holy Patriarchate of Constantinople to which the Monastery of Vlatadon and the St Nikolaos Orphanos (metohi of the Vlatadon Monastery) belong. Last and most important, the Ephorate of Antiquities of the City of Thessaloniki, the competent regional service of the Ministry of Culture, together with the Central Service of the same Ministry and the Central Archaeological Council, which supervise and coordinate the protection and management of all Unesco monuments in the Greek territory, are the main official bodies for the protection and management of Thessaloniki's Unesco Monuments.

### **3. World Heritage Convention and Sustainable Development-The framework of the research**

After their inclusion in the World Heritage Convention, the monuments of Thessaloniki entered a special category of increased prestige and recognition, which implies, at least theoretically, significant benefits for the city that hosts them: economic and developmental benefits in the context of tourism and especially cultural tourism, and social benefits as the monuments' high status is supposed to raise the self-esteem of the city's residents and consequently to foster the community's cohesion and feeling of local identity.

On the other hand, their inclusion in the World Heritage List created increased demands for their conservation, in terms both of human and material resources, while their protection against damage and distraction became an absolute priority which sometimes contradicts developmental projects and constructional activities.

To resolve this contradiction, the World Heritage Convention has stated<sup>29</sup> the concept of sustainable development; that each State-party “shall endeavor to adopt a general policy which aims to give the cultural and natural heritage a function in the life of the community and to integrate the protection of that heritage into comprehensive planning programmes (article no 5(a))<sup>30</sup>”. In the framework of the Convention, the concept of sustainable development will be further explained and enriched by the Budapest Declaration and the 5 Cs: Credibility (of the List), Conservation, Capacity Building, Communication and Communities as main pillars of sustainable development<sup>31</sup>.

Most recent development, under the influence of the 2030 Agenda of the United Nations for Sustainable Development<sup>32</sup>, is the adoption of a policy for the “*Integration of a*

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<sup>29</sup> In The World Heritage Convention the principle of sustainable development is proclaimed, perhaps for the first time in an international binding institutional text, with a then (1972) pioneering wording.

<sup>30</sup>Convention Concerning the Protection of the World Cultural and Natural Heritage, <https://whc.unesco.org/en/conventiontext/>

<sup>31</sup> Budapest Declaration on World Heritage (Decision 26 COM 9 and Decision 31 COM 13B), accessible from <https://whc.unesco.org/document/1358> and <https://whc.unesco.org/document/9192> respectively.

<sup>32</sup> Goal 11: Make cities and human settlements inclusive, safe, resilient and sustainable, target 11.4: Strengthen efforts to protect and safeguard the world's cultural and natural heritage

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*Sustainable Development Perspective into the Processes of the World Heritage Convention”* which emphasizes the dimensions of: Environmental Sustainability, Inclusive Social Development (underpinned by inclusive governance), Inclusive Economic Development and Fostering Peace and Security (in case of war, civil conflict and all forms of violence)<sup>33</sup>. Two of them, the Inclusive Social Development and the Inclusive Economic Development are the most relevant to the case of Thessaloniki’s Unesco monuments, and to urban heritage in time of peace. For the integration of a sustainable development perspective, the mentioned dimensions are analyzed in strategic Objectives, as following:

*Strategic Objectives:*

*Inclusive Social Development (III,17-23, p.6-8)*

- Contributing to inclusion and equity
- Enhancing of quality of life and well-being
- Respecting, protecting and promoting human rights
- Respecting, consulting and involving indigenous peoples and local communities
- Achieving gender equality.

*Inclusive Economic Development (III, 24-27, p.8-10)*

- Ensuring growth, employment, income and livelihoods
- Promoting economic investment and quality tourism
- Strengthening capacity-building, innovation and local entrepreneurship

The main tool, according to Unesco’s guidelines (2005)<sup>34</sup>, which should specify how the outstanding universal value of a property should be preserved, preferably through “participatory means”, (UNESCO: p. 26, par. 108) and the way and means to achieve the strategic objectives mentioned above is the Management Plan (or any other documented management system) which from 2005 onwards became obligatory for all inscribed sites and a prerequisite for every new inscription. The management plan constitutes the basis of effective management and includes, among others, a thorough shared understanding of the property by all stakeholders, a cycle of planning, implementation, monitoring, evaluation and feedback and the involvement of partners and stakeholders (Operational Guidelines 2005, par.108).

A mechanism of monitoring the implementation of the declared policy has also been established under the World Heritage Convention, called “Periodic Reporting”<sup>35</sup>. Every six years or so, the States Parties are invited to submit to the World Heritage Committee a Periodic Report on the implementation of the World Heritage Convention in their territory.

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[https://sdgs.un.org/goals/goal11#targets\\_and\\_indicators](https://sdgs.un.org/goals/goal11#targets_and_indicators)

<sup>33</sup>Policy Document for the Integration of a Sustainable Development Perspective into the Processes of the World Heritage Convention, as adopted by the General Assembly of States Parties to the World Heritage Convention at its 20th session (UNESCO, 2015), p. 4, par.III,13. <https://whc.unesco.org/en/sustainabledevelopment/>

<sup>34</sup>Operational Guidelines 2005 for the Implementation of the World Heritage Convention, Intergovernmental Committee for the Protection of the World Cultural and Natural Heritage, World Heritage Centre par. 108, p.26

<sup>35</sup>World Heritage Convention, article 29, <https://whc.unesco.org/en/periodicreporting/>



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The process lasts for a period of six years approximately and is conducted through questionnaires completed by the responsible site managers in each country. Information on legislative and administrative provisions and other actions taken for the application of the Convention is provided. These questionnaires are sent to the World Heritage Centre where regional reports are developed (Greece belongs to the region of Europe and North America, subregion of Mediterranean). Then the regional reports are examined by World Heritage Committee and recommendations are formulated to the State Parties on compliance with the objectives of the Convention. In the final stage, regional action plans are created, setting priorities and goals at a regional level<sup>36</sup>. Two cycles of Periodic Reporting have been completed until now-2006 and 2015-and a third one began in 2018 and is still ongoing.

### 4. Working hypothesis and Methodology

Regarding the research on the policies for protection and management of Thessaloniki's WH Monuments our aim is to examine to what extent the Unesco's policy for the integration of a sustainable development perspective in the processes of World Heritage Convention is implemented in the case of the WHM of Thessaloniki, focusing to the social and economic dimensions and their strategic objectives, some of which were used as the base of the field survey and as axes for our analysis. The strategic objectives which were chosen as the most suitable for the case of Thessaloniki were: the “contributing to inclusion and equity”, the “enhancing of quality of life and well-being” and the “respecting, consulting and involving indigenous peoples and local communities”, as to the inclusive social development dimension, and the “ensuring growth, employment, income and livelihoods and “promoting economic investment and quality tourism”, as to the inclusive economic development dimension.

A series of questionnaires has been developed to be delivered to certain groups of users (university students, citizens and residents-members of Non Governmental Organizations active in the protection of the monuments, professional guides, tourists) together with a series of semi structured interviews addressed to experts and responsible managers of the main bodies involved in the management (public, municipal and ecclesiastic authorities) of the monuments. At the same time a systematic recording and documentation of the state in and around the monuments is taking place through regular visits. The questionnaires of the three cycles of Periodic Reporting (2006, 2015 and 2023-still under process) answered by the responsible for the site's management public body—the Ephorate of Antiquities of the City of Thessaloniki were used as a guide for the formulation of the main research questions and the elaboration of the survey questionnaires and interviews. The research focuses on the event of the visit to the World Heritage Monuments and the issues connected to it. The visit is, in our opinion, the crucial event for the interaction of the monument with the public and a reliable indicator of the achievement of the goals of Unesco's sustainable development policy.

The survey is still ongoing but the first results seem to confirm and enrich with more quantitative data and qualitative details the questionnaires of the Periodic Reporting and the

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<sup>36</sup>Operational Guidelines 2024 for the Implementation of the World Heritage Convention, Intergovernmental Committee for the Protection of the World Cultural and Natural Heritage, World Heritage Centre , par. 199-210, p.62-64 <https://whc.unesco.org/en/guidelines>.



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observations made on the field. These latter form the basis of the remarks on the management of the site we are going to present here.

### **5.The management of Thessaloniki’s World Heritage Monuments: some remarks on the management system and emerging issues**

In the case of Thessaloniki, there is no management plan and this is the situation for the majority of the sites of the Greek World Heritage List<sup>37</sup>. The management system of Unesco’s Monuments hasn’t changed much since the date of inscription, 1988. The Ephorate of Antiquities of the City of Thessaloniki (regional service of the Ministry of culture) is the responsible body for the protection, and the Central Service of the ministry supervises and coordinates all the works and activities concerning the WHM.

The legal framework for the protection of Thessaloniki’s Unesco monuments (and of Unesco Monuments in general) is the Law 4858/2021 “Codification of the law “On the Protection of Antiquities and Cultural Heritage in general” (known also as Archaeological Law)<sup>38</sup> and the competent Ephorate of Antiquities is the main governmental body responsible for its implementation.

The main obligation for every State Party of the World Heritage Convention is to preserve the outstanding universal value of the site together with integrity and authenticity (<https://whc.unesco.org/en/list/456>). Under the supervision and guidance of the Ephorate many conservation and enhancement works have been carried out in the monuments, in some cases with great success, like the exemplary restoration works in St. Panteleimon (the Europa Nostra award 2000) and the enhancement of the outer perimeter of the eastern part of the Byzantine Walls. Since 2022 a major program of restoration and enhancement of many monuments inserted in the urban web, the Unesco monuments among them, is running<sup>39</sup>. Moreover, the Ephorate controls the surrounding area of the monuments imposing prohibitions and restrictions in constructional works and various activities (commercial and recreational) in order to protect effectively the WH monuments.

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<sup>37</sup>Only three of the inscribed sites of the Greek World Heritage List have management plan: the Old Town of Corfu (inscribed in 2007), the archaeological site of Philippoi (inscribed in 2016) and Zagori Cultural Landscape (inscribed in 2023). The project of the Ministry of Culture “Drafting of management plans for the monuments and sites of Greece inscribed in the World Heritage List of UNESCO” aimed to fulfill this obligation towards Unesco. It was initiated in 2018 and had as deadline the end of June 2022. The outcomes are still anticipated.

<sup>38</sup> There are also separate Ministerial Decrees for each monument which define boundaries and specific terms of protection.

<sup>39</sup> The conservation programme is funded by Recovery and Resilience Facility Loans and ESPA (Corporate Pact for Development Framework) and comprises the following Unesco monuments: the **churches of Acheiropoitos**, St. Sofia , Panagia Chalkeon, St. Aikaterini, St. Nicholas Orphanos, Profitis Ilias, Rotunda and the Byzantine Walls (northern and western parts).

[https://www.facebook.com/profile/100068773424009/search/?q=Unesco%20monuments&locale=el\\_GR](https://www.facebook.com/profile/100068773424009/search/?q=Unesco%20monuments&locale=el_GR)

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Despite the efforts of the Ephorate, the surrounding area often does not contribute to the enhancement of the monuments and their value, due to factors related to the major problems of the city referred above (lack of open spaces which could have been designated as buffer zones and could have been landscaped, concentration of garbage bins in the vicinity of the monuments, air pollution, noise pollution due to the vehicles' circulation and sometimes to the establishment and operation of entertainment businesses in the area near the monuments.), problems which the Ephorate is not the only competent to address and often has not the means to solve, and the solution of which depends on other bodies and authorities (partly on the municipal authorities)<sup>40</sup>. The involvement of the administrative bodies and services responsible for the numerous listed buildings in the surroundings of the World Heritage Monuments and the wider protected ensembles of the “historical place” and the “traditional settlement” (the Ephorate of Modern Monuments and Technical Works and the Department of Traditional Settlements and Listed Buildings) make the task of protection even more complicated.

Another factor affecting the state of many of the monuments is their regular use as churches. As some scholars observe, the coexistence in a religious site of secular and religious values amplifies the contrast between private and collective interests further increasing the level of management complexity (Presti and Petrillo 2010, 306). Special facilities and equipment are demanded for the conduction of liturgies and other ceremonies, while sometimes interventions take place (like repairs, changes of flooring, painting of walls, installations of lighting or heating and cooling appliances) incompatible with the character of the monuments with the responsibility of the Ecclesiastic authorities and against the restrictions and prohibitions imposed by the Ephorate<sup>41</sup>. The needs and demands of the users, who attend the liturgies or participate in special ceremonies and events such as weddings, baptisms, etc., have also impact on the state of the Monuments, sometimes negative. For example, it is not rare the courtyards of the churches to be used as parking areas by the participants in these religious mysteries and social events.

The lack of coordination among the different Services, bodies and authorities has a serious impact on the state of the monuments and a subsequent negative effect in the enhancement of the monuments degrading their surrounding area and the quality of the visit. This fragmentation extends to other aspects of the protection and management such as the presentation and promotion of the distinguished assets on the internet. This becomes obvious even from the initial stage, when someone attempts to collect the necessary information for the organization of the visit. Each of the involved bodies and authorities provides in its website the part of the information considered the most significant depending on the organization's character and interests. For example, the Ephorate is more concerned for the

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<sup>40</sup> These problems were created during the evolution and transformation of Thessaloniki in a modern Greek city and unfortunately constitute the pathology of the majority of Greek cities.

<sup>41</sup> The relations between the two bodies vary from an harmonious cooperation to a deep conflict depending on the circumstances and the specific persons involved every time. Characteristic is the case of Rotunda the function of which was at the heart of the dispute between the Ministry of Culture and the Ecclesiastic authorities.

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presentation of the scientific content of the monuments<sup>42</sup>, the Holy Metropolis is interested in the religious function, the Municipality of Thessaloniki<sup>43</sup> tries to promote the monuments as major visitor attractions and main component of the city’s unique cultural identity<sup>44</sup>. There are also other stakeholders in the tourism sector like the NGO “Tourism Organization of Thessaloniki” and many private travel agencies that promote the visit to the Unesco Monuments of the city<sup>45</sup>. In any case, the information is never complete (Zygomalas 2023, 28). A crucial element for the organization of a visit, that is usually missing, is the opening hours of the monuments. The opening hours differ between the secular and religious monuments, as the first ones are supervised as to their operation by the Ephorate and the religious ones by the Metropolis. The access to the monuments is also another problematic point for the organization of the visit as specific instructions concerning the means of transport or the traffics’ circulation are usually absent<sup>46</sup>. As a result, organizing a visit to the monuments, especially to some of them is not such an easy task.

In a second stage, during the visit, there are other problems for the visitor to face. There is no visitor’s management plan for any of them and the visitor has no guidance as to his movement into the monument. There are no visitor facilities like rest areas and toilets and things become even more difficult for persons with special needs and disabilities or for other categories of the population like mothers with pushchairs and babies. We have to mention the realization, with the responsibility of the Ephorate of Antiquity of the City of Thessaloniki, of

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<sup>42</sup>[http://odysseus.culture.gr/h/3/gh3530.jsp?obj\\_id=9141](http://odysseus.culture.gr/h/3/gh3530.jsp?obj_id=9141),

<https://storymaps.arcgis.com/stories/a10838af2a024c2aa7be58c2e9737de9>,

<sup>43</sup><https://thessaloniki.gr/i-want-to-know-the-city/discover/unesco-monuments/?lang=en>, all accessed on 04/08/2025

<https://thessaloniki.travel/el/exerevnontas-tin-poli/thematikes-diadromes/palaiochristianiki-vyzantini-diadromi/page/2/>, accessed on 04/08/2025

<sup>44</sup><https://www.dimosneapolis-sykeon.gr/%CE%B7-%CF%80%CE%BF%CE%BB%CE%B7-%CE%BC%CE%B1%CF%82/%CF%80%CE%B1%CF%81%CE%BF%CF%85%CF%83%CE%B9%CE%B1%CF%83%CE%B7-%CF%80%CE%B5%CF%81%CE%B9%CE%BF%CF%87%CE%B7%CF%82>, As to the Municipality of Neapolis-Sykeon, although in the official website, Heptapyrgion and the byzantine walls are referred as the most characteristic sights of the Municipality, nowhere is mentioned that they are listed as Unesco monuments.

<sup>45</sup><https://www.thessalonikitourism.gr/index.php/en/history-culture-2/unesco-en>, <https://bestofthessaloniki.com/thessaloniki-monumental-unesco/>, <https://thessalonikiblog.com/el/%CE%BC%CE%BD%CE%B7%CE%BC%CE%B5%CE%AF%CE%B1-unesco-%CE%B8%CE%B5%CF%83%CF%83%CE%B1%CE%BB%CE%BF%CE%BD%CE%AF%CE%BA%CE%B7%CF%82-%CE%B7%CE%BC%CE%AD%CF%81%CE%B1-1/> all accessed on 04/08/2025.

<sup>46</sup> For example there is a map for Unesco Monuments edited by the Municipality of Thessaloniki, which contains adequate historical information about the monuments but no instructions on how to get there. <https://thessaloniki.gr/wp-content/uploads/2017/02/Thessaloniki-Unesco-Monuments-Map-GR-ENG-Web.pdf>

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the project “Prospelasis” a very important effort to improve the monument’s accessibility<sup>47</sup>. In the framework of this program, interventions were carried out in six of the fifteen World Heritage Monuments<sup>48</sup>. The interventions aimed to improving physical and sensory accessibility and in general included installations of lifts, metal platforms and ramps (and an accessible toilet in one case) and of wi-fi information systems. It has been almost 15 years since this remarkable effort, and it has been no extension to the rest of monuments, neither follow up to the previous ones.

Moreover, there is no in situ information, neither digital nor printed, especially in many of the religious monuments. There are some signs placed by the Municipality of Thessaloniki which provide only some basic information on the monuments and without any reference to the World Heritage status<sup>49</sup>. So, in case of individual visitors not accompanied by a professional guide, a previous preparation and knowledge is demanded, otherwise is difficult to understand the historical and artistic importance of the monument and to appreciate its unique universal value.

All the factors mentioned above, the major problems of the city that affect the state of the surrounding area, the problems caused by the religious function of the monuments (desirable as it is the original use but sometimes problematic), the fragmented and ultimately incomplete presentation of the monuments on internet, the lack of scheduled visit and visitor facilities and of in situ information in the majority of the monuments, are degrading the visitor’s experience. Moreover, there is no connection to tourism industry and the private sector (commercial and recreational activities, enterprises in the surroundings of the monuments). As a consequence, the ability of the WHM monuments to function as major attractions for cultural and religious tourism is shrinking and this fact affects negatively the achievement of the objectives of Inclusive Economic Development.

Specific categories of visitors are more related with the social dimension of sustainable development like the members of the educational community of Thessaloniki, pupils and students of the numerous primary and secondary schools of the city and students of the universities<sup>50</sup> with their teachers and professors. For all of them, the monuments constitute an important educational resource which remains to a considerable extent unexploited. Educational programs and guided tours adapted to the different ages and educational needs are very limited<sup>51</sup>, due to various reasons, mainly to the lack of staff and to the many and

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<sup>47</sup>The other partner of the project was the Aristoteleion University of Thessaloniki, Research Group for Transportation System (coordinator: professor Aristoteles Naniopoulos) <http://prospelasis.com/project/antikeimeno-stoxoi-toy-ergoy> accessed on 04/09/2025

<sup>48</sup> Church of Acheiropoietos, Church of Saint Demetrios (Hagios Dimitrios), Church of Nicholas Orphanos, Church of Hagia Sofia, Rotunda, Heptapyrgion Fortres <http://prospelasis.com/sites/default/files/pdf/d7.pdf> accessed on 04/09/2025

<sup>49</sup> The Unesco emblem either is not displayed or it is placed at a discrete, relatively obscure point (Zygomalas 2023, 24).

<sup>50</sup> Aristoteleion University of Thessaloniki, University of Macedonia, International Hellenic University.

<sup>51</sup>Educational programs are conducted by the Ephorate of Thessaloniki in specific monuments (principally in the Heptapyrgion) and for a certain period of the year

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complicated other duties the staff the staff of the competent Ephorate has to accomplish. So, usually the educational success of the visit depends on the initiative and good will of the teachers and professors or on the knowledge and inspiration of a professional guide. Apparently, it has not been established a regular and systematic communication and cooperation between the managerial authorities of the Monuments and the educational institutions of the city.

The same is true for the organization of cultural events, usually with the initiative of municipal or regional authorities who ask for the permission of the Ministry of Culture to use the Monuments-a difficult and time-consuming process. The Central Archaeological Council is the responsible body to grant the permission and impose terms and restrictions on the event in order to protect the monuments (number of spectators, kind of equipment, etc.) upon the suggestion of the competent Ephorate. As a result, the number of cultural events is relatively limited and their occurrence is irregular. A bright exception, two cultural institutions that have been created recently, the Heptapyrgion Festival, an initiative of the Prefecture of Thessaloniki in cooperation with the Ephorate which since 2019<sup>52</sup> takes place in the fortress of Heptapyrgion every summer, and the Worship Week, an initiative of the Municipality of Thessaloniki<sup>53</sup> under the aegis of the Holy Metropolis of Thessaloniki, which, since 2024, takes place mainly in the WH Monuments of Thessaloniki (Rotunda, St. Demetrios, St. Sofia, Acheiropoiitos) one week before the Passion Week.

The difficulties and deficiencies before and during the visit affect negatively the frequency and the quality of the visitor's experience. The interaction of the monuments with the public (the general public or specific segments of it like the student population or the audience of cultural events) remains limited and to a certain degree superficial and WH Monuments' potential for education, equity and well-being is not fully exploited. Moreover, citizens and local communities are by law excluded from the management of the Monuments. Nevertheless, we cannot fail to mention the organizations of citizens and residents active in the protection of the city's monuments, among them the UNESCO ones, like the “Friends of the Historical Centre of Thessaloniki”, “Friends of Thessaloniki's Monuments”, “Friends of Rotunda” and others.

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[https://www.facebook.com/profile/100068773424009/search/?q=%CE%B5%CE%BA%CF%80%CE%B1%CE%B9%CE%B4%CE%B5%CF%85%CF%84%CE%B9%CE%BA%CE%AC%20%CF%80%CF%81%CE%BF%CE%B3%CF%81%CE%AC%CE%BC%CE%BC%CE%B1%CF%84%CE%B1&locale=el\\_GR](https://www.facebook.com/profile/100068773424009/search/?q=%CE%B5%CE%BA%CF%80%CE%B1%CE%B9%CE%B4%CE%B5%CF%85%CF%84%CE%B9%CE%BA%CE%AC%20%CF%80%CF%81%CE%BF%CE%B3%CF%81%CE%AC%CE%BC%CE%BC%CE%B1%CF%84%CE%B1&locale=el_GR) Accessed on 04/10/2025

<sup>52</sup><https://kepo.gr/festival/#> Accessed on 04/10/2025

<sup>53</sup><https://thessaloniki.travel/el/event/%CE%BB%CE%B1%CF%84%CF%81%CE%B5%CF%85%CF%84%CE%B9%CE%BA%CE%AE-%CE%B5%CE%B2%CE%B4%CE%BF%CE%BC%CE%AC%CE%B4%CE%B1/> According to the statements of the Mayor of Thessaloniki St. Aggeloudis the Worship Week is anticipated to be a starting point for the promotion of Religious and Pilgrimage Tourism in Thessaloniki. <https://e-thessalonikiculture.gr/latreftiki-evdomada/>, accessed on 04/10/2025

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As a consequence of the above, the objectives of Inclusive Social Development, the citizens' wellbeing and the local communities' participation are difficult to achieve, under the circumstances.

These field observations are confirmed by the assumptions of the competent Ephorate of Antiquities to the questions of the Periodic Reporting questionnaires. So, as to the inclusive economic development, the Ephorate admits that there is only some flow of economic benefits to local communities (Periodic Reporting 2014 par.4.4.5,) while the relationship and the cooperation of the World's Heritage property managers with tourism industry is characterized as “fair” in 2014 (Periodic Reporting 2014 par.4.3.7) and “good” in 2023 (Periodic Reporting 2023, 5.3.16.10), although admitting that, regarding to improving the visitor's experience, the contact is “largely confined to administrative and regulatory matters” (Periodic Reporting 2023 9.11).

As to the adequacy of the visitor facilities and services for education, information, interpretation and awareness building, the situation doesn't seem to have significantly changed since 2006 and is characterized as “poor” in the questionnaire of 2023, the website and other online information included (Periodic Reporting 2023, 8.4). Additionally, the existent planned education and awareness programme only partly meets the needs of the public and could be improved, consequently and the influence of World Heritage status on education, information and awareness building activities (Periodic Reporting 2014 4.6.3). Especially for children and youth there is “a limited and ad hoc education and awareness programme” (Periodic Reporting 2023, 11.8.2.)

As to the role of local communities, since 2006 it is stated that it is not possible to involve local people in the management (Periodic Reporting 2006, par.11), as there are no mechanisms for participation (Periodic Reporting 2023, 5.3.15.1.) while the relationship and the cooperation of the World's Heritage property managers with local residents and communities and with local/municipal authorities is characterized as “fair” (Periodic Reporting 2014 par.4.3.7). In the questionnaire of 2023, it is referred only some participation of local authorities (Periodic Reporting 2023,5.3.15.2) but the cooperation is characterized as good (Periodic Reporting 2023, 5.3.16.2).

The extent to which the management system contributes towards achieving the objectives of World Heritage Committee's “Policy for the Integration of a Sustainable Development Perspective into the Processes of the World Heritage Convention” is rated as “full achievement” for social inclusion and equity (Periodic Reporting 2023 5.3.17.3.) and as “significant” to fostering inclusive local economic development and to enhancing livelihood (Periodic Reporting 2023 5.3.17.5).

### **6. Some thoughts on a different approach for the management of Thessaloniki's WHM**

It becomes evident that the current management system is not capable to achieve the strategic objectives and the targets of Inclusive Economic and Social Development perspective. The complexity of problems in an urban context in combination with the overlapping



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competencies and the lack of coordination<sup>54</sup> among different administrative bodies and levels of administration don't support the implementation of inclusive policies of sustainable development. The system seems more successful as to the conservation of the monuments and the implementation of a consistent conservation policy<sup>55</sup>. As to the visitor's experience, some great efforts have been done in the past, like the “Prospelasis” project but unfortunately since then it has been no continuity or follow up. Regarding the use and the conduct of cultural events, the initiatives of local authorities and the establishment of synergies with the Ephorate of Antiquities and the Holy Metropolis have been proven effective for the creation of institutions like the Heptapyrgion Festival and the Worship Week. These few successful examples offer a strong argument for the importance of the establishment of a stable status for participation and cooperation of all the involved stakeholders.

The Unesco's requirement for inclusive governance presupposes the institutionalized participation of all stakeholders with clear and defined responsibilities in a single management body. This steering group could take quick and effective decisions and propose comprehensive solutions, taking into account the dimensions of economic and social sustainability.

In the core of such a proposal lies a different notion for the object of protection. Though they do not form a coherent in the space ensemble, Thessaloniki's WH Monuments should not be treated as isolated, separate monuments.

In our opinion, a landscape approach would be more suitable for the case of Thessaloniki because of all the special characteristics mentioned above. The great number of monuments, the loss of their original context, their strong spatial integration in the tissue of the modern city, the dispersion in the designated areas of the Historical Centre and Upper Town, the coexistence with numerous other important monuments of various eras together with the contemporary buildings, the combination of tangible and intangible heritage in the religious monuments, the variety of users and stakeholders, and finally the specific geographical position and topographical features (peril of the impact of Climate change) of the city advocate for the usefulness of a broader concept as the basis for their management. Unesco's Recommendation (2011) on Historic Urban Landscape, a tool which has not been utilized until now (Periodic Reporting questionnaire 2023 5.3.5) offers perhaps an alternative basis for the management of Thessaloniki's monuments.

The Recommendation recognizes the results of rapid and uncontrolled urbanization, like the excessive building density, the loss of public spaces, the standardization and monotony of the building environment, the debilitating poverty and the social isolation, the increasing risk

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<sup>54</sup>According to the 2023 questionnaire, paragraph "Identification of Priority Management Needs": “There is coordination between the range of administrative bodies involved in the management of the property, but it could be improved “(2023, 11.1.5.3.11).

<sup>55</sup>This management system is very close to the so-called “material based approach” of heritage conservation which focuses on the preservation of the material fabric (Poulios 2014a 19, Poulios 2014b, 17) and is driven by experts, mostly state-appointed heritage authorities manned by conservation professionals while community is not taken into account (Poulios 2014b,18). The difference, in our opinion for the case of Thessaloniki's monuments, is that the Holy Metropolis is also actively involved as the main administrator of the religious use.

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of climate relating disasters and finally the social and spatial fragmentation and the deterioration of the quality of life in urban areas. It considers urban heritage a key resource in fostering economic development and social cohesion and in achieving a balance between urban growth and the quality of life on a sustainable basis (Introduction.3).

According to the Recommendation’s definition, the “historic urban landscape” is an urban area understood as the result of an historic layering of cultural and natural values and attributes, extending beyond the notion of “historic centre” or “ensemble” to include the broader urban context and its geographical setting (I, par.8)<sup>56</sup>. In the context of the “Historic Urban Landscape” both tangible and intangible heritage are included in equal terms. This broad, unifying and dynamic notion is closer to the complexity of the contemporary landscape of the Historical Centre and the Upper town, where the Unesco monuments are scattered and inextricably linked, spatially and visually, with various other monuments and contemporary constructions, rich in historical references, social memory and cultural meaning. In this context of a rich building stock and of multiple layering due to the uninterrupted habitation, this approach advocates for a shift of urban heritage conservation from individual architectural monuments towards a broader recognition of the importance of the social, cultural and economic processes in the conservation of the urban values (Introduction 4). In this way, the historic urban landscape provides the basis for the identification, assessment, conservation and management within an overall sustainable framework (I.10), involving a variety of stakeholders, including local, national, regional, international, private and public actors (Introduction.6).

Thessaloniki is probably the most appropriate case for the implementation of this Recommendation. In view of the drafting of a Management Plan that the country is obliged to submit at some point in the immediate future, the separate fragmentary initiatives could be organized to consistent policies related to the broader urban context, in the framework of historic urban landscape’s approach. The effective conservation of the Unesco Monuments and of their outstanding universal value cannot be discerned from the rest of the tangible heritage of the city or from their intangible content which continues to be enriched through regular use. The planning of short and long term actions in all related sectors of protection and management and the assurance of their continuity would optimize and add value to the anticipated benefits. The need for coordination of all the involved administrative bodies and the demand for the participation of local communities (local authorities, NGOs of active citizens, and individual residents) could be met by the creation of a single management body. In this way, the conservation policy would integrate with the goals of inclusive economic and social sustainable development policy and the enhancement of the universal value of the distinguished monuments with the interaction of the public with the urban heritage and the subsequent social and economic benefits.

In the case of Thessaloniki’s World Heritage Monuments, the possibility of restoring their original context has been lost forever (perhaps a last chance was the byzantine avenues and monumental squares uncovered during the excavations of the city’s subway). The surroundings of the monuments have changed many times and continue to change, and traces

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<sup>56</sup><https://whc.unesco.org/uploads/activities/documents/activity-638-98.pdf>

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of these transformations are still standing or have been revealed through excavations of the architectural palimpsest of the city. The WH monuments, however, remain constant reference points in the neighborhoods of the Historical Centre and the Upper Town, sometimes more and sometimes less visible, and they are still being made meaningful by the daily movement and activity of the residents and visitors of the town. This landscape may not exactly be compatible with the ideas and requirements of the conventional heritage enhancement, but it is unique. The monuments have become an integral part of the city and can only be treated as such. And then perhaps what at first seems like the most significant threat to the WHM, “the location within the urban tissue of Thessalonika, which is continuously changing” (Periodic Reporting 2006, par. 12), will become the greatest opportunity for the Monuments and the City.

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## **THE LEGACY OF HIPPOCRATES IN THE MODERN WORLD AIMING AT WELL-BEING AND SUSTAINABILITY. THE CASE OF KOS.**

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### **Abstract**

The aim of the paper is to highlight how the 2500-year legacy of Hippocrates, "Father of Medicine", through his vast scientific work, can be utilized in the modern world, at well-being and sustainability, based on values able to improve our lives with a holistic approach.

If well-being is the result of the “art of living”, then Hippocrates is more relevant than ever to guide us through his valuable advice and the value system that runs through it.

Well-being. Meaning:

- Wellness, Physical and Mental Health, Reflects the quality of the social values.
- “Health is a state of complete physical, mental and social well-being”, Hippocrates said before 2.500 years

Hippocrates the Coan (of Kos) 460 B.C.- 370 B.C. , “Father of Western Medicine”, is the first holistic physician, philosopher and teacher with a 2500-year-old heritage of knowledge .

“HIPOOCRATIC OATH” is the basis of the Geneve Declaration, 1947. It is the most important ethical document for the behavior of the physicians after the World War II.

HIPPOCRATIC GARDEN. At least 250 plants are mentioned in the Hippocratic Collection. His Pharmacology is still the source to identify and isolate several modern medicaments like Aspirin against fever, Coumarines for anticoagulation, Ephedrine against cough, Vincristine against cancer, Tamoxiphen against breast cancer, and many others

Kos transformation, in a sustainable way, with ESG practices can be widely inspired by his advices for health and well-being.

Guest experience in Kos will be inspired from Hippocrates's quotes. We’re sharing his quotes so we can benefit from his wisdom and his philosophy.

Hippocrates is a heritage of Kos. His advices lead Kos the way achieving well-being. The hotels, the destination, can develop a strategy to support the Sustainable Development Goals and actively to implement them.

**Key words:** Hippocrates, Sustainability, Culture, Heritage, Well-being, Kos, Tourism



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### **OPTIMIZING DESTINATION MANAGEMENT: THE ROLE OF BIMs IN PROMOTING CULTURAL HERITAGE AND SUSTAINABILITY**

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#### **Abstract**

The objective of this work is to investigate the relationship between Business Information Models (BIMs) in tourism and cultural tourism sustainability, as a foundation for effective destination management. Within the tourism sector, there exists a wide variety of business models, each designed to address specific customer requirements. The competitive environment in which these models are developed, defines their objectives and operational methodologies based on the specific needs they aim to address. By aligning their goals to meet market demands and adjusting their operations accordingly, they ensure their relevance and efficacy within the tourism industry.

The analysis aims to categorize the most well-known and widely used BIMs in the field of tourism services and to collect tourist experience models for travellers to align them (matching) with data and expert activities. BIMs are also utilized to facilitate the creation of extended destination profiles, offering critical insights into cultural resources, tourist demand, and the carrying capacity of a destination. This leads to strategic planning that mitigates over-tourism and supports the sustainable utilization of cultural assets. The fact that these models aid in data-driven decision-making enables the development of policies that prioritize local community participation and integrate their needs into tourism strategies. Through their data analysis and management capabilities, they enhance the development of strategies that promote sustainability, focusing on cultural heritage preservation and supporting local needs. Furthermore, by analysing visitor preferences and behaviors, these models help identify tourists who are inclined towards sustainable practices and cultural appreciation. This ensures the attraction of a visitor base oriented towards sustainability goals.

Another aspect considered in this paper is the use of artificial intelligence in destination management, not only for the deeper understanding of tourists' needs but mainly for stakeholders responsible for creating customised branded experiences rather than uncoordinated visitor experiences. Finally, this paper highlights the significant role of BIMs

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in connecting tourism development and sustainability, demonstrating their potential for an inclusive approach to destination management. By integrating advanced information models into tourism practices, the paper contributes to a deeper understanding of how technology and data can drive sustainable cultural tourism strategies.

**Key words:** Business Information Models, AI in tourism, cultural tourism, sustainability

### Introduction

Tourism represents one of the most powerful economic and developmental sectors globally but currently, many destinations are unable to effectively respond to the increasing tourist demand and the challenges that come with. Sustainability is now a central focus in the evolution of business models within the tourism sector. The dominant trend is a shift toward integrating environmental, social, and economic sustainability into core business strategies, with growing emphasis on innovation, collaboration, and inclusivity as well as appropriate planning that addresses both emerging challenges and capitalizes on new opportunities. Understanding the impacts and issues associated with sustainable tourism development in business models is essential for focusing on more effective and sustainable management strategies, benefiting both local communities and visitors.

Achieving sustainable tourism management requires balancing the often-conflicting needs and interests of various stakeholders and at the same time recognizing the interconnected nature of these relationships. Managing such dynamics demands for active participation and collaboration among all parties involved, each respecting the role of the others. Moreover, tourism is recognized as a key sector for advancing the UN Sustainable Development Goals (SDGs), with research showing that tourism activities are associated with 14 out of the 17 SDGs. Tourism can positively impact goals such as poverty reduction, gender equality, economic growth, and sustainable communities, but can also have negative effects on goals like health, gender equality, and environmental sustainability if not managed responsibly (Poulimenou et al, 2022; Makhdoom et al, 2024). Sustainable business models in tourism, such as those based on the circular economy or inclusive business practices, are being discussed and implemented to align with the SDGs.

These models focus on reducing negative impacts and maximizing positive contributions to society and the environment (Rosato et al, 2021). Furthermore, there is a move toward transforming traditional business models into green or sustainable business models (SBMs), often requiring significant innovation in products, technology, and organizational processes (Elmo et al, 2020). Taking the above into consideration, this research has been initiated in the framework of a European co-funded project, named “Indiana: Intelligent Management System”, implemented by Ionian University, Corfu Greece in collaboration with DOTSOFT S.A.. The INDIANA project involves the research, design, and development of an innovative platform that disseminates tourist and cultural Points of Interest (POIs) to travelers, on a highly personalized level, with the use of state-of-the-art technologies, Big Data and Artificial Intelligence.

**The Evolution and Significance of Business Models in the Digital Economy and Tourism**

In today's world, both mature and developing tourism markets are indeed facing new conditions that require the redesigning and updating of their strategies. Emerging markets, in particular, are in need to implement robust and innovative marketing strategies tailored to their unique characteristics and needs (Zhao, 2023). Businesses, institutions and policy makers are currently looking for ways to promote and consolidate a sustainable presence, responding to multidimensional tourism behavior (Conti et al, 2023). Over the past decade, the traditional value chain of tourism services has been strongly challenged due to various factors such as intense competition that goes beyond the traditional boundaries of the industry, technological progress that brings about rapid changes in the business environment, diversified tourism behavior in the post-COVID period, new regulatory and normative requirements requiring increased adaptability (Gruchmann et al, 2022). These conditions inevitably lead to a reshaping and re-approaching of the tourism market.

Within this context, the creation, capture and diffusion of business value are re-examined, with business models taking on a central role in both academic research and management practice. Business models research reveals that there is an urgent need for innovation to overcome outdated practices (Geissdoerfer et al, 2018; Velu, 2024), while the analysis of traditional and digital business models showcases that they are characterized by flexibility, scalability, highlights the use of modern technologies (such as VR, AR, booking platforms, Big Data, and Machine Learning) and their interconnection with social networks and digital interaction with customers.

Today, business models have become a central focus in academic research and professional practice, including the tourism sector, as is evident by the literature review. Over the decades, the definition of business models has expanded, covering diverse applications and interpretations. Research by Zott, Amit, and Massa (2011) traces the term's academic origins to the 1970s. DaSilva and Turkman (2014) and Novak (2014) trace its first scholarly mention in 1957. Since then, references to business models have surged, reflecting their growing importance. Researchers and scholars have proposed various definitions: Hamel (2002) describes a business model as "a way of doing business," while Tikkanen et al. (2005) define it as a system composed of structural and cognitive elements. Despite initial critiques of the term as simplistic (Magretta, 2002; Ghaziani et al, 2005; Seddon et al., 2004), business models have gained prominence in academic discourse (Zott et al., 2011; DaSilva et al, 2014; Massa et al., 2017). Baden-Fuller and Morgan (2010) introduced the notion of business models as "templates" that can be replicated.

Early studies linked business models to strategy (Porter, 2001; Magretta, 2002), while George and Bock (2011) explored their integration with theoretical frameworks. Veit et al. (2014) positioned business models as an intermediary layer between corporate strategy and operational processes. The present study adopts the definition by Zott and Amit (2010), which views a business model as a structured set of activities, along with the resources and capabilities necessary for execution, either within a firm or through collaborations with partners, suppliers, and customers. This definition underscores the role of resources and value chains in shaping business operations. The digital era has revolutionized business activities through technologies such as Industry 4.0, the Internet of Things (IoT), cloud computing, big

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data, and blockchain, reshaping value creation and business practices. The intersection of digital technology and business model innovation is now well-established, with researchers offering diverse interpretations. Some equate digital business models with technology-driven frameworks like IoT-based models, while Katunskis and Neamtu (2016) examine them through the lens of Industry 4.0. Veit et al. (2014) define digital business models as those in which "changes in digital technologies drive fundamental transformations in business operations and revenue generation." This perspective highlights the disruptive impact of information and communication technologies, particularly in the tourism sector. The adoption of digital innovations not only redefines processes and strategies but also necessitates continuous adaptation to evolving market conditions.

A business model defines how a company creates, delivers, and captures value, forming the foundation for revenue generation, customer targeting, and product or service offerings. Key components include cost structures, distribution channels, customer relationships, and strategic partnerships. Common business models range from subscription and freemium to direct sales, franchising, and e-commerce, each providing a structured roadmap for operational success and competitiveness. Tourism business models are diverse, addressing specialized traveler needs. The industry's evolving nature demands constant adaptation to technological advancements and shifting consumer preferences. In the framework of this study, we have examined core business models and mainly focused on marketplaces that lie on digital technologies for their development. These include:

- ✓ **Online Travel Agencies (OTAs):** These agencies are full-service providers that act as one-stop solutions for travelers.
- ✓ **Tours & Activities (T&A) Marketplaces:** Specialized platforms focusing on enhancing tourism experiences, like specific activity packages and guided tours.
- ✓ **Experience Platforms:** Platforms that offer highly customized activity recommendations with a targeted focus for more nuanced traveler categories.

Online Travel Agencies (OTAs) seem to dominate the market, offering comprehensive services while branching into related sectors like Tours & Activities (T&A) marketplaces and Experience Platforms. This branching out is indicative of how this competitive landscape drives BIMs to expand horizontally, integrating additional services for a holistic experience.

### Evaluation of Business Models in Tourism

The evaluation of business models in tourism is based on a series of criteria that affect their success and sustainability. For the proper evaluation of the above-mentioned cases, the examination of the following criteria has been conducted:

- ✓ **Revenue Model:** Revenue sources and pricing strategies.
- ✓ **Customer Acquisition and Retention:** Strategies for attracting and retaining customers.
- ✓ **Value Proposition:** The key features that differentiate the service in the market.
- ✓ **Technological Infrastructure:** The role of technology in the operation and development of the model.
- ✓ **Target Audience and Market Segment:** The focus on specific categories of travelers and needs.
- ✓ **Scalability Capabilities:** The ability to adapt and geographically expand the

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- ✓ model.
- ✓ **Competitiveness and Customer Satisfaction:** Evaluation of the market position and the degree of customer satisfaction.

From the revenue model to customer satisfaction, each aspect plays a role in the overall value that a platform offers to both users and partners. The types of revenue streams, such as commissions or subscriptions, determine the financial viability, while customer acquisition channels, such as social media, contribute to attracting and retaining the customer base. Differentiating the value proposition is equally important, making services unique and competitive in a crowded market. At the same time, the technological infrastructure, which more and more includes the use of AI and Big Data, can improve the user experience and enhance the security of the platforms used by the different business models (Deliyannis et al, 2023). Targeting specific demographic groups or niche markets, adapting to local needs, geographic reach and strategic partnerships contribute to market scalability and reach. Finally, market competitiveness depends on competitive advantage, while customer satisfaction is influenced by reviews and the way the business responds to their needs. It has been mentioned that smart tourism and circular economy can drive value creation and business model innovation in tourism companies and destinations, promoting sustainability and local involvement (Del Vecchio et al, 2021).

### **Analysis results for core business models in tourism**

The conducted analysis allowed the identification of opportunities for innovation and strategic development in the tourism sector, offering valuable information for the optimization of business models and their adaptation to new technological and consumer trends. The analysis of the criteria for the examined core business models has shown the basic differences in concept and development that may affect sustainability strategies. Apart from literature review, data and information were collected from the relevant tourism platform, such as Expedia, Booking, Airbnb Experiences, GetyourGuide and Live the World. Specifically, the classification of the models was based on the type of services, the geographical scope of their services, their charged to uses. Subsequently, additional services provided were identified as well as their overlap between the examined business models. The services researched were: AI Assistance, Accommodation/travel, Itinerary planner, Ready itineraries, Simple Activity Suggestions, Tour Oriented, Local Activities, Reviews/Ratings, Smart functions (Push Notifications, Weather, Chat, etc), Discovery.

**In terms of revenue models,** Online Travel Agencies (OTAs) operate primarily on a commission basis from hotels, airlines, and other service providers. There may also be a subscription basis for premium services. Consequently, they leverage a wide range of partnerships, ensuring stable revenue streams, although they rely heavily on commissions. Tour and Activity Marketplaces (T&A MSPs) also operate on a commission basis from activity providers, with the possibility of direct sales. They may also charge listing fees for providers. Commissions are often lower than those of OTAs, but their model is more flexible, as it allows for service differentiation. Experience Recommendation Platforms often rely on advertising or sponsored partnerships with experienced providers. Direct sales or premium subscriptions for exclusive recommendations are also possible. Consequently, they have a low



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direct revenue stream without extensive partnership networks and their model is mainly adapted to digital advertising and affiliation. In terms of customer acquisition and retention, OTAs have a strong presence in social media, SEO (Search Engine Optimization), and loyalty programs and have strong brands (identity). Recognition and prices often attract new users, but there is a significant dependence on customer loyalty. T&A MSPs rely on social networks and partnerships with influencers or travel bloggers. They often rely on local communities to retain their customers. The model is therefore focused on local content and niche audiences and is dependent on SEO and partnerships with local partners. Experience Recommendation Platforms also leverage SEO, content marketing, and a strong social media strategy for experience recommendations and reviews. The model is therefore based on curated content and personalized recommendations, but at the same time customer loyalty becomes difficult, as it often functions as an information source.

**The value proposition** of OTAs is that they offer a wide range of options at competitive prices, but they often do not differentiate themselves significantly from each other. In terms of user experience, OTAs offer user-friendly platforms with mobile applications and search tools. T&A MSPs differentiate themselves by offering unique local experiences and personalized activity packages. These platforms are usually easy to use but may have fewer options for comparing options. Experience Recommendation Platforms offer highly customized recommendations for specific audiences and personalized experiences. These are usually simple, user-friendly platforms with content aimed at personalization. As far as technology infrastructures of each model in relation to platform design, service integration, use of Artificial Intelligence (AI) and Big Data, and user security, OTAs have platforms available for mobile and desktop, while mobile applications are usually a priority. There are integrated third-party services such as flights, hotels, and rental cars. Regarding AI and Big Data, extensive use of data for recommendations and dynamic pricing is utilized. The focus on data security due to the volume of personal information is strong. T&A MSPs platforms are available for mobile and desktop, with an emphasis on mobile applications. They present less integration with third parties compared to OTAs, but more integration of local experiences. They make limited use of AI, although it can be used for customer insights and activity suggestions. Data protection is adequate, but with less complexity compared to OTAs. Experience Recommendation Platforms usually have responsive design for websites and apps. They have fewer integrations with flights and stays but collaborate with local experience providers. They use AI for personalized experience recommendations, based on preferences. Finally, they provide reliable data security, but also less reliance on personal information compared to OTAs.

In terms of **target audience and market segment** to which each case is addressed are examined, OTAs are considered more suitable for the mass market, without addressing a specific demographic. In terms of market segment, the model targets all types of travelers—economy, luxury, business. There is a low degree of personalization beyond possible loyalty programs provided. The T&A MSPs model targets new travelers and experience seekers. It focuses on local and personalized experiences for leisure travelers. In this case, there is a high degree of customization with specific local experiences. Experience Recommendation Platforms target audiences seeking personalized experiences and recommendations. The



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model focused on niche markets with specialized offerings. Highly personalized experiences are provided, designed for individual users.

Regarding the **scalability and market reach** of the models, their geographical reach, partnerships and local adaptation have been examined. OTAs have a global reach with a local presence. They enter into numerous strategic alliances with airlines and hotels. Regarding local adaptation, they adapt well to different markets. In the case of T&A MSPs, the model is usually focused on local markets, but easily scalable. Partnerships are entered into with local businesses, hotels, and travel agencies, while regarding local adaptation, the model seems to be very well adapted to local characteristics. Finally, Experience Recommendation Platforms are often limited to specific regions or niche markets. They have fewer official partners and focus on local experiences. Effective adaptation for local culture and language is achieved.

In the **market competitiveness** section, the competitive advantages of each model and the entry barriers it raises have been examined. OTAs provide a wide selection of products and competitive prices. Entry barriers are the difficulty for new businesses due to large initial capital and strong competition. The competitive advantage of T&A MSPs lies in supporting more personalized local experiences, while entry barriers are lower compared to OTAs. Competition from large platforms is high. Experience Recommendation Platforms offer Personalized experience recommendations and personalized content. Here too, the entry barriers are quite low, but scaling internationally is difficult.

Finally, the perspective on **customer satisfaction and reviews** has been examined. In OTAs, customer ratings are usually positive for ease of use, but there are often complaints about customer service. Responses to customer comments are typical and complaint handling is often slow. In T&A MSPs, local experiences are usually highly valued, and the models are characterized by high quality of service. Also, a quick response to complaints is observed due to their smaller size. Finally, in Experience Recommendation Platforms, trust is observed in ratings for the quality of recommendations. While the response rate to user comments is usually good, as is the communication with users.

Our analysis revealed significant gaps in existing business models, particularly in the integration of AI-driven personalization, seamless multi-service integration, and localized experience curation. While many platforms excel in core travel services, holistic service ecosystems that combine AI-powered itinerary planning, real-time smart notifications, and user-generated content remain underdeveloped. Moreover, platforms tend to specialize in either accommodation/travel bookings or experience-based tourism, but few successfully bridge the gap between the two. A hybrid model that integrates both elements, leveraging AI and big data analytics to create personalized, adaptable itineraries, could offer a competitive advantage. Additionally, the importance of sustainability and eco-friendly tourism models is growing, yet remains a relatively untapped segment in the mainstream travel industry.

### Operational Criteria for User Experience (UX)

The research also focused on user experience in travel platforms as a crucial factor in their success and appeal. From booking platforms such as Online Travel Agencies (OTAs) to activity marketplaces and experience recommendation platforms, accessibility, ease of use,

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personalization and post booking communication play a significant role in user interaction. Especially user experience and accessibility are essential for travel platforms, impacting interactivity and user satisfaction. OTAs stand out for their comprehensive experience, from seamless navigation and personalization to accessibility and post-booking communication. Activity marketplaces emphasize the easy search for experiences, offering basic accessibility features but lacking the detailed filtering options of OTAs. Experience recommendation platforms, while more limited in features, excel in simplicity and tailored content discovery. However, the absence of a booking process means they do not prioritize post-booking communication and change management. The evolution of digital platforms towards greater accessibility and user-friendliness remains critical for differentiation in the tourism services market.

The detailed criteria as analysed by the research are as follows:

|                                         | <b>OTAs</b>                                                                                                                                                        | <b>Activity Marketplaces</b>                                                                                                                   | <b>Experience Recommendation Platforms</b>                                                                                          |
|-----------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------|
| <b>Ease of Use</b>                      | Clear menus, step-by-step booking process (search, filters, selection, payment), strong search functions with extensive filters.                                   | Generally intuitive, though activity variety can cause confusion; simpler booking steps than OTAs; intuitive search but with fewer filters.    | Simplified navigation, no booking process, primarily recommendation-based search.                                                   |
| <b>Visual Design and Aesthetics</b>     | Professional, modern design with detailed information; responsive, but loading times may vary due to heavy data usage                                              | Visually appealing, image-driven design; mobile-friendly, though media-heavy content may impact speed                                          | Minimalistic design, emphasizing content discovery; fast loading speeds with lightweight media.                                     |
| <b>Personalization</b>                  | Personalized suggestions based on past searches and purchases; users can save destinations and options; offers extensive local adaptation (languages, currencies). | Location-based recommendations; option to save activities or tours; limited localization compared to OTAs but often supports local languages.  | Highly personalized recommendations based on interests; option to save suggestions; localized experiences reflecting local culture. |
| <b>Search Functionality and Filters</b> | Extensive filtering options (price, amenities, dates, ratings); high relevance of search results tailored to user preferences.                                     | Basic filters (dates, activity type); some specialized filters (family-friendly, eco-friendly activities); relevant but less tailored results. | Fewer filters focused on recommendations; highly personalized results based on user preferences.                                    |

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|                                |                                                                                                                                                                             |                                                                                                                                                                                             |                                                                                                                                                             |
|--------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Booking Process</b>         | Detailed process with direct payment and transparent cost presentation; flexible cancellation policies.                                                                     | Less complex than OTAs but still involves direct booking and payment; often provides cancellation policies.                                                                                 | No direct booking process; recommendations only, with no cancellation policies.                                                                             |
| <b>Trust and Reliability</b>   | Large volume of verified user reviews; secure payment processes with SSL and other trust signals.                                                                           | Reliable reviews, though fewer than OTAs; secure transactions but with fewer guarantees.                                                                                                    | Relies on user-generated reviews, focusing on authenticity rather than payment guarantees.                                                                  |
| <b>Post-Booking Experience</b> | Comprehensive communication with regular updates via email or apps; easy booking management (modifications/cancellations); often provides travel tips and loyalty programs. | Notifications about activity changes, though less frequent than OTAs; tools for booking management, sometimes requiring third-party interactions; occasional loyalty programs or discounts. | No booking management; may send emails with personalized suggestions or guides but lacks booking-related updates or loyalty programs.                       |
| <b>Accessibility</b>           | Significant investments in accessibility; compatibility with screen readers, voice commands, text magnification, and color contrast adjustments; adheres to WCAG standards. | Fewer accessibility tools but increasing compliance with WCAG standards; limited filtering for accessible activities; accessibility information depends on activity providers.              | Basic accessibility features such as text magnification and color adjustment; WCAG compliance varies; lacks detailed accessibility information and filters. |

These results suggest that Online Travel Agencies generally offer user-friendly navigation and clear booking processes with robust search and filter functions, while Activity Marketplaces and Experience Recommendation Platforms may enhance booking experiences through personalized recommendations but can differ in navigation simplicity and clarity depending on their platform design and integration of social or collaborative features. Aesthetic design principles in online travel and experience platforms can enhance user attention and engagement, influencing user behavior. In this framework platforms commonly personalize user experiences by analyzing past behavior and interests to provide tailored recommendations and adaptive interfaces, while some also incorporate localization features to further enhance customer relevance. In terms of accessibility the platforms mainly cater user needs by following Web Content Accessibility Guidelines (WCAG) standards, using tools such as accessibility evaluators and testing software to ensure compliance, but differences exist in the range and effectiveness of accessibility tools and the provision of information to users and developers.

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### Conclusions

This study highlighted the evolutionary landscape of digital business models in the tourism sector and underscores the need for continuous adaptation to technological advancements and shifting consumer preferences. The identification of service gaps and emerging opportunities presents a roadmap for future innovation, emphasizing the role of AI-driven customization, smart functionalities, and integrated service ecosystems in shaping the next generation of tourism business models. The research showcased several benefits in the current development of business models in tourism, such as the personalization of suggestions based on user profiles, the real-time booking capability through user-friendly interfaces and the enriching experiences using tools such as digital guides, VR/AR and live updates. On the other hand, several gaps have been identified such as the lack of comprehensive information for unorganized activities or small providers, limited use of predictive analytics to predict traveler needs and reduced connection between different platforms for a holistic user experience.

Based on the above, the following steps of the research include the drafting of improvement strategies, focused on sustainable tourism management, such as the development of unified platforms that connect and integrate information from OTAs, Tour Marketplaces and Experience Platforms, the application of machine learning models to predict traveler needs based on historical data and preferences and the use of performance indicators to measure traveler satisfaction. The results of the research showed that the existing business models provide strong bases, however, they show room for improvement through the use of advanced technologies. The INDIANA project can contribute substantially to bridging the gaps identified, promoting personalization and enhancing the traveler's experience.

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### REVIVING TRADITION: TOBACCO WAREHOUSES IN KAVALA AS PILLARS OF SUSTAINABLE GROWTH

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#### Abstract

Tobacco and tobacco warehouses hold a significant place in Greece's history, particularly in the Region of Eastern Macedonia and Thrace. The area is renowned for cultivating Oriental Tobacco, which is officially recognized on Greece's National Inventory of Intangible Cultural Heritage (No. 52| 2020). Beyond its historic and cultural value, this legacy is reflected in the region's architectural heritage, with numerous tobacco-related structures still prominently integrated into the urban fabric today.

The present paper examines the role of tobacco warehouses in Kavala, a city in Eastern Macedonia and Thrace, in fostering sustainable urban growth and preserving cultural heritage. Once a prominent tobacco hub, Kavala's historical identity is closely tied to the tobacco industry. Today, these heritage buildings, which were once vital to the city's economy, are now envisioned as key assets for revitalizing local communities through adaptive reuse.

By analyzing the architectural, social and economic significance of tobacco structures, the research highlights their potential to drive sustainable urban growth, enhance tourism, strengthen social cohesion and safeguard cultural heritage, thereby contributing to the city's ongoing transformation. Repurposing the warehouses can create a link between Kavala's rich past and its future, blending history with modern sustainable principles. This transformation can enhance community engagement, promote tourism and create eco – friendly business opportunities. As iconic landmarks of adaptive resilience, tobacco buildings serve as vital assets in addressing contemporary urban challenges, while maintaining a balance between tradition and innovation.

**Key words:** Tobacco warehouses, Kavala, Sustainable Growth, Cultural Heritage, Socio-economic impact.

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### TRANSFORMING URBAN SPACES FOR REMOTE WORK: POLICY IMPLICATIONS AND DESIGN STRATEGIES

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#### Abstract

The increasing adoption of remote work is reshaping how we approach urban planning, residential living, and workplace design. This paper delves into the implications of remote work on urban infrastructures, highlighting the need to adapt planning policies to this evolving trend. By addressing residential land use, transportation, energy, and workspace design, the study aims to provide actionable insights for urban planners, architects, and policymakers.

Remote work's influence extends to residential preferences, with mixed-use communities offering local amenities becoming increasingly desirable. Reduced reliance on proximity to workplaces may drive demand for suburban and rural housing, emphasizing the need for more spacious and affordable homes. This shift calls for a reevaluation of urban planning norms (e.g., the European standard of 40 m<sup>2</sup>/person) to accommodate home offices and home outdoor workspaces (e.g., on balconies). Additionally, the increase in home energy consumption calls for enhancements to internet infrastructure and a potential need to shift towards renewable energy sources.

Transportation planning may also shift, with cities prioritising walkability, biking, and public transport over car-centric plans. Workplaces, meanwhile, are evolving toward more flexible models, including smaller satellite offices, coworking spaces, and hybrid setups. These spaces not only reduce operational costs for businesses but also cater to the needs of remote workers by offering shared amenities, flexible leasing, and opportunities for community engagement.

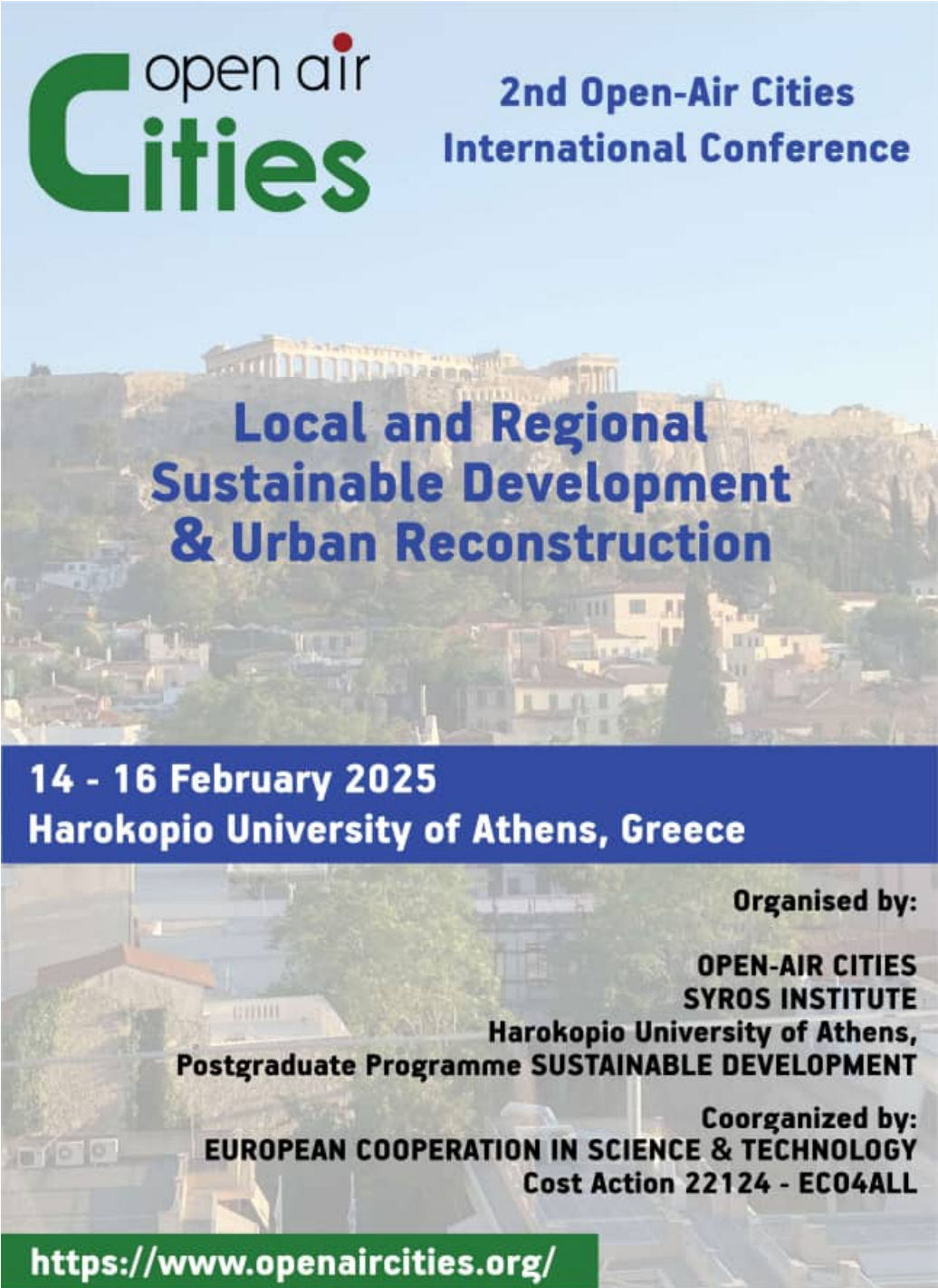
This study, funded by the European Union Horizon Europe project R-Map (GA101132497), began in February 2024 and is currently grounded in a comprehensive literature review. Preliminary findings will be supplemented by ongoing research and first-hand insights to be presented at the 2nd OPEN-AIR CITIES International Conference in February 2025.

**Key words:** Remote work; urban planning; urban policy; urban design; use of land

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### REGENERATIVE AND CIRCULAR CITY DEVELOPMENT THROUGH DISTRIBUTED URBAN PRODUCTION AND THE MAKER MOVEMENT IN THESSALONIKI, GREECE

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#### Abstract

This paper's goal is to analyse the potential of distributed urban production to lead to regenerative and circular city development in Thessaloniki, by engaging urban and spatial analysis tools, and by building upon the results of the EU Horizon2020 Pop-Machina project (Grant Agreement n. 821479). Pop-Machina grasps the opportunity to nurture the bottom-up development of maker communities and supports them to create new, circular and marketable products collaboratively. This is expected to stimulate urban innovation, reshape the urban productive system, and result in new job creation and the enhancement of the urban regeneration potential of the city.

To this end, this paper (i) provides an overview of the regulatory and strategic context in which the city operates; and (ii) applies an innovative methodology to identify the characteristics of its urban maker ecosystem and the urban assets that may be leveraged as sources of strength for a more circular and regenerative urban production ecosystem. The results of this spatially based investigation of the cultural, socio-economic, regulatory, and

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technological characteristics of the maker community ecosystem of Thessaloniki provide insights for local, national and EU-level policy recommendations towards optimising distributed urban production for a circular and regenerative development.

More specifically, the study's findings offer insights into the city's metabolism and can inform urban planning and design decisions to embed circular and regenerative measures effectively. They contribute to the development of recommendations for specific types of maker activities and maker infrastructure that should be developed, resonant with the city's making profile, and needs identified in specific neighbourhoods. Last, the paper proposes changes that need to be made across scales to open new pathways for the maker movement's contribution to urban circularity and regeneration.

**Key words:** Thessaloniki; urban policy; urban planning; spatial analysis; urban productive system; urban regeneration; circular economy



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### **SERVICE DESIGN IN URBAN LIFE: PROPOSING A CO-DESIGN MODEL FOR INTERVENTIONS IN URBAN COMMONS**

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#### **Abstract**

Urban commoning refers to making alternative spaces and relationships amongst local actors, and it is strongly dependent on local community and government. Design has been extensively utilized in the process of identifying, maintaining, or altering commons. However, challenges such as limited adaptability of the local government, local culture that does not facilitate participation, lack of infrastructure, and skepticism towards new methods hinder the development of experiments for a more extensive exploration. Design shows potential for greater impact, if it addresses the commons within a more strategic framework.

This thesis examines the relationship of service design with the urban reality, in search of frameworks through which the latter can be redefined, as we attempt to transition to more sustainable futures. Following a literature review, analyzing first of all the meaning of urban commons, then reviewing approaches not in the design field, the author identifies the characteristics which define design as the most relevant framework through which we can manage today's urban complexity. This has a goal of contributing to a more fluid social regulation in regards to urban matters, while building infrastructure and tools to support the aforementioned transition. It is deemed most suitable for design activity to occur in the organizational, or meso-level of the system. As a result of that, a model for managing design interventions of urban commons is presented, to be used by a multitude of organizations and actors, enabling parallel interventions towards one common. This model is strongly inspired by co-design, service design, urban commoning, and futuring methodologies.

**Keywords:**Service Design, Co-Design, Urban Commons

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# URBAN OBSERVATORIES. GAZING AT THE CITY.SNAPSHOTS AND ALLEGORICAL INTERPRETATIONS OF THE URBAN LANDSCAPE OF ATHENS

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## Abstract

The urban landscape of Athens, characterized by a complex interplay of metropolitan experiences, cultural layers, diverse encounters, historical memory, social transformations, and aesthetic impulses, serves as a focal point for observation. Urban observatories have been established in various locations, including Ymittos, Omonia Square, Kifissias Avenue, the electric railway lines, Alexandra's Avenue refugee camps, Kerameikos, and the dwarfs of Petroupolis, among others. These small-scale architectural interventions propose supervisory trails and pathways, curate Athenian imagery, and function as sites for reflection on the urban imaginary for residents and visitors. Experimental and alternative structures populate the urban public space, transcending the mundane and repetitive nature of busy urban areas. These structures, whether viewed from above, in close proximity, or from a distance, engage with the city and contribute to its mythology through the introduction of new spatial narratives and representations. By fostering embodied presence, they expand the domain of visual culture, facilitating the recollection of monuments and guiding physical contemplation, particularly in relation to emerging technologies. Furthermore, they establish prototypical models for interpreting the materiality of urban spaces, unearthing forgotten fragments of the city's discontinuous, ambiguous, and indistinct identity, while revisiting the memory of historical events and socio-political ceremonies.

The graduate student designs of architectural structures, aimed at observing urban life and public spaces, present unique chronotope narratives of Athens' urban character. This city is marked by diversity, contradiction, and unpredictability, where its historical essence, mythological roots, and archaeological landmarks converge with its contemporary, fluid, and chaotic identity. These designs provide both analogue and digital panoramas that explore historical and cultural, geographical and urban, as well as anthropological and psychographic attributes and variances. They seek to decode the random, the quotidian, and the familiar aspects of urban life and identity.

**Key words:** Spatial narratives, urban observatories, supervision, architectural design, public space, architectural panoramas, memory.

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### Introduction

The urban landscape of Athens, a tapestry of metropolitan experiences, cultural deposits (Eco, 1998), multifaceted encounters, historical memory, social transformations, and aesthetic impulses, becomes a subject of observation. In Ymittos mountain and Omonia Square, above Kifissias Avenue and over the tracks of the electric railway, alongside the refugee camps on Alexandra Avenue, at Zappeion or Kerameikos, and in the neighbourhoods of Petroupolis and beyond, urban observatories are established. These small-scale architectural constructions propose curated view sequences and pathways, collect Athenian imagery, and serve as fields for reflecting the urban imagination, inviting the experiential involvement of both residents and visitors. Experimental and alternative structures populate the urban public space, rising above the mundane and repetitive. They are inscribed in bustling urban areas, in squares where human flows are dense or in the peace and tranquillity of the mountains. From above, up close, or from a distance, they ‘look at’ the city and enrich its mythology with new spatial narratives and representations. Through embodied presence, they expand the realm of visual culture, aiding in the recollection of monuments and guiding physical contemplation, particularly in relation to new technologies.

This paper explores how spatial narratives shape cultural heritage, the role of urban observatories in contemporary city planning, and the interweaving between public space and architectural design. Observatories create interpretive frameworks to interpret the ‘materiality’ (tangible or intangible) of urban spaces, seeking out forgotten fragments and ‘deposits’ of their discontinuous, vague, and indistinct physiognomy while evoking memories of historical events and socio-political achievements. The students’ proposals for the design of architectural structures, which involve targeted observations of city life and outdoor public space, constitute unique narratives of the urbanity of Athens. A city that is diverse, contradictory, and unexpected, where its historical character, mythological origins, and archaeological monuments intertwine and intersect with its current porous and chaotic image.

Organizational architectural thinking, through analytical and compositional processes, seeks to provide form and a tangible shape to the concept of the observatory as a cultural intervention within the urban landscape - urbanspace. The observatories captured in the student studies connect the architectural shell with human practices. They offer both analogue and digital panoramas that explore historical, cultural, geographical, urban, anthropological, and psychographic qualities and diversities. These panoramas manifest and embellish the random, the everyday, and the familiar. They evoke dominant fantasies, obsessions and desires of citizens, intertwining distinct urbanities of the metropolis. They approach the distinct urban experiences and the connotations of urban life and identity, revealing “the spirit that emerges from the places”, as Pikionis (1987) states.

### Looking at the city “again”

“The knowledge of cities is linked to the deciphering of their dreamlike, expressive images”  
(Kracauer, 1931)

“The city shifts over time, it’s not a fixed image.  
It defines itself through contrasts, it yearns to explode.”  
(Wenders, 1988: 37)

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The captivating character of multifocal, multifaceted and historically rich cities, such as Athens, arises from the concentration of diverse elements and overlapping layers. The amalgamation of infrastructure, buildings, antiquities, monuments, landmarks, urban myths, micro-histories, collective narratives, spatial snapshots, and sensory stimuli creates a heterogeneous tapestry that underscores the city's historical trajectory and reveals its spatiotemporal depth. The unique essence of Athenian city is synthesized through the interplay of reality and myth, the present and the past, as well as memory and history by means of apparent or hidden cultural and collective deposits (Moirá, Makris, 2024a).

The observatory, both as a structure and as a vantage point, positions the viewing body at a specific location in space, allowing for meaningful interaction with the environment. It fosters a context rich in significance, as observing the world constitutes a revelation and manifests its essence, facilitating a negotiation and decoding of the elements that comprise its totality. The image of the place is not merely a reflection or a simple mirroring of its form on the observer's retina. The image of the place is not merely a passive contemplation; rather, it involves an understanding of its secret, invisible, and enigmatic laws and entities. In experiential perception, the view of a place can evoke memories, provide enlightening in terms of the factual information, elicit sensitivity and excitement. This occurs when the researcher-architect successfully identifies new and significant formal, syntactic, and structural relationships, and to devise the means by which to render the character of the landscape or the observed object, including its invisible aspects (Moirá et al, 2024b: 152-158).

The perception of a city's image, the contemplation of its urban form, the observation of its bustling and complex nature, and the immersion in its cultural content are the focal points of study for the urban observatory. The observatory aims to establish a new reference point for the city. It challenges stereotypes and reflects on the evolving condition of habitation and residence in Athens, as well as the renegotiation of the familiar and the unfamiliar. Its goal extends beyond mere observation; it aims to stimulate vision and provide an experience that uncovers the indistinct and overlooked urban character that is often obscured by the hurried and superficial perceptions of daily life. The conception of observatory's form and function depends on the context in which it is integrated, the architectural design that serves its functional needs by defining relationships and activities, and, most importantly, the narrative focus and the type of surveillance experience it aims to ensure. At times the proposed view is strictly defined to guide the gaze in a single direction and shaping the viewing angle and cone of vision, or to turn sequentially and selectively in more directions, orienting the viewer's gaze to the wider urban landscape. Subjective experience and observation, which are proposed, can also be peripatetic, evolving through space and time, organizing a specific path from one point to another or serves a process of wandering in multiple directions, depending on the impression the observatory wants to create.

In this scenario, the viewer engages with a sequence of images by manipulating the heterogeneities, scale, metric relationships, and proportions that constitute the syntactic structure in space. Walking observation enhances the experience through selected, fragmentary, and discrete images of the city, or through a continuous sequence that evokes a cinematic quality in the viewing process. In this manner, a condition is established in which the body and movements of the subject are in constant interaction with the environment. The world and the self continuously shape and redefine one another. The perception of the body

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and the image of the world are transformed into a singular and continuous existential experience. There is no space that is not connected to the unconscious image of the perceived self, (Pallasmaa, 2022: 96-97).

Siegfried Kracauer (1995) writes of the “experience of the city as a labyrinth of fragmented signals”. In his article ‘Strassen in Berlin und anderswo’ he makes a clear distinction between images of the city. He writes: “One can distinguish between two types of cityscape: those which are consciously fashioned and those which come about unintentionally. The former spring from the artistic will which is realized in those squares, vistas, building ensembles and perspectives which Baedeker generally sees fit to highlight with a star. In contrast, the latter come into being without prior plan.” (Kracauer, 1964: 40). Therefore, the architectural design of each urban observatory has the potential to shape, control, submit or even impose specific observational conditions, thereby revealing intriguing perspectives of the urban landscape and its timeless political and cultural evolution. In the observatory, the gaze is directed to penetrate cracks, skylights, and openings. This approach aims to unveil enigmatic and imperceptible images—what Kracauer refers to as the grey images of the city. These images, being indistinguishable and illegible, are often overlooked and bypassed by the observer.

The experience of the observer is guided by the spatial design of the observatory, as users follow directional cues within the environment of the design proposal. This interaction can be self-directed, allowing individuals to navigate selectively through space or adhere to specific instructions, such as walking, standing, sitting, or lying down. The observer's gaze can encompass the urban landscape in a full 360 degrees, akin to a periscope, enabling a comprehensive view of the city or focusing on particular segments of the urban panorama. They can examine the space from various perspectives—top to bottom, inside to outside, or from ground level to the sky—immersing themselves in a multi-sensory experience that integrates the urban landscape with their own perception or their virtual integration.

De Certeau (1984) argues that spatial narratives are constructed through the everyday actions of individuals navigating urban landscapes. This perspective reframes public spaces not merely as architecturally designed zones, but as lived arenas of micro-resistance and adaptation. Thus, cultural heritage must be understood not only as a static historical artifact but as a dynamic, evolving spatial text. With the introduction of the distinction “voyeurs or walkers”, Michel de Certeau introduces the distinction between two distinct categories of urban imagery. On one hand, there are the panoramic views that observe the city from above, providing a distant perspective that offers the viewer an urban panorama—a representation of the city-map from a vantage point. These images engage in myth-making, transforming the intricate fabric of the city into a visual artifact and positioning us, the viewers, as voyeurs. On the other hand, urban observatories are being invented that symbolically or tangibly engage the observer with the life of the city, including the flow of cars and trains, as well as the daily movements and activities of its ordinary users. At the height of this gaze, diverge images emerge that are often unreadable and hermetic, encapsulating the dark and poetic spatiality of the inhabited city. This city is shaped by fragments of urban imagery, each containing echoes of the past, leaving it to the observer to synthesize these elements and form their own interpretations of the unstable, chaotic, and fluid nature of the contemporary city, characterized by multiple fragmentary signs. Not merely the singular, normalized image of a

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postcard city, but rather its facets that remain unseen due to habit and saturation. This palimpsest of subjective experience illuminates the tensions, densities, discontinuities, ruptures, and intersections within the urban continuum, revealing the invisible nuggets of urban, political, historical, and social culture that define cities.

The urban landscape, as noted by Moraitis, “is the quintessential public place whose configurations reflect, throughout the entire range of our known urban history, the different expressions of the cultural and political identity of societies” (Moraitis, 2024: 311). In this context, student studies of urban observatories are designed to serve as focal points of public reference. This approach allows for urban porosity—a concept introduced by Walter Benjamin and Asia Lacis (1925) in relation to Naples—where new cultural associations can emerge. These associations have the potential to enhance the public character of the city, facilitate the networking of places, promote the exchange of ideas, and ultimately contribute to the formation of the Athens’ cultural landscape.

### **Choosing the location, the design, and the narrative of the urban experience**

“The worth of cities is determined by the number of places in them devoted to improvisation.”  
(Kracauer, 1964:50)

Architecture, when it seeks a simultaneous and unified understanding of place and action, possesses a performative character, as noted by Kotionis. Architecture includes within its jurisdiction the very organization of life itself, encompassing all actions and achievements that enable individuals to inhabit their familiar spaces, while integrating both the visual and performing arts. “It is not a matter of first establishing the place and then introducing an action within it; rather, there exists an interaction that co-constitutes both the content and dynamics of the place” (Kotionis, 2024: 690). Athens, as described by the artist Sevastakis, is “a fragile city.” He notes that “the violent urbanization multiplied, to the point of suffocation, both in terms of area and height, the built environment and adopted a harsh construction language with absolute geometry, which rather contradicted the great encroaching and structural anarchy that enveloped the city of hasty and unstable habitation. In the traces of fluid installations, the modern city was erected in a very short time” (Sevastakis, 2024:140). A disguise of irregularity and improvisation did not lead to aesthetic, structural, class, or cultural formations; rather, it resulted in a simplistic interpretation of modernist ideals and the deductive logic of the Athenian apartment building. The urban observatories designed by the students are intrinsically connected to the cultural, socio-political, and environmental characteristics of the urban landscape. They aim to transcend the overt elements of the image and uncover the hidden identifying features of Athens. The urban observatories designed by the students reflect an effort to understand the city of Athens as a broader, multidimensional, and complex spatial and cultural imprint on the natural environment.

De Certeau noted: “Places are fragmentary and inward-turning histories, pasts that others are not allowed to read, accumulated times that can be unfolded but like stories held in reserve, remaining in an enigmatic state, (...) there is no place that is not haunted by many different spirits hidden there in silence, spirits one can “invoke” or not (De Certeau, 1984: 108). The studies focus on significant geographical landmarks, enigmatic points of tension, and areas of historical and social densification, such as historic squares, allowing observers to



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perceive the city “again” and in new ways. The proposed urban observatories unveil their chaotic complexity and enigmatic allure and always mutating forms. According to Ingold, (2000: 188) “building is a process that goes on as long as people live in an environment. It does not start with a plan we have conceived in advance and ends with a ready-made object. The ‘final form’ is only fleeting.” Both the built and the natural landscapes are elucidated and unveiled through the interconnection of diverse objects and subjects that engage with its environment. In the current framework, the exploration of the depth of matter-form relations in urban landscape contemplation examines how spatial narratives and perception models influence the understanding of urban environments. Research in this field often examines how anthropogenic imprints, or traces of human activity, manifest in architectural spaces and how they contribute to collective memory (Schulz, 1980). Emerging methodologies, such as digital reconstructions, participatory urbanism, and sensory mapping, help analyse how past human activity leaves enduring marks in architecture. These inquiries often utilize experimental perception models to explore urban transformation, historical layering, and spatial interpretation. (Picon, 2018). Many studies address the visibility of historical and material traces in contemporary settings, offering insights into how cities encode past narratives within evolving landscapes (Anderson, 2015).

Urban observatories are situated at the city's periphery, along the boundaries of the natural landscape, or within its historical centre—areas characterized by a rich presence of cultural deposits, archaeological resources, and social interactions. These observatories play a vital role in emphasizing and critically analysing the city's cultural identity. In terms of form and structural composition, these constructions can be categorized as either small-scale enclosed structures—such as capsules and uniquely designed shells—or as open installations that are still in development. The latter feature an aesthetic appeal and provide free access, functioning as balconies, platforms, scaffolding, or towers.

Ymittos one of the four mountains which delineates the boundary of Athens' basin, rivals Athens' natural observatories, Lycabettus and the Acropolis hill, as a prime location. It is selected as an ideal site for proposed observatories that capture distant panoramas, situating Athens within the broader context of the Attica region and the Saronic Sea, thereby providing geographical insights. The proposed observation installations, simultaneously, evoke a sense of secret and hidden shelters within the mountain's body, which manage the past and the present, through new architectural structures or structures for the regeneration of dilapidated buildings. The observatory, which appears to precariously perch on the mountain's edge, evokes the notion of a refuge—a sanctuary equipped with openings for surveillance that provide selective views of the city. At night, a light fixture embedded in the ceiling emits bright signals into the sky.

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Cases from student designs. ‘Spatial Narratives’ Studio, Spring 2024

For instance, the stone tower of Anthousa, ancient beacon tower (fryktoria), is resurrected from obscurity with a slightly perforated metallic structure that frames and accentuates it, allowing visitors to navigate safely alongside and around it while enjoying the surrounding natural and urban landscapes. The observatories are designed interventions that facilitate the revelation of landscapes through interaction. The regenerating ruins attract attention and draw people to specific, perhaps underutilized or transitional areas, creating new focal points for interaction and the emergence of unexpected cultural associations, thereby facilitating the networking of places. The Anthousa project is exemplary, the new metallic structure actively interacts with the historical trace (the fryktoria), not erasing it but framing and allowing navigation around it, revealing its presence and context within the surrounding natural and urban landscape through this designed encounter.



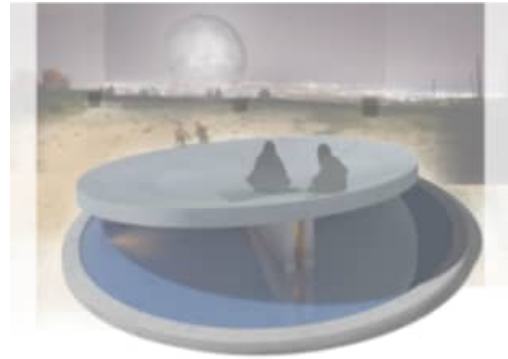
Cases from student designs. ‘Spatial Narratives’ Studio, Spring 2024

On the opposite end of the city, the observatory has selected the Petroupolis Dam as its site for integration, provides a stunning view of the city, Ymittos, and the moon rising behind it from a disc that has landed on the mountain. This inclined circular platform offers visitors a captivating perspective of the cityscape against the backdrop of a starry night sky. The Petroupoli observatories explicitly contrast the natural landscape with the urban sprawl, allowing the observer to physically inhabit this boundary. using design to amplify this location as a topos of maximum tension. The design (e.g., the disc seeming to 'land' from the sky) accentuates this juxtaposition.

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Cases from student designs. ‘Spatial Narratives’ Studio, Spring 2024

Other observatories are strategically installed at central, emblematic locations throughout the city, including intersections, squares, pedestrian bridges, and above electric lines overseeing the city's traffic, publicity and cultural landscape. They serve as poetic multisensorial allegories for the continuous flow of people and transportation, highlighting the impassable roadways and the relationships between the city's disparate spaces. These observatories represent cross-sections, interstices, and intermediate zones suspended in the void. They oversee transitions and passages of the crowd, transforming the familiar, everyday practices of citizens into a transient ritual—such as safely crossing from one side of the city to the other—while fostering a new perception of urban time and space.

The first observatory above Kifissias Avenue is a sculptural installation composed of dense, discontinuous tubes resembling a construction site or an unfinished structure. This design creates an enclosed, permeable structure that appears to float in the void, extending transversely toward the pedestrian bridge and heightening the unsettling, unfamiliar sense of ‘danger’ above the river of cars below, to provoke awareness of the infrastructure's scale/speed. The physical sensation of being suspended above traffic in the Kifissias structure profoundly shapes the perception of that space through bodily vulnerability.



Cases from student designs. ‘Spatial Narratives’ Studio, Spring 2024

In contrast, the second observatory situated above the train lines takes the shape of a tunnel formed by identical frames aligned parallel to the pedestrian bridge. This structure includes two enclosed balconies that provide views of the trains moving in opposite directions. the openings in the Kifissias or the structure near the train lines wouldn't just offer panoramic

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views but deliberately fragmented glimpses of the underlying chaos of traffic or the repetitive motion of trains, revealing the "unconsciously fashioned" cityscape Kracauer (1995) contrasted with monumental planning.



Cases from student designs. ‘Spatial Narratives’ Studio, Spring 2024

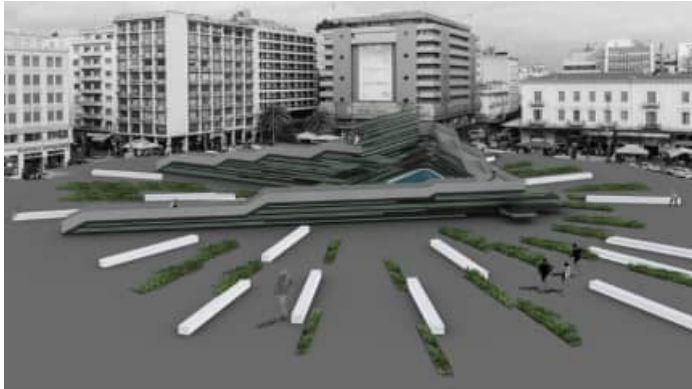
Omonia Square, the second most recognizable historic square in Athens after Syntagma Square, serves as a significant urban focal point. It is a place that is both central and marginal, timeless yet ephemeral, changeable yet stable and unchanging over time. The observatory, located in Omonia Square, extends like a pathway that branches out in a triangular arrangement, developing in a staggered manner in height with ramps and corridors. This design provides an unobstructed view of the Acropolis, the iconic neoclassical buildings—including the historic Bagion and Alexandros hotels, which serve as informal gateways to the traditional city, as well as the Neon Cafe—and the surrounding roadways. The structure primarily consists of iron, featuring overlapping glass surfaces and complementary radial luminous prismatic elements along its perimeter. The observatory re-manages and reinterprets the concepts of memory (as exemplified by the Zongolopoulos fountain and the Varotsos sculpture ‘Runner’), multiculturalism - reflecting the enduring presence of internal migrants and refugees at the edges of the square and at the metro exits. It also refers to the centripetal dynamics of urban syntax, specifically the avenues that converge at the centre. The Omonia observatory is placed within a square embodying contrast (Wenders, 1988) (central/marginal, historical/contemporary, grandeur/neglect). Its design, with branching paths and varying heights, likely forces encounter with these conflicting elements – the view towards the Acropolis juxtaposed with the immediate reality of the square's complex social dynamics. The square serves as a hub and crossroads, acting as both a starting point and a point of convergence for various historical periods and cultural characteristics. The Omonia observatory, while offering grand views, likely incorporates moments where ramps or corridors frame narrow, specific sightlines towards neoclassical details or the mundane activity at street level, forcing a focused gaze that decodes these less obvious, "dreamlike" elements Kracauer (1931) spoke of. The act of walking, climbing, and turning, choreographed by its architectural design, becomes integral to the observational experience, aligning with Pallasmaa's focus on embodied, existential perception (Pallasmaa, 2012).



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Cases from student designs. ‘Spatial Narratives’ Studio, Spring 2024

An observatory, which is part of Kerameikos, is located at the intersection of Ermou Street and Piraeus Street. It aims to become a metaphorically panoptic, tree-shaped tower designed as a bisected square, serving as a new urban epicentre for the city. Rising at the streets’ intersection, it resembles a luminous screen-eye that observes its surroundings while simultaneously collecting and displaying images of crowd movement on digital screens. Thus, it functions not only as an observatory for the wider area but also as a transmitter and receiver of digital images.



Cases from student designs. ‘Spatial Narratives’ Studio, Spring 2024

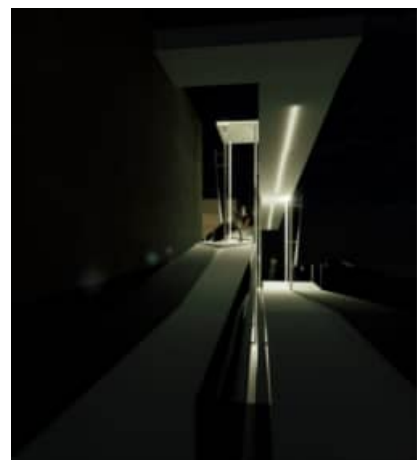
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The Kerameikos tower offers both the potential elevated (“voyeur”) view and the ground-level digital screen reflecting the “walker's” domain (the crowd), creating a complex dialogue between the two modes. This observatory is interconnected with another identical observatory which is proposed for construction in Shibuya, Japan. The two twin observatories will relay a continuous stream of real-time snapshots from their respective urban environments and vice versa. The Kerameikos “screen-eye” directly materializes Kracauer's (1995) “labyrinth of fragmented signals” by not only observing but collecting and displaying digital snapshots of crowd movement, transforming the ephemeral flow into a tangible, albeit fragmented, representation of urban life.

Finally, the observation scaffolding that is suspended and parasitizes next to the refugee buildings in Alexandras Avenue serves as a cultural intervention. It references the ongoing management of the historical significance of the iconic modernist structures and the role they played in accommodating the refugee influx following the Asia Minor Catastrophe. The buildings, inaugurated at the beginning of the 20th century, serve as a historic and emblematic example of social housing, architectural design, and urban planning, reflecting the principles and values of modernism. Simultaneously, they represent a site of exclusion and degradation. Situated along a road axis of major urban thoroughfare with significant traffic, these structures are at the heart of a diverse urban environment. They are adjacent to high-intensity public facilities, including a football stadium, hospital complexes, metro stations, police headquarters, and courts (Areios Pagos). Additionally, the surrounding area features a variety of shops, cinemas, theatres, and restaurants. The observatory seeks to evoke the collective memory embedded in the space, the buildings, the cultural activities, and the enduring aspirations of its inhabitants. The design features a symbolic upward trajectory, incorporating ramps that allow for the observation of the surrounding area from high up on the rooftops of the buildings. The Alexandra Ave ramps offering views from the rooftops allow observation of the surrounding urban fabric – often messy and unplanned – from an unusual perspective, unveiling the “indistinct” character often obscured by ground-level perception. At the same time, it includes a screen that displays scenes from the city's past and anticipated future, literally and figuratively projecting images such as photographs from the significant demonstration in December 2008, films, and contemporary artistic actions and installations.



Cases from student designs. ‘Spatial Narratives’ Studio, Spring 2024



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The observation structure within the Zappeion Park holds significant symbolic value, representing the timeless emblematic promenade of Athenian citizens throughout the history of the Greek state, as documented in literary, visual, and historical records. Additionally, it serves as a destination for visitors, as the area offers a privileged view of the Parthenon is a tourist destination, as it is an integral part of the broader archaeological and cultural landscape. The observatory proposes a parallel route to the open outdoor space of the Zappeion through a playful and clearly defined passage. A curved structure, resembling an arch, composed of superimposed parametric frames creates a threshold, a passage through space like the 19<sup>th</sup>-century arcades. It is designed to impose its own rhythm on movement, placing particular emphasis on the entry and exit of the spectator-visitor. This creates a symbolic urban arcade, but devoid of a commercial character, allowing visitors to traverse the Zappeion's space without distractions while enjoying the interplay of fragmented city images turning the act of passage itself into a “hybrid ritual” of perception, a modern, non-commercial flânerie. This unique tunnel facilitates contemplation and signifies the beginning and end of a journey-experience in both space and time.



Cases from student designs. ‘Spatial Narratives’ Studio, Spring 2024

### **Conclusions: synthesizing the role of Athenian urban observatories**

“The same town, when looked at from different places, appears quite different and is, as it were, multiplied in perspectives.”  
(von Leibniz, 2014: 25)

The exploration of urban observatories in Athen’s landscape, as conceptualized through the described student proposals, presents a compelling argument for the value of targeted, architecturally defined interventions in fostering new modes of urban perception and understanding. The architectural form enables and directs the action of observation, making the place (the observatory structure) and the action (gazing, reflecting, moving) inseparable, co-constituting the unique experience. The core contribution lies in positioning these observatories not merely as passive vantage points, but as active interpretive engines embedded within the city's complex fabric—structures that do not merely observe but actively participate in shaping urban experience. This study has highlighted how architectural design, spatial narratives, and participatory methodologies can transform urban observatories from static observational platforms into dynamic, spatialized forms of urban knowledge production. These observatories do not just document the city of Athens; they mediate, reveal, and

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reframe it—challenging dominant urban discourses and fostering new spatial imaginaries that are rooted in lived experience, memory, and engagement. The following are the key analytical insights. *Mediating Complexity.* The projects successfully grapple with Athens’ defining characteristic: its layered, often contradictory nature – a palimpsest of history, myth, modernity, crisis, and everyday life. The observatories act as mediating devices, offering focused lenses (both literal and metaphorical) through which this complexity can be navigated and comprehended, rather than being overwhelming or ignored. *Beyond the Visual.* While inherently tied to the act of “gazing,” the more potent proposals described implicitly push beyond mere visual consumption. Concepts like peripatetic observation, multi-sensory engagement (implied through presence in diverse environments), and the evocation of memory and narrative suggest a move towards a more phenomenological and embodied understanding of urban space, aligning with thinkers like Pallasmaa. *Narrative Construction.* The observatories are framed as generators of novel spatiotemporal narratives and representations. This highlights their potential role in cultural production, actively shaping the city’s evolving identity and mythology, challenging dominant or stagnant narratives (e.g., the purely classical vs. the solely chaotic). They function as potential sites for contesting and re-inscribing meaning, as suggested by De Certeau’s distinction between the strategic view from above and the tactical paths from within. *Critical Engagement.* Several proposals (e.g., Kifissias Ave, Alexandra Ave refugees’ buildings, Omonia square) demonstrate a capacity for critical engagement with the urban condition – addressing infrastructure’s dominance, historical memory and trauma, social marginalization, and the dynamics of central public spaces. They aim to make visible the often “indistinct and overlooked,” echoing Kracauer’s interest in the city’s less obvious, yet revealing, facets. *Architectural Agency.* The analysis underscores that the architectural form itself is not neutral. The design choices – framing, enclosure, materiality, pathway sequencing, height, orientation – are presented as deliberate tools for shaping experience, directing attention, and provoking specific reflections or emotional responses. This affirms architecture’s performative capacity, as noted by Kotionis, in organizing not just space but also perception and interaction.

## Epilogue

The observatories scattered across Athens serve as unique venues for site-specific art, transforming unconventional locations such as overpasses, mountainsides, repurposed structures, and central urban squares into immersive spaces for artistic expression. These settings provide context-rich backdrops for installations, performances, and experimental happenings, engaging directly with the surrounding environment and its layered narratives. Furthermore, the observatories, with their meticulously framed views, architectural compositions, and striking juxtapositions of urban elements, inspire artists—including photographers, filmmakers, writers, painters, and musicians—encouraging the creation of new works that capture the visual and spatial essence of the city. As a result, these structures serve as catalysts for the reinterpretation of Athenian landscapes. At the same time, these sites function as platforms for dialogue and debate. Positioned in socially or historically significant locations such as Omonia and Alexandra Avenue, they serve as focal points for public discussions, workshops, and cultural events addressing pressing urban issues, social memory,

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migration, and development. Through curated programming, they foster civic engagement and collective reflection on the evolving urban landscape.

Embracing contemporary digital culture, these observatories have the potential to integrate interactive technologies, incorporating digital screens, augmented reality (AR) choices, and locative media projects. This convergence of physical and digital realms allows for dynamic explorations of urban narratives, data visualizations about the city, and the presentation of digital art, bridging past and present through immersive, technology-driven experiences.

Their visual presence within the cityscape also positions them as emerging cultural nodes. Beyond their primary function, they become informal landmarks, generating movement and interaction while anchoring small-scale cultural activities, spontaneous gatherings, and social exchanges. In doing so, they redefine public space and contribute to a more vibrant, participatory urban experience. In parallel, these structures play a critical role in re-contextualizing heritage. By framing specific viewpoints, they juxtapose iconic landmarks—such as the Acropolis seen from Zappeion or Ymittos—with contemporary urban realities, infrastructure, and overlooked historical layers. This perspective fosters a dynamic understanding of heritage, emphasizing its continuity and transformation rather than a static, monumentalized past.

Moreover, they shed light on often-overlooked or intangible aspects of heritage. Directing attention to industrial archaeology, modernist social housing, the evolving social history of public squares, or ancient infrastructure traces, they make the invisible deposits tangible. These interventions challenge conventional heritage narratives, revealing the layered complexity of Athens' urban fabric. Crucially, these observatories introduce an experiential mode of heritage interpretation. Rather than relying solely on informational panels, they invite visitors to engage physically—climbing, looking through apertures, or navigating curated pathways—transforming perception into an embodied experience that deepens historical and spatial understanding.

By acting as storytelling devices, they empower artists, and community groups to construct narratives that weave together different historical periods, sites, and social experiences. This narrative-driven approach makes heritage more accessible, engaging, and relevant to contemporary audiences. These observatories encourage a critical engagement with heritage. Rather than promoting passive consumption, they invite reflection on issues of preservation, representation, power dynamics, and the role of heritage in contemporary urban life. Through this lens, visitors are prompted to question and reinterpret the built environment around them.

Ultimately, Athenian observatories act as cultural acupuncture points, directing focused attention to specific locations to stimulate broader awareness, artistic response, and a more nuanced appreciation of both contemporary culture and the city's richly layered history. By fostering dialogue, creativity, and re-interpretation, they offer a proactive means of engaging with Athens' identity, interweaving its past, present, and future into an evolving urban narrative.

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# STRATEGIC STAKEHOLDER ENGAGEMENT FOR LONG-TERM SUSTAINABILITY OF URBAN DEVELOPMENT PROJECTS

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## Abstract

Sustainability in urban development requires a multi-faceted approach to stakeholder engagement and long-term project planning. This presentation explores the critical role of stakeholder analysis in ensuring the success and continuity of urban development initiatives, focusing on sustainability outcomes beyond the initial four years of project implementation.

The research identifies key stakeholder groups across the quadruple helix model—government, industry, academia, and civil society—and evaluates their impact on project sustainability. Through a comparative analysis of case studies from European cities, the presentation highlights effective strategies for collaboration, resource mobilisation, and policy alignment. These strategies have been shown to enhance project outcomes and address environmental, economic, social, and cultural dimensions of urban sustainability.

This presentation emphasises the need for dynamic stakeholder frameworks that adapt to evolving urban challenges, ensuring inclusive participation and long-term project viability. It provides actionable insights into integrating stakeholder analysis into urban planning processes, contributing to the realisation of Sustainable Development Goals (SDGs), including Goal 11 (Sustainable Cities and Communities) and Goal 17 (Partnerships for the Goals).

This work aims to underscore the importance of sustainability planning that extends beyond the initial project phase, offering tools and methodologies for urban developers and policymakers to design resilient and inclusive cities.

**Key words:** Stakeholder analysis, sustainability, urban development, quadruple helix, project lifecycle, SDGs



## **EXPLORING PUBLIC PERCEPTIONS OF THE PARIS 2024 OLYMPICS' SUSTAINABILITY STRATEGY: A CONTENT ANALYSIS OF COMMENTS ON YOUTUBE VIDEOS**

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### **Abstract**

Mega-events like the Olympics are notable for their substantial impact on host cities. The environmental, economic, and social damages caused by past Olympics have influenced perceptions of such events. Over the past two decades, sustainability has become a core value for the International Olympic Committee, and the Paris 2024 Olympics created a unique experience through various sustainability strategies. The Paris 2024 Olympics have been promoted in the media as the ‘greenest’ Olympics to date. Additionally, as the most digitalized Olympics ever, Paris 2024 has made sustainability-focused strategies more widely known.

This study aims to analyze how the highly publicized sustainability strategies of the Paris Olympics on social media platforms are perceived by viewers. It focuses on the spatially based strategies of the Paris 2024 Olympics and examines their impact on environmental, economic, and social sustainability. The paper also includes a review of how these strategies differ from past Olympics.

The study analyzes the six most-viewed videos from international English-language news channels on YouTube that emphasize the sustainability of the Paris Olympics. The general approach of these videos and the perspectives of viewer comments are analyzed using content analysis with Maxqda-software. Sentiment analysis is conducted to assess how the sustainability strategy of the Paris Olympics is perceived.

Initial findings reveal that, despite neutral or positive portrayals in the videos, many comments criticize the so-called sustainability strategies as causing harm to both nature and the social fabric of the city. Some eco-friendly decisions are seen as ‘cheap’ attempts aimed solely at economic gain. However, some viewers appreciate these efforts. Suggestions also include holding the Olympics repeatedly in the same cities to reduce their impact.

The study highlights that sustainable development cannot be achieved through top-down policies alone; public awareness is crucial. Effective use of media can play a key role in enhancing positive perceptions of sustainability. The findings could encourage local and regional organizations to adopt more participatory decision-making processes for sustainable development.

**Key words:** Mega-events, Sustainable Development, Perceived Sustainability, Olympics



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### **A SENSITIVE APPROACH TO THE HISTORIC URBAN LANDSCAPE. THE INTERWAR APARTMENT BUILDINGS OF THE LINEAR OPEN SPACE OF FOKIONOS NEGRI IN ATHENS, GREECE**

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#### **Abstract**

The Historic Urban Landscape (HUL) represents a carrier that humanity is obligated to preserve without interfering with the invincible force of change that is the city itself. UNESCO's approach to managing historic urban landscapes is holistic, integrating the goals of urban heritage preservation and economic and social development. In Athens, the legal framework protecting the architectural heritage of the city centre promotes archaeological richness and neoclassical interpretation for historical and political reasons, neglecting the protection and promotion of open spaces and important buildings of the 20th century. These buildings complete the image and identity of the city as modern monuments, interpreting the mechanisms of its evolution and how people accept it in their daily lives.

The research project "The Interwar Urban Landscape of Fokionos Negri Street: Documentation, analysis, interpretation" aims to study the historical urban landscape of the linear open space of Fokionos Negri, an area formed in the first half of the 20th century and hosts many buildings characteristic of "Athenian Modernism" and also, a very important area for the social and functional evolution of the Kypseli district and the Athenian centre.

One of the main aims is to identify and study buildings of particular architectural/historical/cultural value, which contribute in a specific way to the composition of the urban landscape, highlighting the overlapping layers of the city's history. In this presentation, we focus on interwar apartment buildings located along the Fokionos Negri Street through maps, archival research, personal observations, interviews of the owners and the patrons of the linear park, films and photo reports when the park was the central leisure pillar in Athens. The multimodal methodological choice seems provide information with interpretive value and depth of experience that can contribute to the understanding and appreciation of the historical urban landscape in Greece.

**Key words:** historic urban landscape, interwar urban heritage, Kypseli, Fokionos Negri Street, Athenian modernism

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# THE EXTERNALITIES OF CONTEMPORARY ARCHITECTURE IN TERMS OF SUSTAINABILITY

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## Abstract

At a time of energy transition, how can contemporary architectural design contribute to United Nations Agenda 2030 for Sustainable Development (2015) and the New European Bauhaus (NEB) which aims at transforming the European Green Deal's goals into tangible, positive experiences for the citizens?

Many contemporary green building rating tools and sustainability metrics have limitations in driving truly sustainable outcomes. Focusing narrowly on energy efficiency without considering the whole life cycle and broader environmental and social impacts can lead to suboptimal results. Knowing that the building industry is one of the major contributors to climate change, sustainable building design has to move from an energy efficiency-centered approach to a people-centered experience trying to link sustainability rating systems with the comfort of occupants and the conservation of natural resources. Buildings can act as significant catalysts for improving or degrading the quality of life and the environment.

This paper investigates the externalities of contemporary architecture in terms of sustainability. Mapping these externalities and shedding light on good practices is crucial for integrating sustainability into planning and helping the decision - making process to contribute to the transformation of the built environment for as many people as possible and for as long as possible. The collection of relevant data on design and construction of sustainable buildings will help establish design as a decisive factor for reducing carbon footprint and implementing design disciplines to confront contemporary problems such as climate change, access to resources, health and wellbeing. This research underlines the need for an integrative, multidisciplinary approach that sees architectural design not just as a technical or aesthetic endeavor, but as a driver of societal and environmental wellbeing.

**Key words:** Architecture, sustainability, externalities

## Introduction

Sustainable development in architecture focuses on creating buildings and infrastructure that meet present needs without compromising the ability of future generations to meet their own needs. This approach seeks to minimize environmental impact, enhance social wellbeing, and

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maintain long-term economic viability. According to the Davos Declaration (2018) the foundation of the Environmental, Social and Governance (ESG) standards in the built environment lies in the commitment to environmental protection -including addressing climate change- and in creating assets that are sustainable across all dimensions. In alignment with the Sustainable Development Goals of the United Nations’ Agenda 2030, the European Union has committed to reducing greenhouse gas emissions to net zero by 2050, ensuring a just transition to a carbon-neutral economy that benefits all citizens and regions, while fostering sustainable growth. Within this context, the NEB initiative (European Commission, 2021) aims to unite the goals of the European Green Deal (European Commission, 2019) with principles of aesthetics and inclusiveness. Recognizing the worldwide urge for a transition towards greener, sustainable, beautiful and inclusive built environments – as validated by the UN Agenda 2030 and the NEB - this paper explores the externalities of contemporary architecture in terms of sustainability.

### **The externalities of contemporary architecture in terms of sustainability**

Buildings are worth more than three times the size of global Gross Domestic Product (GDP) (Tostevin and Rushton, 2023). But while expenditure on contemporary architecture is quantitative and easy to calculate in monetary terms, the benefits of architecture as cultural good extend far beyond financial value. These include aesthetic, symbolic, social, educational, environmental, scientific and other values, many of which are inherently hard to measure (Throsby D, 2001). Even when buildings are owned and used by individuals or small groups, the impact is spread all over society and the economy because the built environment affects us all! In this sense, architecture can serve as a significant catalyst for improving or degrading the quality of life and the environment in many ways.

The building sector is one of the major contributors to climate change, being responsible for over 34% of energy demand, around 37% of energy-related CO<sub>2</sub> emissions globally, half of all raw material extraction, one-third of water consumption and one-third of waste generation. Rapid urbanization further exacerbates the situation, as cities and metropolitan areas are responsible for about 70 % of global carbon emissions and consume more than 60 % of available resources. Many impacts of contemporary architecture involve what economists call externalities: benefits or social costs arising as a result of a private activity for parties not included in this activity.

There can be positive externalities as well. For example, buildings designed with sustainability in mind can yield positive effects. For instance, buildings designed with sustainability in mind - prioritizing recycled, local, low carbon, energy-efficient materials aligned with eco-design can affect people and the environment in a positive way. It is becoming apparent that when creating beneficial externalities, the interest of society extends beyond the wellbeing of the direct users, the buyers and the sellers, to also include other people who are indirectly affected, the broader community and future generations. Beyond environmental concerns, architecture also generates social and cultural externalities. Thoughtfully designed buildings and public spaces can foster inclusiveness, accessibility, and a sense of community, thereby improving social cohesion and public health (Gehl, 2011). Health-related benefits such as improved indoor air quality, access to natural light and green

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spaces further contribute to both physical and mental wellbeing (Evans, 2003). Culturally, adaptive reuse projects that preserve historical architecture help strengthen local identity and community resilience.

Given the significance of these multifaceted externalities, it is essential to adopt a holistic, multidimensional approach to analyzing contemporary architecture. Such an approach must account not only for energy performance and material efficiency but also for long-term environmental, social, and economic impacts. Mapping these externalities helps identify best practices and informs policy and design decisions that contribute meaningfully to sustainable development. Ultimately, architecture has the potential to play a transformative role in shaping a more resilient, inclusive and ecologically balanced built environment.

### **Contemporary architecture paradigms and sustainability**

Sustainable development in architecture involves designing structures that are energy-efficient, resource-conscious and supportive of both environmental and social well-being. One of the most effective strategies in this context is adaptive reuse, which focuses on repurposing existing buildings and infrastructure rather than resorting to demolition and new construction. By transforming a building's function—through spatial reconfiguration or architectural blending of old and new—resources are conserved, construction waste is minimized, and cultural heritage is preserved, while also helping to limit urban sprawl. Furthermore, incorporating reclaimed or reused materials into new designs not only reduces embodied carbon but also adds aesthetic character and uniqueness. Innovative approaches such as modular construction, including the use of shipping containers, support flexibility, ease of maintenance, and the potential for future reuse in response to evolving community needs. In parallel, the integration of green infrastructure such as tree planting offers a range of social, environmental, and economic benefits, including the mitigation of the urban heat island effect, the reduction of pollution, and enhancement of biodiversity. These principles can be seen in various architectural examples that successfully balance innovation with sustainability.

### ***Grand Park Bordeaux, Lacaton & Vassal + Frédéric Druot + Christophe Hutin architecture, 2016***

Prioritising the rehabilitation of three modernist social housing's buildings from the early 60's, architects Anne Lacaton and Jean-Philippe Vassal improved the living conditions and comfort of the residents, while also producing environmentally better-performing dwellings and improving the image of urban housing. Following their motto “never demolish, never remove or replace, always add, transform and reuse”, the architects added large winter gardens and balconies in extension of the existing structures, offering each apartment more space, natural light, flexibility of use and wider views. The addition of winter gardens also served as passive solar collectors, improving the energy performance of the building and reducing energy consumption by about 60%.

To complete the transformation in just 12-16 days per apartment, allowing families to stay in their dwellings during the construction works, the architects used prefabricated modules assembled in front of the buildings, with poured concrete used only for foundations. The renovation cost around €50,000 per unit - half as much as a new-build scheme - saving

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approximately €26,5 million in total. As Lacaton stated, ‘Sustainability is also about the way that money is spent on doing something that lasts longer and is of greater use.’

The French duo reexamine sustainability through their reverence for pre-existing structures, conceiving projects by first taking careful inventory of what already exists. Lacaton emphasizes, “Transformation is the opportunity of doing more and better with what is already existing. The demolishing is a decision of easiness and short term. It is a waste of many things—a waste of energy, a waste of material, and a waste of history. Moreover, it has a very negative social impact. For us, it is an act of violence.” (Lacaton A., 2021). For their pioneering work Anne Lacaton and Jean-Philippe Vassal were awarded the Pritzker Architecture Prize.

### ***Redevelopment and reconstruction Munich Re, Sauerbuch Hutton, 2014***

The redevelopment and reconstruction of an existing dark office block of the 1980s by removing sections in its core and enabling natural ventilation and more natural daylight, reduced energy consumption and enhanced occupant comfort. The reuse of the building also involved the renewal of the façade which not only revitalized the building’s appearance and the surrounding environment but also improved thermal insulation, solar control and noise reduction contributing further to lower energy consumption (Sauerbuch Hutton, 2014). It was estimated that by retaining and upgrading the existing structure, enough energy was saved to heat the building for approximately 34 years.

### ***Dexamenes Seaside Hotel in Kourouta, K-studio, 2018***

An abandoned wine factory was revived and transformed into a resort. The existing concrete blocks of wine tanks were preserved and adapted into hotel rooms by removing slices of the tank walls to create doorways. These thick concrete slabs were then placed in a shallow pool in courtyard between the two blocks of tanks, forming stepping-stones that lead to two preserved steel silos. These circular silos now host art installations, spa treatments and private dining experiences (Pintos P., 2020). The shallow pool also contributes to the microclimate of the hotel. Although originally built for industrial use, the project successfully preserved the character and atmosphere of the historic structure.

### ***Design of the area around the Acropolis and the Philopappou Hill in Athens, Pikionis, 1959***

A Greek paradigm with great impact over time is the design of the area around the Acropolis and the Philopappou Hill, which has been declared a Monument of Modern Architecture of World Importance since 1996 (UNESCO) and the construction of the church of St. Demetrius Loumbadiaris, which at the end of works, in 1958, was declared a historical preserved monument, and have been awarded international awards from time to time. Dimitris Pikionis has given new life to the materials that come from massive demolitions of neoclassical buildings in the surrounding area. By reusing older stone, marble and ceramic fragments and composing them with concrete and modern brickwork seeks to artfully integrate the history of the site with the natural landscape and the more recent history. A logical “collage of the past and the present” (Antonakakis D., 1987) aimed at creating a new distinctive and balanced composition, without destroying the value of the elements that make it up.



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### ***APROP Ciutat Vella Emergency Housing in Barcelona, Straddle3 + Eulia Arkitektura + Yaiza Terré, 2019***

The APROP Ciutat Vella Emergency Housing project questions the need for constructing new assets, especially when pre-existing structures are available for repair or upgrade. Serving as a shelter for residents who have suffered eviction, it was built within their own neighborhood using recycled industrial discarded containers, that were given a second life. From a sustainability perspective, the ecological footprint of a container-based apartment building is significantly lower than of a conventional residential building. These structures do not require the extensive use of reinforced concrete, are transportable, can be quickly assembled into settlements and are easy dismantlable and adaptable to new sites. This approach reduces both the energy required and the waste generated during demolitions. Furthermore, all dwellings have at least two facades, allowing for natural cross ventilation and special attention was paid to thermal insulation to optimize energy performance, achieving double A (AA) energy certification (Ott C., 2019). In this way, this housing model not only addresses urgent housing needs but also offers a socially responsible and ecological sustainable alternative that could influence future housing policies.

### ***Vertical Forest Milan, Boeri Studio, 2014***

Integrating green elements in contemporary architecture such as tree planting can have numerous positive effects on the overall building performance, on the surrounding neighborhood and on the environment. Green contributes to improved air quality, reduced energy consumption, enhanced mental health, and at the same time contributes to a more livable, resilient urban environment by moderating the heat island effect and lowering the overall environmental impact of buildings. The two towers feature as much vegetation as is normally found on around 30,000 m<sup>2</sup> of forest. The plants create an optimal microclimate; they also regulate humidity, carbon dioxide absorption, and produce oxygen. The vertical forest has become a habitat for a number of animal species, birds and butterflies (Stefano Boeri Architetti, 2014). The screen of leafy green trees not only reduces the need for air conditioning to heat and cool the tower's apartments, but also create a self-sufficient ecosystem.

### ***Tamedia Office Building Zurich, Shigeru Ban Architects, 2013***

Shigeru Ban, well-known for his innovative use of paper and paperboard, has designed an office building in Zurich made entirely of wood —specifically, 2,000 cubic meters of Austrian spruce, following Japanese construction traditions. The structure is composed exclusively of prefabricated, precision-milled timber elements, which were assembled on site. Timber, when sourced from sustainably managed forests, is an environment-friendly, renewable construction material offering a significantly lower embodied carbon footprint compared to conventional construction materials like concrete and steel. In addition to its environmental benefits, timber is known to have a positive impact on both physical health and psychological wellbeing. The building operates entirely CO<sub>2</sub>-free, utilizing geothermal groundwater for heating and cooling, without reliance on fossil fuels. Furthermore, high quality thermal insulation combined with the use of heat pumps ensures that the operational costs of this carbon-neutral wooden building remain low (Shigeru Ban Architects, 2013).

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### Sustainability metrics

While environmental issues caused by the building sector show that green building design and construction is not an alternative, but a necessity, a precise definition of a broadly “sustainable” or “green” building does not exist yet. A series of green or sustainable building certification systems have however emerged over the past decades to provide to market actors recognized evidence of the quality of a building from a sustainability viewpoint. Building Research Establishment Environmental Assessment Method (BREEAM) which is adapted to European regulations and the Leadership in Energy and Environmental Design (LEED) which is U.S. centric are the most widely recognized sustainability rating systems around the world, focusing on a wide range of criteria. The LEED certification evaluates land use, water, energy and emissions, materials, indoor environmental quality, and innovation. BREEAM assesses project management, energy, health and wellbeing, transport, water, materials, waste, Land use, and Pollution. Applying for and obtaining certifications increases the cost of the investment but certified buildings can often provide increased return on investment, lower vacancy rates, enhanced brand reputation and visibility, maintenance and operational cost savings and potential tax incentives (UCEM, 2024).

But could the aforementioned projects or smaller renovation projects receive any of these certifications? On the other hand, many projects might appear extremely sustainable at a superficial level but are all these projects actually “green” with their overall context – physical, economic, social, etc.?

#### ***Bloomberg’s New European Headquarters in London, Foster + Partners***

Bloomberg’s New European Headquarters in London, designed by Foster + Partners achieved an Outstanding rating according to the BREEAM sustainability assessment method - the highest design-stage score - and has garnered significant international attention and awards (Foster + Partners, 2017). Compared to a typical office building, it saves 73% in water consumption, uses 40% less energy for lighting, features a ‘smart’ CO<sub>2</sub>-control system that dynamically adjusts airflow, and operates a combined heat and power generation system estimated to reduce CO<sub>2</sub> emissions.

While these green features have undoubtedly set new standards on sustainability, they have not been sufficient to prevent criticism regarding its designation as the world’s most sustainable office building. The use of 600 tons of bronze imported from Japan, 10,000 tons of granite from India, and serrated glass imported from China raised questions about the sustainability of the construction process itself. Furthermore, while the combined heat and power generation center is more efficient than a conventional system, it still burns natural gas, contributing substantially to the building’s total embodied carbon footprint.

One of the chief criticisms of standards like BREEAM and LEED is their focus on operational carbon emissions - the emissions produced during the building’s usage - excluding most of the embodied carbon emissions generated during construction, which can account for approximately half of a building’s lifetime CO<sub>2</sub> emissions (Waugh A., 2021). This focus encourages the designers to add unnecessary “systems” to achieve high ratings since mechanically-cooled buildings is easier to achieve higher ratings than naturally ventilated ones. This means air conditioning can be favoured over simple design solutions like operable

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windows (UCEM, 2024). Although BREEAM and LEED have made modest updates to include embodied carbon considerations, significant gaps remain.

### ***PowerHouse Kjørbo in Oslo, Snøhetta, 2014***

An exemplary case of sustainable building design that integrates sustainability rating systems with the conservation of natural resources is PowerHouse Kjørbo, located outside Oslo and designed by Snøhetta. This project demonstrates the feasibility of transforming two existing office buildings, originally constructed in 1979, into energy-positive structures. Adopting a holistic approach, the renovation process simultaneously addressed architectural quality, energy efficiency, choice of materials, embodied carbon, and building systems—ultimately aiming to produce more energy than the buildings consume. A key objective was the reuse of materials and the selection of environmentally friendly construction alternatives, while preserving the buildings’ original structural identity. The design incorporated a ground-source heat pump system in combination with a highly efficient ventilation strategy. Photovoltaic panels were installed on the roofs, and the interiors were designed to maximize natural daylight, enhancing both energy savings and visual comfort. Notably, the project became the first rehabilitation initiative worldwide to achieve the highest possible rating in the BREEAM-NOR certification system (85.2%), earning both national and international recognition, as well as multiple awards (Snøhetta, 2014).

## **Conclusions**

Currently, the bar for sustainability is so low that often the “sustainability part” is completely ignored or the designers at the end just add a green roof or tons of solar panels just to tick off a check-list, without caring about solar panels after their 25-year-long life-span. On the other hand, while green building certifications undoubtedly have played a significant role in shaping sustainability discourse and influencing practices within the construction sector, their application is not without limitations. Even though they have evolved to integrate factors such as embodied carbon, they should not be followed blindly. Certifications may fail to reflect the full environmental footprint of a building and frequently neglect broader ecological and social implications. Furthermore, their rigid frameworks can inhibit recognition of innovative design solutions that deviate from established benchmarks yet achieve superior sustainability outcomes. In response to such limitations, the European Commission has introduced an evidence-based scientific handbook aimed at evaluating the built environment through the three core dimensions of the New European Bauhaus initiative – sustainability, aesthetic value and inclusiveness (Lourenço, P. et al., 2024).

Despite the challenges and the negative externalities associated with contemporary architectural practices, sustainable design holds significant transformative potential. Mapping the externalities of contemporary architecture which embodies sustainability into planning is crucial for creating a truly holistic approach to design, one that considers the long-term environmental, social, and economic outcomes. Such an approach can guide decision-making processes to contribute to the transition toward a built environment that is not only resilient and inclusive, but also beneficial to as many people as possible, for as long as possible. Ultimately the highest ambition of sustainable architecture is to regenerate and reconnect to

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nature (European Commission, 2024), taking the step from a human-centred to a life-centred perspective.

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### REDESIGNING A PUBLIC SQUARE FOR MANIFESTATIONS: A SERBIAN EXAMPLE OF SOMBOR SQUARE

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#### Abstract

One of the basic functions of a traditional public square is to be a central place for different outdoor events, such as open markets, cultural manifestations, concerts, or religious and political rallies. However, public squares without vibrant surroundings specifically dedicated to outdoor events are rather rare. In many cases, they are particularly formed for these purposes, but some have historically developed into public squares for events.

One such historical example is the Square of the Holy Trinity in Sombor, Serbia. Initially, this square was formed in the city centre to house all functions typical for a central urban square, including shops and administrative buildings in its surroundings. However, during the 20th century, the square in Sombor lost this initial multifunctionality, as surrounding buildings became protected as heritage and got mainly cultural institutions, while the square transitioned to be a city place for specialised mass events, such as a flower market on springs, ethno-bazaar on autumns or ice rink on winters.

The City of Sombor organised an urban-architectural competition for the conceptual (re)design of the Square of the Holy Trinity in 2023. One of the main premises given in the competition instructions was that all proposals for the new design had to preserve the function of a public square for various urban events surrounded by heritage buildings. On the other side, the very same instructions emphasise that the same design proposal had to make the square more functionally active and physically attractive for different users. These two, quite opposite stances made a challenging framework for the new urban design. Between ideas from urban design and the events literature, this paper aims to explain all these constraints during the design process and customisation of the final design for this Sombor square for public events.

**Key words:** redesign, public square, manifestations, cultural heritage, competition, Sombor



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### **GAZI - PSALLIDI: EXPLORING DIFFERENCES BETWEEN TRADITIONAL MAP MAKING AND CONTEMPORARY MAPPING PRACTICES UPON TWO ATHENIAN NEIGHBOURHOODS**

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#### **Abstract**

As part of the "Architectural Design 2" course of the Civil Engineering Educators Department of the School of Pedagogical and Technological Education (ASPETE) that took place during the fall semester 2024-2025, students were asked to survey the Psallidi neighbourhood in Marousi, Athens and on this basis to choose a location for an urban intervention. Nine years ago, during the fall semester 2015-2016, in the "Urban Planning 1" course of the School of Architecture of the National Technical University of Athens (NTUA) students were asked to survey the Gazi neighbourhood in Central Athens and upon their findings to propose an urban intervention.

The methodology for the survey that has been proposed by the teaching team in both cases consisted of three kinds of maps, one analytical and objective and two perceptual and subjective: land uses, mental mapping and psychogeography (of both feelings and multisensory data).

Although coincidentally the two neighbourhoods have a similar trace on a map (size and shape), they differ essentially in that while Gazi is a dense, central area with a mix of uses and forms, Psallidi is a peripheral residential area with relative uniformity.

By comparing the students' maps that emerged from the two mappings, the paper attempts to explore how the latest time-perceptual and subjective approaches contribute to a better understanding of the content of urban space that extends beyond function and embraces aspects such as relationship and interaction of the individual with the urban space. Additionally, it is important to explore the impact on the forms and volumes produced in both areas as a result of the evolutions of the two areas based on their socio-cultural differences. Finally, this study will act as a pilot juxtaposition that will allow researchers to trace social, cultural, and urban function issues by following the triple mapping process.

**Key words:** mental mapping, psychogeography, urban evolution, Marousi, Gazi

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### **CINEMA AS A PLANNING “TOOL” FOR A SUSTAINABLE, CHILD-FRIENDLY AND THEREFORE WORTH LIVING CITY**

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#### **Abstract**

According to Jorge Luis Borges “city is always in search of poetic”. The ability of art to shape language, which differentiates each place, also determines its creative expression. Cinematic representation is a special process to investigate the way we imagine cities as an experience, but also as a theoretical construction, since the cinema projects authentic urban images, which interact with the city's residents. Movies allow us to draw some conclusions about how we experience real urban space, how we would like it to be, what we are afraid of or what we hope it can happen in the future. After all, cinema has no right to set aside life, but it must observe, listen and doubt...

As the architectural historian Francois Loyer mentions “to find out what a city is, we should not ask Le Corbusier, but Michelangelo Antonioni, Francesco Rosi or even Jean-Luc Godard”. The study and interpretation of the city in cinema seeks in its representations that social dynamic, which will allow a meditation about the city to be expressed. It is an opportunity to deepen into a theory of representation, for the sake of a theory of spatial practice.

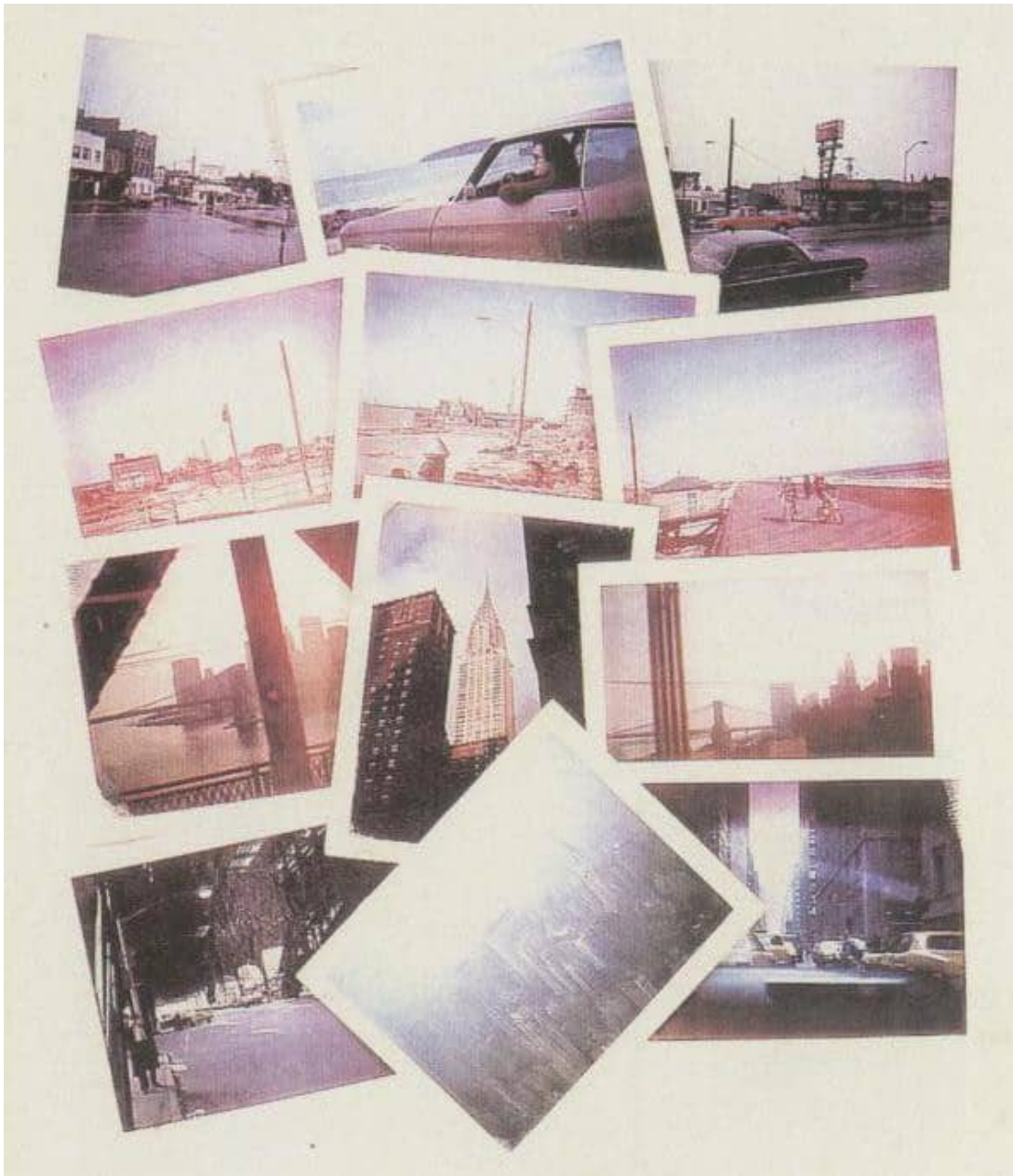
The cinematographic lens roams the city streets, penetrates walls and touches its soul and mind, its myth and word on diachrony. It offers an ability of deepening and metamorphosing the fragmentary and ephemeral urban experience into systematized and unified knowledge, which makes us even capable of urban planning action in an effort for a sustainable, pleasant for children and therefore worth living city. After all the former General Secretary of the United Nations, Ban Ki-moon, pointed out that “our struggle for global sustainability will be won or lost in cities”.

**Key words:** cinema, representation, planning “tool”, urban, sustainable, worth living, city

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Wim Wenders in the cities (from the film “Alice in the Cities”, 1974)

“The city is always in search of a poetic.”  
Jorge Luis Borges

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### 1. Cinema in the city

The way in which man experiences the world at a certain period of his development is expressed in his art. Cinematic expression, in particular, is a kind of recording and processing of temporal experience. At the same time, the ability of art to shape a language that differentiates each place also determines its creative expression.

In moments when light and landscape dominate, consciously or not, in the world of images, cinematic depictions of cities and their details as elements of memory and knowledge for the viewer constitute a dominant urban mythology in contemporary cultural creation.

Besides, it is no coincidence that the development of cinema at the beginning of the 20th century coincided with the city dwellers' effort to capture the constant change of modern urban life and the ephemeral nature of events, to connect images and situations that follow each other at great speed, and to render them into a single whole.

Cinema was the first art that managed to “capture” space so completely. “It is a peculiar spatial form of culture” (Mark Shiel, 2001) that can be understood more fully if its aesthetic theory (space in films) and its “urban” practice (films in space) are studied.

The characteristics of the cinematographic film are not only found in the way in which man positions himself in front of the camera, but also in the way in which it depicts the world with its help. Cinema, based on the entire breadth of the visual and auditory sensory world, has the consequence of broadening and deepening our sensory perception. It is also a special means of exploring how we imagine cities as an experience but also as a theoretical construction. Films allow us to draw some conclusions about how we experience real urban space, how we would like it to be, what we fear, or hope may happen in the future. Essentially, it is an opportunity to delve into a theory of representation for the sake of a theory of spatial practice.

According to the architectural historian Francois Loyer, “To find out what a city is, we should not ask Le Corbusier, but Michelangelo Antonioni, Francesco Rosi or even Jean-Luc Godard.” The reading and interpretation of the city in cinema seeks in its representations that social dynamic that will allow a reflection on the city to be expressed. “You just have to keep your eyes open, then reality is charged with meaning,” M. Antonioni assumes. After all, cinema does not have the right to set aside life, it must see, listen, and doubt...

The cinematic lens roams the streets of the city, penetrates the walls of the buildings and touches its soul and mind, its myth and its discourse in timelessness. It offers a possibility of deepening and transmuting the fragmented and ephemeral urban experience into systematized and unified knowledge, which makes us capable even of urban planning action in the effort for a city that is not only sustainable, but also worth living.

After all, according to the former General Secretary of UN, Ban Ki-moon, “*Our fight for global sustainability will be won or lost in cities*”. But the city is not the problem, but the solution. In this context, the UN 2030 Agenda for Sustainable Development highlights 17 sustainable development goals to change the world, on a path towards dignity with a time horizon of 2030. In particular, goal number 11 focuses on the sustainable development of cities and communities, to create safe, resilient and sustainable cities and human settlements, without exclusions.

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### 2. The UN 2030 Agenda for Sustainable Development

The 2030 Agenda for Sustainable Development was signed by the international community on 25/9/2015 during the 70th UN General Assembly and was characterized as a path towards dignity with a time horizon of 2030, as we did not inherit this world from our parents, but borrowed it from our children.

Indeed, on 25 September 2015, UN Member States agreed to create a common framework for sustainable development which included 17 goals that they should seek to achieve by 2030. These goals reflect the vision of the global community for our common desired future and indicate how the holistic approach to sustainable development will be achieved at Local, Regional, National and International levels. Its achievement is a one-way street for humanity, with no alternative avenues or prospects, as Ban Ki-moon (UN General Secretary from 2007-2016) characteristically stated, *“We have no plan B, because there is no planet B.”*

The term sustainable development first appeared at the United Nations Conference on the Human Environment held in Stockholm in 1972 and its definition was shaped by the World Conservation Strategy (1980), the Brundtland Report (1987) and the United Nations Conference on Environment and Development held in Rio (1992).

According to the Brundtland Commission, sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs.

In other words, sustainable development is undoubtedly essential for meeting human needs and improving the quality of human life. For this reason, it should be based on the efficient and environmentally responsible management of all the planet's scarce resources. It is development that seeks to meet the economic, social and environmental needs of society in a way that ensures short-term, medium-term and, most importantly, long-term prosperity. Essentially, sustainable development must meet current needs without compromising the well-being of future generations.

To understand the importance of the concept of Sustainability, one must consider the so-called “Three Pillars of Sustainability”, or in other words the corresponding aspects of sustainable development: social, economic and environmental. These three aspects are interrelated and if combined and implemented in practice, they can create a solid foundation for a sustainable world from which everyone can benefit, as natural resources are preserved, the environment is protected, the economy is not affected and the quality of life of citizens is improved.

Therefore, sustainable development is a combination of these three pillars. If any of the three pillars is “weak” then the system is not sustainable.

To be more specific, the three (3) pillars of sustainable development are:

1. Environment (use of natural resources, environmental management, pollution prevention)
2. Economy (profit, cost reduction, economic growth (growth) increase in GDP, i.e. increase in real national product, research and development).
3. Society (standard of living, education, justice and equal opportunities).



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Today, it has become widely accepted that achieving sustainable development for a better future requires a holistic approach, which combines economic growth, social justice and environmental sustainability.

The Agenda 2030 promotes the integration of all three dimensions of sustainable development into all sectoral policies and promotes the interconnection and coherence of sustainable development policies, giving intellectual dimension and qualitative depth to the three pillars of sustainable development. At the same time, it emphasizes the importance of enhancing the participation of social partners, civil society, and all stakeholders in the development and implementation of national sustainable development strategies and programs.

Greece adopted from the outset, at the UN General Assembly on 25/9/2015, the Sustainable Development Goals (SDGs) of the 2030 Agenda. It has committed itself within the framework of the UN resolution to their implementation and therefore must mobilize its forces for this in combination with their appropriate adaptation to national priorities, specificities and needs.

Particularly in a country like Greece, which had been severely affected by the economic crisis and austerity policies, with an unprecedented reduction in national product and income and a drastic increase in unemployment, poverty and social exclusion, the 2030 Agenda offered:

- a) Arguments for the implementation of horizontal social policies towards fair and sustainable development, taking into account that the decade of recession widened income, social and regional inequalities and
- b) Procedures that favor open governance based on measurable goals.

### ***2.1 The 17 Sustainable Development Goals (SDGs) of the 2030 Agenda***

As mentioned above, the UN 2030 Agenda for Sustainable Development highlights 17 Sustainable Development Goals (SDGs) to change the world, on a path towards dignity, with a time horizon of 2030. The 17 SDGs are global, of general application and create implementation commitments for all countries, developing and developed, considering national realities. These are goals that are SMART, i.e. Specific, Measurable, Achievable, Realistic and Time bounded. In particular, SDG 17, cooperation, is also essential for all the others to function, as they are interdependent, interact and must cooperate. The SDGs are broken down into 169 sub-goals and 230 indicators for their measurement and evaluation by the UN and 99 indicators by the European Union (EU). The monitoring of the implementation of the SDGs falls under the General Secretariat of the Government of each EU Member State, with progress measurements at national level and reporting to the United Nations Directorate-General for International Cooperation and Development. The local adaptation and use of the 2030 Agenda for Sustainable Development at Member State level concerns all 17 SDGs. After all, the concept of Sustainable Development is reflected in both the preamble and the main part of the Treaty on European Union (TEU, 1992), while since 22/11/2016 the EU revised its position on Sustainable Development in accordance with the UN Agenda 2030, following a holistic approach to achieve the SDGs, which become binding within the framework of the European Union, in contrast to the UN Agenda 2030, which does not have a high degree of legal bindingness, as there are no sanctions. Now, the SDGs in the European



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Union are turning into a source of inspiration for political decision-making. Strengthening its external action to consolidate the concept of sustainability in the rest of the world (developing countries) and at the same time seeking to improve the situation regarding the 17 SDGs in the EU itself.

### THE SUSTAINABLE DEVELOPMENT GOALS



UN Agenda 2030, Sustainable Development Goals.

More specifically, the 17 Sustainable Development Goals of the UN Agenda 2030 are:

- ✓ Goal 1: No poverty. End poverty in all its forms everywhere
- ✓ Goal 2: Zero hunger. End hunger, achieve food security and improved nutrition and promote sustainable agriculture
- ✓ Goal 3: Good health and well-being. Ensure healthy lives and promote well-being for all at all ages
- ✓ Goal 4: Quality education. Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all
- ✓ Goal 5: Gender equality. Achieve gender equality and empower all women and girls
- ✓ Goal 6: Clean water and sanitation. Ensure availability and sustainable management of water and sanitation for all
- ✓ Goal 7: Affordable and clean energy. Ensure access to affordable, reliable sustainable and modern energy for all
- ✓ Goal 8: Decent work and economic growth. Promote sustainable, inclusive and sustainable economic growth, full and productive employment and decent work for all
- ✓ Goal 9: Industry innovation and infrastructure. Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation.
- ✓ Goal 10: Reduce inequalities. Reduce inequality within and among countries
- ✓ Goal 11: Sustainable cities and communities. Make cities and human settlements inclusive, safe, resilient and sustainable.
- ✓ Goal 12: Responsible consumption and production. Ensure sustainable consumption and production patterns
- ✓ Goal 13: Climate action. Take urgent action to combat climate change and its impacts

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- ✓ Goal 14: Life below water. Conserve and sustainably use the oceans, seas and marine resources for sustainable development.
- ✓ Goal 15: Life on land. Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forest, combat desertification, and halt and reverse land degradation and halt biodiversity loss.
- ✓ Goal 16: Peace, justice and strong institutions. Promote peaceful and inclusive societies for sustainable development, provide access to justice for all and build effective, accountable and inclusive institutions at all levels.
- ✓ Goal 17: Partnership for the goals. Strengthen the means of implementation and revitalize the Global partnership for sustainable development

UN General Secretary, António Guterres points out: *“The Sustainable Development Goals are the path that leads us to a fairer, more peaceful and prosperous world and a healthy planet. They are also a call for solidarity between generations. There is no greater duty than to invest in the well-being of young people.”*

It is in this context that the commitments of the 2030 Agenda concerning the SDGs were formulated:

- “No one will be left behind”

- The 5 Ps of sustainable development are: people – planet – prosperity – peace – partnership

Therefore, sustainable development mainly requires changing behaviors, achieving another civilization, as we must keep in mind that whatever programs we design, they cannot succeed in societies that fail environmentally, socially, and economically. The 17 SDGs seek societies with economic prosperity and social development and qualitative characteristics, such as fair distribution of wealth, respect for social values and peaceful coexistence of people and nations.

### **2.2 The 11<sup>th</sup> SDG for sustainable cities**

Goal 11 of the 2030 Agenda focuses on the sustainable development of cities and communities, to create safe, resilient, sustainable cities and human settlements, without exclusion.



The 11<sup>th</sup> SDG of the UN's 2030 Agenda

However, as early as 2008 and for the first time in human history, the global urban population surpassed the global rural population, according to UN data.

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The Morumbi favela, one of the largest slums in São Paulo

The ever-growing human population is now expected to increase dramatically in cities. Indeed, as of 2017, 55% of the world's population resides in urban centers, while by 2050 it is expected that 65% of the world's population, or approximately 6.5 billion people, will live in urban centers.



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Los Olvidados, L. Buñuel, 1950

Cinema, since 1950 with the film “The Forgotten” (“Los olvidados”) by L. Buñuel, which depicted the slums of Mexico City for the first time, but also up to the recent “City of God” by F. Meireles (2002), which entered one of the most dangerous favelas in Rio, and “Slumdog Millionaire” by D. Boyle (2009), which was filmed in the Daravi favela in Mumbai, has turned its camera and focused on the slums and favelas of the third world.



The Daravi slum in Mumbai, where the film “Slumdog Millionaire” by D. Boyle was filmed, 2009.

Europe's cities are home to 3/4 (75%) of its population, as well as 70% of jobs, while 85% of European GDP is produced in cities. In Greece, half of its population is concentrated

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in just 4.3% of its territory. According to Hellenic Statistical Authority data in 2011, 73% of the Greek population lived in cities, in 2022 the percentage exceeded 80% of the population. By 2050, it is estimated that 85% of European citizens will live and work in cities.

The consequences of population concentration in cities are:

- The abandonment of the countryside and the primary production sector (agriculture, livestock)
- The intensity of energy consumption
- The intensity of waste production
- The inadequacy of infrastructure
- The increase in pollution
- The climate crisis - deregulation
- The lack of social cohesion

Therefore, the main problems that arise in the city are:

- The concentration of unemployment
- Social isolation
- The concentration of poverty
- The acute environmental problems

While the various challenges that urban centers face are:

- Economic
- Environmental
- Climatic
- Social
- Demographic

It is now imperative to ensure livable living conditions for all citizens of a city, as another natural resource, space, is being dangerously depleted with the intensification of the phenomenon of urbanization. Goal 11 seeks inclusive cities and human settlements that are safe, resilient and sustainable and is broken down into the following sub-targets:

11.1: Housing, upgrading of slums.

11.2: Public transport and transport systems

11.3. Sustainable and inclusive urbanization, sustainable planning

11.4. Safeguarding world cultural and natural heritage

11.5. Addressing natural disasters

11.6. Addressing environmental pollution, saving energy.

11.7. Green public spaces for all (accessible without exclusion)

11.8. Support urban-peri-urban-rural partnerships

11.9. Increase the number of cities adopting integrated policies and plans (in line with the above sub-targets)

11.10. Support the least developed countries to build sustainable cities

Regarding Goal 11, Greece's commitment is to continuously strengthen, without exclusions, sustainable urban development and participatory, integrated and sustainable urban planning. In this context, Local and Specific Urban Plans are currently being drawn up in Municipalities across Greece and under the supervision of TCG (Technical Chamber of

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Greece), implementing the EU-established spatial planning and sustainable urban development strategies. Having as main challenges:

- ✓ The expansion of urban activities beyond the defined urban zones,
- ✓ The construction of buildings and housing in some cases without prior appropriate planning and building permits, especially in coastal areas
- ✓ The need to increase public and green spaces in city centers
- ✓ The transition from outdated practices, such as landfill, to reuse and recycling with source separation, even at the domestic level
- ✓ Urban mobility

In the context of the local adaptation and use of the 2030 Agenda (localization) and the achievement of the Sustainable Development Goals, the purpose of sustainability is analyzed, which is composed of:

- ✓ Attractiveness (for citizens, investors, institutions, etc.)
- ✓ Preservation and improvement of the environment.
- ✓ Resilience (adaptation to climate change, preparedness to deal with natural disasters, economic crises, etc.)
- ✓ Responsible use of resources (natural, human and economic).
- ✓ Social cohesion (inclusiveness, reduction of inequalities, participation, etc.)
- ✓ Prosperity/ Well-being (quality of life, equal opportunities, human city, etc.)

In particular, the implementation of SDG number 11 for a sustainable city concerns the balancing of different and often competing needs at the environmental, social and economic levels, without compromising the capabilities of future generations to meet their own needs.

### **3. The physiognomy of the city in cinema. Cinema as a planning “tool”**

In films, cities are the “urban imaginary”, according to Ed. Soja, which constitutes a guideline not only for understanding, but also for reproducing urban space as a place and way of life, while at the same time confirming or opposing prevailing interpretations, desires and mythologies. The demand for self-knowledge and the need for shared spatial awareness is now placed at the basis of a variation of the triaxial spatiality according to Ed. Soja (Thirdspace, 1996), which includes:

- ✓ What is lived by the creator
- ✓ What is conceived by the cinematographic lens
- ✓ What is perceived by the viewer

Utopian or dystopian, the city is constituted as a pivotal point in the evolution of the human adventure, as cinema follows the footsteps of man on his journey to discover the lost city of the past and the imperative search for a city worth living in the present and sustainable in the future. A journey from space to its depiction, from speech to image, from architecture to cinema and vice versa.

The meeting of architecture and cinema in urban planning consists of the management of complexity and concerns the transversal communications between different fields and the possibility of innovative approaches to plan either through their collaboration or through its multiple representations. Different ways of storytelling are combined multiple times and produce representations. If, therefore, cinema represents the imaginary version of the real,



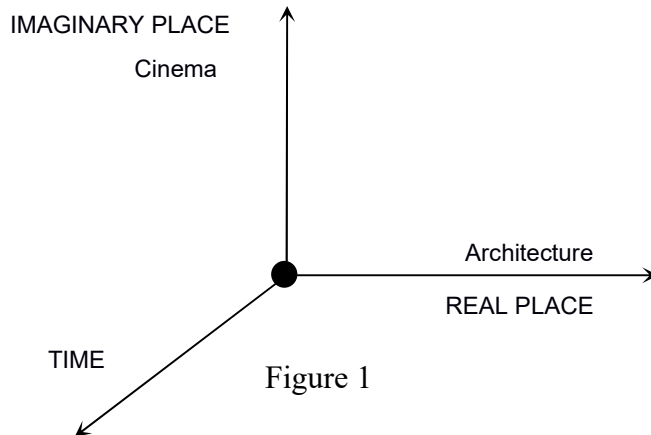
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architecture remains as the real version of the imaginary. The dimension that defines them is time (Figure 1).

The relationship between architecture and cinema concerns a new sensitivity, a new “narrative”, a wandering in the “unfamiliar” reality of our cities.



In every art, experimentation precedes rules. Over time, the technique of cinema has also acquired its own method. Audiovisual composition, editing and mixing, are the "cinematic peculiarity", thanks to which the film restructures reality through contractions and expansions of space and time. It is the basic tool of cinema that makes it an art, differentiating it from other arts.

Cinema as an art of fragmentation and composition makes the succession of shots a potential reconstruction of our relationship with space and time. For the pioneering Soviet filmmaker Dziga Vertov, the camera, as early as the third decade of the 20<sup>th</sup> century, was not simply a substitute for the eye, but a tool that could overcome the shortcomings of human vision.



“The man with the movie camera”, D. Vertov 1929

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The entry of cinema into the city can be analyzed as a recording of a wandering course that reflects urban life as an event in time and the rhythm of the city as a sequence of shots in routes of representation of reality (Figure 2). Space is perceived in motion, that is, as urban life is experienced in its dynamic unfolding, while time is no longer calculated through movement, but itself constitutes its rhythm and measure. This is a new mythology of the city where wandering goes hand in hand with cinematic traveling and architecture with urban narrative.

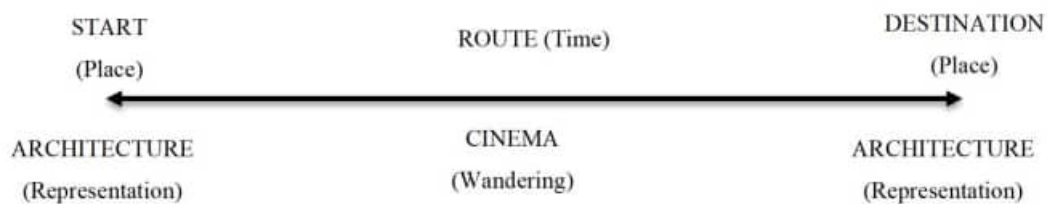


Figure 2

Cinema is par excellence an “urban” art, its matrix is the city. It is another way of reading its semantic and emotional content and at the same time a representation of its spatial “reality”. The “iconology” of such an approach, as graphically presented in figure 3, highlights the relationship between the phenomenon of the city and its Architecture, and Cinema. Space as a place and as an object of representation is not inert and static, but contains vectors and speeds. Time as a flow arises from the succession of shots, while in its entirety it depends on editing, which reduces it again to movement and sequence of shots. Time does not flow only from the alternation of shots, but also within them. Editing invades them in order to create an interaction that will maintain their coherence by adopting a new balance. The journey of wandering goes hand in hand with the alternation of shots and temporal impressions. Its pace is synchronized with the rhythm of the city and the flow of shots. In particular, the form and rhythm of the metropolis offered cinema the evolution of its technique and discourse. The traveling of the camera visualizes the wandering, the movement in the metropolis, while editing is the only way to render its feverish rhythm and depict its “phantasmagoria”, its unexpectedness. The only way to tell the fragmentary stories that take place in its bowels, as it is the basic and necessary prerequisite of the aesthetics of the art of cinema, being the carrier of rhythm.

Cinema was not content with recording images and reproducing movement. It learned to produce movement with its own means and not only with the movements of the camera, the panoramic shot and the traveling shot, but with montage, which activates space and spatializes time and with the changes in shooting angle and distance between the object and the camera. It has the ability to act simultaneously fragmentarily and in flow, in parallel, intertwined, but also conflicting paths, with rhythm or against it, training man to stop standing and looking, but to observe, to know, to see...

It is a narrative, iconographic and design investigation for the revelation of the “truth” of the city.

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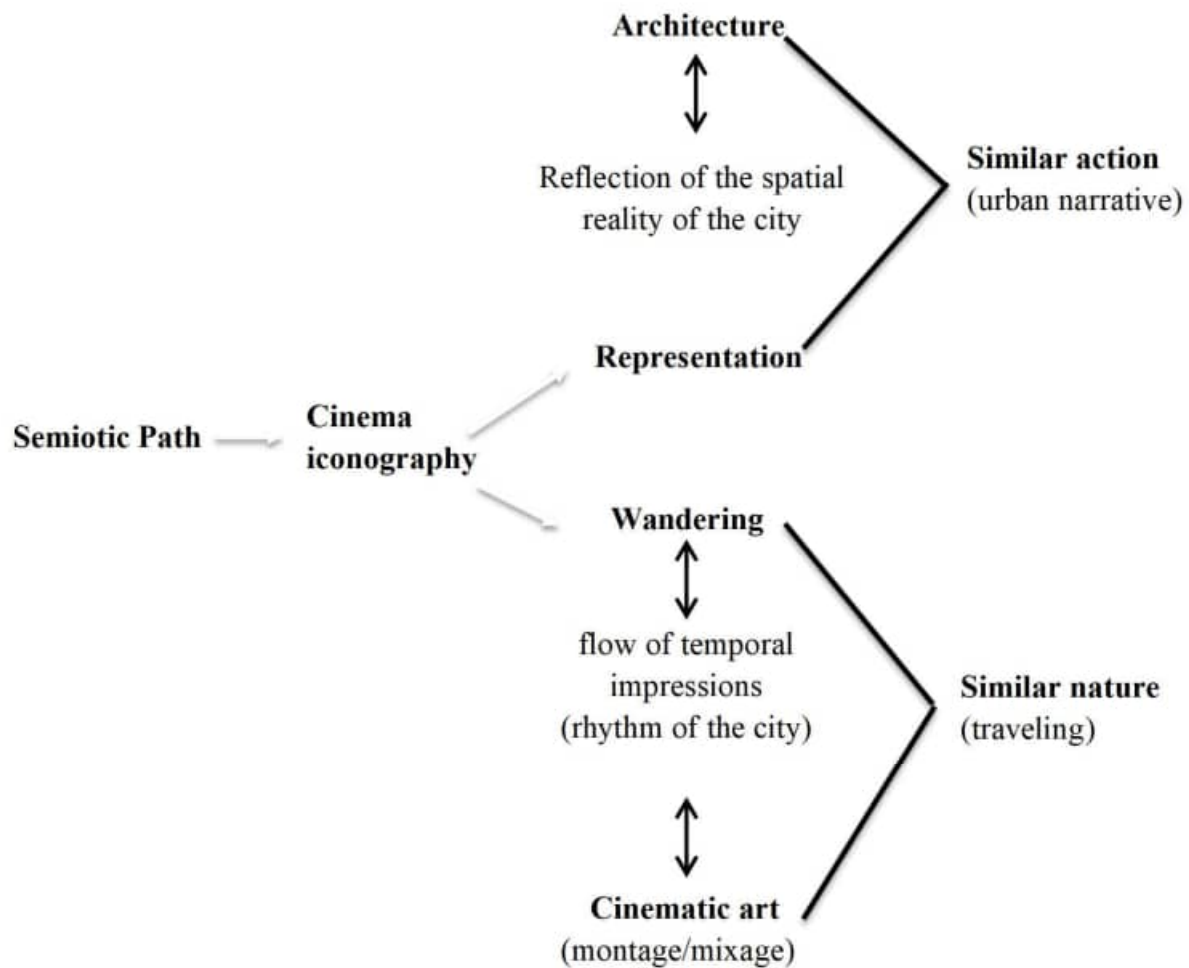


Figure 3

In particular, cinematic writing can be highlighted as a “tool” for reading, interpreting, evaluating and ultimately analyzing the quality and content of the city. Even as a “tool” for spatial planning, as it is original, beyond the traditional and usual, easy to use, now with the use of digital cameras, having the ability to provide complete and accurate urban information. It is indicative that already in the 1980s, sociologist W. Whyte filmed urban squares, parks and pedestrian streets, managing to analyze how urban spaces function and to suggest ways of designing successful public spaces. Today, with the development of digital technology applications from mobile phones to drones and even for a “handmade” DIY (Do It Yourself) Cinema, more and more possibilities are provided for research, analysis and synthesis of the parameters for the spatial planning of an urban area. Following a process of opposition between city and cinema (Table 1), urban narrative and script (story), urban planning study and reperege (field research), urban planning plans and decoupage (camera positions),

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movement in the city (traffic, networks) and the traveling of the camera and finally between the rhythm of the city and the cinematic technique of audiovisual editing (montage/ mixage).

| City                                        | Cinema                       |
|---------------------------------------------|------------------------------|
| Urban narrative                             | Scenario (story)             |
| Urban planning study                        | Reperage (research)          |
| Urban planning plans                        | Decoupage (camera positions) |
| Movement in the city<br>(traffic, networks) | Camera Traveling             |
| Rhythm of the city                          | Montage/ mixage              |

Table 1

Now, the camera records continuously. The new generation guides the digital camera, now, without separations, but also without “sensitivities”, towards a new form of “representation”. It is now the urban image that interacts with the passersby of the city. It is about direct cinematography with processes of participation and reflection, as dictated by the principles of direct democracy. In the era of globalization, economic crisis and pandemic, where the fictitious, the virtual, has been transformed into certainty, while the real, the true into uncertainty, all that is left to us is Godard’s admonition and a basic principle of cinema: “walk towards the light and illuminate the night...”

Therefore, the art of cinema does not concern the studio city, a sterile, unobtrusive image of the city, juxtaposed with an urban planning of distance, in opposition to any idea of immediacy. “*The city carries the momentum of life and is carried by it: the city, a game of synthesis between architecture and urban planning, within its volumes, its spaces and its light, is teeming with life*” will say Kostas Axelos. Cinema does not have the right to set aside life, it must see, listen and doubt...

The analysis of cinematic urban patterns requires, beyond the spatial, their sociological and anthropocentric approach, as the city is not only its image. The city is its people, its living forces, the cause that moves and unites them. It is the actions, thoughts and desires of its inhabitants, its myth, its discourse and its history. As director Thanasis Rentzis notes (2009): “*The city (which received a consciousness of itself through cinema) and cinema (which focuses on all points of urban space) are discussed and meditated upon productively and inductively, searching for common components and the intersecting discourse with the aim of understanding, revising and rearranging the terms of our fluctuating and long-suffering urban life.*”

The city now acquires its “animated” dimension by highlighting its “interpretations – roles” in cinematic writing. Thus, we have the “real” and the “imaginary” city, the “historical” and the “future”. At the same time, the attitude of the art of cinema towards the city is

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revealed, which is sometimes critical, sometimes of projection and highlighting its historicity, through the creation of symbol cities and sometimes of laboratory, as in the case of Athens, which is projected in conditions of mixing historical standards and urban planning models. This is, as mentioned above, an opportunity to delve into a theory of representation, for the sake of a theory of spatial practice. A collage that emphasizes the parallel exhibition not only of different moments, but also of different types of representation of the city's physiognomy.

Through cinema, it is possible to predict the future of the city, as it is represented as the city of “the next day”, but also its current transformation, from the concept of “metropolis”, to the globalized “metapolis”. However, always keeping in mind the “other city”, the city of the 3<sup>rd</sup> world in the “new” order of things. Those parts of the big cities where misery, violence, illegality, poverty prevail. These are the slums, the marginal cities, the favelas, which are increasingly dense, as since 2008 and for the first time in the history of humanity, the global urban population has surpassed the global rural population. There, cinema does not entertain. It denounces, provokes, sensitizes, moves...

### **3.1 Filmed Athens**

In Athens, the coexistence of multiple spaces in the same place, such as the ancient Athens of monuments and the modern Athens of apartment buildings, results in the abolition of any sense of linear flow of time, which makes the city cinematic.

Regarding Greek cinema and its relationship with the city, the choice of protagonists who follow exactly the course of life and the evolution of post-war Athens is characteristic. From “The Neighborhood Girl” and “The Drunkard” (Or. Makris) of the old Athenian neighborhood (Plaka), we move on to the films with Logothetides (“A Pebble in the Lake”, “A Hero with Slippers”, “Fake Lira”), the classic Athenian bourgeois of the 1950s-1960s, to come to the typical internal immigrant, the sly, cunning, but honest, provincial Thymios Hadjichristou and to the crazy from the movement and modern rhythms, the anxiety and the frantic running of the troubled bourgeois of the 1960s-1970s period with Th. Vegos as his ideal interpreter. The decade of the 80s and 90s with the director in the foreground is characterized by a decadent social introversion (solitude of apartment buildings, drugs, etc.) until it reaches, from about the middle of the last decade of the 20th century and onwards, a focus on the immigrant, protagonist of Athens as “other”, as a foreign, but also as a strange city. And if the question was initially: who is the immigrant? in films such as “From the Snow” by Sotiris Goritsas (1993), with the dawn of the new century it mutated, focusing on a more internal search regarding the question of who we are in relation to the immigrant? in creations such as “Plato's Academy” by Philippos Tsitos (2009).



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“Plato's Academy”, P. Tsitos 2009

A search for personal and even family identity, which intensified with the advent of the economic crisis from 2010 onwards, in the context of the investigation of its causes in films such as “” (2010) and “Explosion” (2014) by Syllas Tzoumerkas, “Another World” by Christoforos Papakaliatis (2015) and others.



“Another World”, Christoforos Papakaliatis 2015



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In cinema, what matters is the search for a sense of space and ourselves within the world and especially in the city, the depiction of our urban life in its dynamic unfolding. In space, as a real field of forces, it is the energy that in the case of the city emanates from its social dynamics, the sum of the forces that shape and define it. The dynamics of migration combined with the effects of the economic-humanitarian crisis and the pandemic of recent years now determine the social and cultural physiognomy of Athens and have a catalytic effect on the formation of its urban environment. The “stranger” has become our mirror. He is a resident, a part of ourselves and not just another user of our city, after all, as is pointed out in K. Katzourakis’ film “The Road to the West” (2003) “...and whoever does not have a job in his own place is also a stranger”.

The question of sustainability in the city is now being raised. Today, the future of metropolitan Athens, of the homeless, the unemployed and the immigrants, is at stake in the areas of disruption, in the in-between spaces, in the circulating urban voids, in the degraded zones, in the suspended spaces of otherness in the center and on the outskirts of the city. Places where bold and inventive design programs must be implemented and must be explored narratively and iconographically by the films. With studies on the limits, on the combinations, on the microscale, on the multiple scenarios of free appropriation of space by the resident, as in times of crisis, inventive adaptation is a privilege of the weak, in complete contrast to the entrenchment of the private, following a cinematic practice that mobilizes it, as it activates space and spatializes time in a process of developing a dialectical relationship between image and movement, where each sequence of images will become an object of reflection. Cinema fulfills the deepest need of man to see and hear without intermediaries, as it projects these places as they are and us in relation to them. Places that the eye has learned to avoid. As an art of audio-visual composition, it makes it possible to reinvent our relationship with space and time, since it cannot but represent what is at stake in these areas.

In the films of Athens, it is the cracks of time between the images that tell the story. The most remote suburbs, but also the intermediate spaces, the unbuilt areas, the urban voids in the city center and on its outskirts are the protagonists of its changes and contradictions. Both filmmakers and architects take refuge there as:

- ✓ They are the stitching points of the city, since its boundaries have evaporated
- ✓ They are spaces that function as repositories of memory
- ✓ It is today, the present that produces memory and shapes social dynamics
- ✓ It is a meeting place for forming ideas and inspiration.

In a globalized, crisis-ridden, and intercultural environment, Athens must now immediately focus on the faces of its residents, especially the most vulnerable, on an alternative experience and representation of the city, having as its sole prerequisite its self-awareness, in a process of transformation, not simply into a sustainable, but into a worth living city for all its citizens.

#### **4. The sustainable and ultimately worth living city**

The human population living in cities is constantly increasing and will increase dramatically in the long term. Combined with the fact that the pandemic, according to the UN, has increased the percentage of people worldwide living in slums to over 1 billion, it is now

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imperative for a city that will be focused on people and therefore worthy of living in it. A “smart” city, which will make a conscious effort for the innovative use of technologies, information and communication networks (ICT) to support a more inclusive, diverse and sustainable urban environment. According to D. Papastergiou (former Mayor of Trikala) *“it is the city that “listens” to its citizens and together they proceed with projects and actions with substance and a human face”*. A city that, with the help of cinema, does not bypass needs, but projects them, does not ignore problems, but solves them, aiming for sustainability, with the human being as the only choice. A city that should be sustainable and at the same time resilient and “open” to design and offer services to all its citizens without exception, without discrimination, so that everyone feels part of a worth living city and at the same time a “smart” city that innovates and has in its DNA the change of culture. It is the place where traditional networks and services become more efficient with the use of ICT for the benefit of residents. The term “smart” city is an umbrella for how technologies can improve the efficiency of a city's operations and the quality of life of its residents, while at the same time promoting the local economy.

In a smart city, new technologies and innovation are the means for:

- ✓ Improving the quality of life of citizens
- ✓ Sustainable urban development
- ✓ Boosting competitiveness
- ✓ Creating new communication channels
- ✓ Access to information
- ✓ Ease of access and enhancing the efficiency of public services.
- ✓ Environmental protection
- ✓ Enhancing accessibility, safety, and comfort
- ✓ Mobility
- ✓ Social cohesion and integration.

As Dimitris Papastergiou (former Mayor of Trikala) notes: *“We essentially mean a city with a central, integrated strategic plan and steady steps towards specific directions. These directions have been selected based on the specific characteristics of each area. That is, the goal is to use the tools that allow for the improvement of the functioning of the Municipality for the benefit of citizens. “Smart” is not only the city with the use of IT, but also the one that uses its services correctly and with planning”*.

Therefore, “smart” is the city that increases the rate at which it provides social, economic and environmental sustainability results and responds to challenges such as climate change, rapid population growth and political and economic instability, radically improving the way it engages society, applies collaborative leadership methods, works across all sectors and systems of the city and uses data information and modern technologies to provide better services and quality of life to those in the city (residents, businesses, visitors), now and for the foreseeable future, without the existence of any unfair disadvantage among them, or the degradation of the natural environment.

But what does a “smart” city mean for the citizen?

- Increased efficiency and accessibility to services
- Reduction of poverty, unemployment and social exclusion
- Reduction of pollution and environmental impacts

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- Collection of data for their disposal and reuse in the effective formulation of policies (open, anonymous data)

Now, the definition of sustainable cities combines traditional urban sustainability with the needs of modern cities (ICT and innovative participatory methods) the resilient with the smart city:

- Resilient city: promotes efforts to prepare for events (e.g. natural disasters) that constitute an existential threat to urban life, strengthening and securing the critical infrastructure on which it depends.
- Smart city: priority in the application of information and communication technologies (ICT) to urban management problems, aim to optimize city systems and services

Essentially, there are 5 principles for designing sustainable cities:

- Urban policy for the common good
- Integrated approach
- Participation and co-creation
- Multilevel governance
- Place-centered approach

The sustainable city open to new ideas and innovations is the tolerant and inclusive city, which welcomes a variety of people and cultures. A city of equal opportunities for all, open to the combination of the lifestyle and creativity of the population, with cultural and commercial diversity. In other words, a city where all its citizens feel that they are part of it, a worth living city which:

- Creates opportunities for diverse contributions and participation, inviting citizens to play a greater role in shaping their community and in social and economic development.
- Is connected to its citizens, as it responds to their goals and objectives.
- Designs and delivers, without discrimination, services to all its citizens.
- Reduces barriers to information and provides access to services through digital networks, connecting people wherever they are.
- Promotes unhindered consultation, participation and the recording of all opinions
- Is a consumer and mediator of technological solutions that promote transparency, collaboration and inclusion.
- Requires an “open” approach from urban planners.

It is therefore the sustainable city that can be “smart” and resilient, open and safe, and ultimately worth living, contributing both to the completeness of services and the quality of life of its citizens, as well as to sustainable development, which satisfies the environmental, social and economic needs of its citizens today, without compromising the ability of future generations to satisfy their own needs.

Therefore, it is imperative for a city to be centered on people and therefore worth living in. A worth living city, according to the professor of Ecology Panagiotis D. Dimopoulos assumes:

- A model of integrated development that is compatible with the environment, is founded on, goes hand in hand with and contributes to the social and cultural development of its citizens,

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- The creation or strengthening of the characteristics of a fair and equal city,
- A rational urban planning based on criteria that protect the physiognomy of the city and serve the coexistence of the natural environment with the urban environment.

In order for a city to be sustainable, focused on people and their needs and therefore livable and enviable...

### 5. In conclusion

The relationship between city and cinema is highlighted not only in films that showcase the city, but mainly in those that represent the particularity of the urban phenomenon in its everyday life. An approach that must start from what the city is, which remains well hidden, as we do not see the city, we do not look at it in the eye, we do not try to understand it or feel it, we simply pass by it. “Because ultimately the highest intervention of the narrative art of cinema is that it challenges us to compare what we see and hear with what we live, with what comes to mind, with what we would like, with what we have tried, but also with what we have never thought or felt...” (S. Stavridis 1998)

Today, in the era of uncertainty, as a result of the economic-humanitarian crisis and the pandemic of recent years, the stakes are now to initiate a dialogue around the urban landscape, its changes and their impacts, as they are identified in cinematic representations and the pursuits of contemporary urban planning and architecture. The cinematic discourse on the city can constitute a new starting point in the effort to understand urban life theoretically and in practice; to become aware of the crisis of urban space and to confront the everyday violence it exerts through a process of reflection for an alternative representation of its “truth”. To highlight cinematic writing as a “tool” of urban planning, contributing to a process of formulating an “other”, contemporary language for architecture. An alternative perspective, another way of seeing the city, beyond the traditional and usual ones, which will make us capable of urban action. This requires the interdisciplinary analysis of cinematic urban models, focusing, in addition to urban planning, on their sociological and anthropocentric approach, as the city is not simply its image, but a living organism. Therefore, it is possible to develop a new field of urban action, which will be capable of recognizing and interpreting, analyzing and evaluating, through cinema, the urban, sociological, humanitarian and other issues of the modern city and, in particular, nowadays, a city in crisis. For the creation of not just a viable, but a worth living and at the same time enviable city. Always keeping in mind, the advice of the architect D. Pikioni: *“A little more humanity, deeper understanding and mental sensitivity – and everything changes: from the initial attitude to the details.”*

Today, the great stakes of the Greek city of the homeless and immigrants are at stake in the intermediate spaces, in the urban voids in the center and on the outskirts of the city. Cinema fulfills the deepest human need to see and hear without intermediaries, as it projects these places as they are with us in front of them. Places that the eye has learned to avoid. Cinema cannot help but represent what is at stake in these areas. The urban image interacts with the passerby of the city, developing a dialectical relationship between image and movement, where each sequence of images becomes an object of reflection. Both immigration, the economic-humanitarian crisis, and the pandemic of recent years, now constitute the social dynamics of the city, which determines the cinematic writing. After all, cinema as an art "in

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motion" can capture urban life in its dynamic unfolding, highlighting the social phenomena that constitute this dynamic.

Now the game of the city is played in regenerations. At the same time, a new design on the scale of the city can bring about resistance to superficial change, the acceptance of the documentation of the city's cultural memory, the enhancement of the value of public space, the dialogical relationship with the environment that brings about essential changes in the relationship between public and private space. The point interventions for the transformation of the urban landscape, combined with the formation of a collective interest, a cultural consensus among the factors that contribute to their implementation, constitute the important first steps for a sustainable city. This collective interest can be initiated by cinema, focusing on the relationship between it and the city as a living social reality. In the context of the search for a sustainable and at the same time worth living city.

For cinema, the city is not simply a field for recording stories, which transforms it into a perceptible text. The spaces of the city themselves, with their function, guide the narrative. Stories are mapped with roads that can direct you everywhere, but also nowhere. But the urban landscape also contains a story, it contains an identity, a physiognomy. It affects people, creates a sense of time and a “cinematic” emotion, it is experiential, in short, the landscape is inhabited.

The cinematic possibility of a narrative about the city and at the same time a description of its image are those elements that can not only be projected, but also act catalytically in the formation of its physiognomy, as cinema was created to capture the eternal that constantly changes forms in contrast to architecture which aims to make the form eternal. As Doors singer Jim Morrison wrote in his notes on vision: “In dim light, form is sacrificed to light. In full light, light is sacrificed to form.”

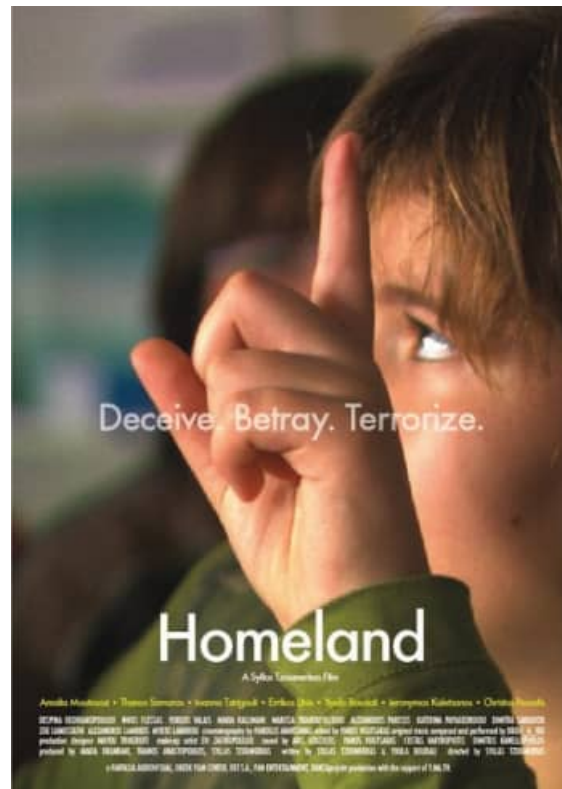
But the city of cinema is never a definitive image. It is always in evolution, like its urban environment, as it is made up of people who experience it, feel it, are moved within it, it is a living organism. It is a city that is always invented, even when it is real. The cinematic image usually imposes fragmentary perspectives of the city, delimited by the frames chosen by the creator. As Jean-Louis Comolli (1996) said: “The cities that have been loved by cinema have been filmed as enigmas. They are there and they are not there, they hide at the same time as they reveal themselves, they escape and condense in the bodies that embody them, they disappear within them”. Therefore, it is not only cinema that “loses” the city, but also the city itself that has been “lost”. According to anthropologist Marc Augè, there is no longer anything but a city or a “desert”, so it is not exactly a city, as we considered it until today, but mainly a space that must be reevaluated, rediscovered from the beginning to evolve/ design the history of tomorrow. The subway stations, the informal settlements of the periphery, the ghettos of the urban center and the favelas of the third world megacities, are, in the same way as the highways, the waiting rooms at airports, the office towers and the malls of the spectacular metropolises, the undefined space of a history that, although we were completely unaware of, some inspired creators such as Wim Wenders, Jean-Luc Godard, Federico Fellini, became our eyes and ears and were able, through their images, to make us see and hear the noise it makes, as it approaches like a swell. While waiting for it, we must see and listen, be vigilant and focus on the city dweller of the new century. To design:

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- Behaviors of people in the city, which will make it not only sustainable, but worth living for all its citizens, as sustainable development mainly requires a change in mentality to achieve another culture,
- Cities that children will love and want to live in, not only now, but also when they grow up.



Homeland, Syllas Tzoumerkas, 2010

In this context, Jean-Luc Godard (video: “moments from the history of cinema”) points out the contribution of cinema:

“What is cinema? Nothing  
What does it want? Everything  
What can it do? Something”.

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### CITY-CENTERED VALUES

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#### **Abstract**

City-centered values are goods related to institutions and human rights in the urban context. The right to the city has been conceived by Henri Lefebvre as a radical challenge for participation of urban dwellers in decision-making, such as spatial planning, and for social inclusion. It has recently begun to be constitutionalized, as it is the case of the 2008 Constitution of Ecuador, which in article 31 regulates the right of persons “to fully enjoy the city and its public spaces”. The “right to Tourism Municipality” has not been consecrated, although Tourism Municipality has been introduced in some legal orders of Spanish Autonomous Communities. This institution enables cities, including coastal ones, to develop further their potential as tourism destinations, inter alia through additional financial support. There is a significant tendency of convergence of these urban guarantees, despite their heteroclite background. Besides, another potentially urban value consists in the port entelechy to hospitality being offered to people and ships. Both the magnificent invention of Aristotle, entelechy, and hospitality are absent from all Constitutions and could be constitutionalized by previewing that “Hospitality is the entelechy of the port”.

**Key words:** city-centered values, maritime values, port entelechy to hospitality, right to the city, right to Tourism Municipality

#### **Introduction**

The term “polis” declares the city-state but also encompasses the set of rights and obligations of citizens and is strictly related to culture. It would be interesting to focus on certain social and legal values related to the city and potentially to the maritime context, with emphasis on philosophical terms.

First of all, this paper will present the right to the city, an inspired innovation of the French philosopher Henri Lefebvre.

Then, it will refer to a newer institution, such as the Tourism Municipality, in the Spanish legal order.

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Afterwards, it will adopt a more specific and detailed approach, to harbors, let alone in the current context of maritimization (Lecoq, 2014). It will look for the intrinsic destination of the port institution.

### **The right to the city**

In a year of intense political and constitutional changes in Europe, 1968, the right to the city was proposed in France by Henri Lefebvre. It was defined as the right of all urban dwellers to participate in the shaping of the city. The philosopher, in his work on “The Right to the City”, referred to the role of festivals within the urban space. Festivals are not seen as simply recreational events, but moments that transform and reconfigure the use and meaning of urban space. In this context, festivals can be considered acts that temporarily subvert the everyday order of the city, opening up possibilities for new forms of sociability and appropriation of space by the inhabitants.

In his conception of the right to the city, Lefebvre stresses that people not only have a right to the city in terms of physical access or urban services, but also in terms of their ability to participate in the production and transformation of urban spaces, as it is the case of urban planning. Festivals, with their ephemeral and festive character, embody a form of appropriation and playful use of urban space that escapes the routines imposed by capitalism and urban bureaucracy. They reflect cultural diversity, which can be interpreted as the principle of multiculturalism that can particularly favor minorities and representatives of cultures that do not have easy access to the media. They also illustrate the creativity of urban dwellers, contributing to the construction of a more inclusive and democratic city. They allow the city to be experienced differently, recovering a sense of community and collective participation that is fundamental to the idea of a full “right to the city”. Lefebvre criticizes how leisure in modern cities has been commercialized, becoming an extension of work and consumption. Instead of being a space of freedom and creativity, leisure in capitalist cities is often a time subordinated to the logics of the market, in which individuals are consumers rather than creators of their own free time.

It is notable that Lefebvre and Epicurus have visions that, although different in context, seek to transform the human experience for the better. Lefebvre, with his right to the city, emphasizes active participation in urban life as a form of freedom and fulfillment. Through festivals and the creative use of space, citizens reclaim their right to a living and collective city, escaping capitalist and bureaucratic control. On the other hand, the ancient Greek philosopher promoted friendship as one of the highest pleasures, an essential bond that provides peace and happiness in life. His approach stresses the importance of genuine relationships and community to achieve a fulfilling life. Both philosophers’ approaches value the importance of community and the creative use of space or relationships to challenge oppressive structures, proposing that true happiness and fulfillment are found in these acts of participation and connection.

Lefebvre’s archetypal approach was followed by the urban movements, according to which the economic system and its multiple expressions (real estate developers, large urban renewal projects, tourist industry, police) have a very negative impact on the collective ability

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of inhabitants to lead fully satisfying lives. Later, the comparable concept of the inclusive city emerged, which is now applied to urban governance.

Urbanization is a strong trend of the 21st century, on a global scale. Slightly more than half of the planet's population now lives in cities. For some years now, The right to the city has been gaining ground in certain non-governmental organizations (NGOs), as witnessed inter alia by the Quito and Barcelona Social Forums in 2004, the World Charter on the Right to the City, popularized by Unesco, the European Declaration on the Right to the City, voted by the Chamber of Local Authorities in 2005, and the Right to the City Coalition (Paquot, 2012). In general, this right has been promoted internationally, especially through organizations like UN-Habitat, which has supported its inclusion in urban policies. In the 2030 Agenda for Sustainable Development, the governments of the world's States committed to ‘making cities more inclusive, safe, resilient and sustainable’.

An emblematic case of recognition of the right to the city consists in its incorporation in the 2008 Constitution of Ecuador, which in article 31 regulates the right of persons ‘to fully enjoy the city and its public spaces’. In addition, the Political Constitution of Mexico City, adopted in 2017, includes in its Article 12 the explicit recognition of the right to the City, as follows:

*1. Mexico City guarantees the right to the city, which consists in the full and equitable use and usufruct of the city, founded on principles of social justice, democracy, participation, equality, sustainability, of respect for cultural diversity, nature and the environment.*

*2. The right to the city is a collective right that guarantees the full exercise of human rights, the social function of the city, its democratic management, and ensures territorial justice, social inclusion, and the equitable distribution of public goods with the participation of the citizenry.*

Thus, this right is a guarantee that is proposed as a collective human right that promotes the fair, equitable, sustainable and democratic use of the city, in addition to emphasizing citizen participation in urban decision-making.

### **The right to Tourism Municipality in Spain**

Key concerns of the current era are how to secure ecological sustainability and the universal right to tourism, given that globalization has been conducive to economic crises worldwide and to political instability particularly in authoritarian and undeveloped countries (Maniatis, 2016). As far as the Spain is concerned, the institution of the tourism municipality appears with the approval of Law 7/1985 on Bases of Local Regime. Distancing itself from the tradition of the Regulation of services of the Local Corporations, approved by decree of June 17, 1955 that consecrates the municipalization like form of development of the activity of the municipality for the benefit of the economic services of its competition, assuming the risk of the Company by means of the power to regulate it and to control its regime, the Law uses the expression ‘municipalization’ only at the time of establishing the attributions of the plenary ones of the City councils and the regime of majorities applicable to the adoption of its agreements (Míguez Macho, 2017). However, it opens up a new potential role for the municipalities. It does not contemplate the figure of the tourism municipality in itself configured, but leaves open the possibility of creating special municipal regimes for those

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municipalities “*that gather other characteristics that make it advisable, like its historical-artistic character or the predominance in its term of tourism activities...*” (Melgosa Arcos, 2011). Most of the Autonomous Communities have refrained from creating the category of tourism municipality, while those that have institutionalized it have not adopted a uniform regulatory treatment. These regulations are adapted to the particularity of a municipality that, due to its tourism attractiveness, has to take care of a high number of tourists, and they look for to ensure the quality of the services offered to them.

As regards the legislation of the Autonomous Community of Andalusia, the legal analysis of the applicable decree 72/2017 ends up to the conclusion that quality is the main objective while the purpose of this regime is not to compensate for the higher costs incurred by the influx of visitors, particularly in case of seasonality of demand, but to maintain and raise the tourism attractiveness of the municipality (Carmen Núñez Lozano, 2018). It is an approach focused on the tourism sector of the economy, considered as a strategic economic element of Andalusia, according to article 37.1.14 of its Statute of Autonomy, which is comparable to the constitutionalization of the tourism sector (“*Touristik*” instead of “*Tourismus*”, in German) in East Germany, in 1968.

Furthermore, it is noteworthy that in the Andalusian system considerable quantitative limitations of a demographic nature have been institutionalized. On the one hand, the premise to be able to obtain the status of “*Tourism Municipality of Andalusia*” is to have a population of no more than one hundred thousand inhabitants. On the other hand, it is important to note that this decree has eliminated the requirement that the municipality has more than five thousand inhabitants, introduced in the 2006 reform and, according to the doctrine, of dubious legality. The substantive requirements to achieve the status of tourism municipality are related to:

- a. The assisted tourist population, constituted by those who do not have the status of neighbors of the municipality, but have temporary stay, in the same for reasons of tourism visit or overnight stay in tourism accommodations,
- b. The tourism offer, which must have such consistency and attractiveness that it is capable of generating a flow of visitors to the municipality,
- c. The municipal plan for tourism quality that contemplates the measures of improvement of the services and benefits,
- d. The elements of valuation, among which the element “*m) Existence of an urban planning that contemplates the endowments of free spaces and others that fulfill the minimum reserves foreseen by the urban planning legislation, justifying its incidence on the assisted tourist population*” (Rivero Ysern, 2008).

On the one hand, the declaration of a municipality as tourism municipality implies obligations for the Administration of the Autonomous Community of Andalusia, which will be obliged to consider it as a priority in the actions of planning and promotion of its economic plans when it is compatible with the objectives of the same and, where appropriate, with the finalist nature of its financing. Essentially, the right of the tourist municipality to be a beneficiary of the management and promotion actions of the sectorial economic plans has

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been consecrated. It should be noted that the legislation on the matter avoids using the term “right” for the legal relationship of the municipality involved vis-à-vis the Autonomous Community, which shows a conservative spirit, perhaps to protect the economic resources of the Autonomous Community against an enforceable right. However, fundamental rights belong not only to natural persons, such as citizens, and legal persons under private law, illustrated by the majority of companies, but also to legal persons under public law that are part of the institution of local self-administration. In addition to the above, at the juridical level it is unusual to regulate a legal relationship by referring to obligations or duties of one party and at the same time not to symmetrical rights of the other party.

On the other hand, the tourism municipalities must carry out actions aimed at promoting and improving the actions and services with an impact on the tourism activity. Other obligations that are directly imposed are the following:

*a) To introduce mechanisms of citizen participation and of the economic and social agents in all the processes of tourism planning that are carried out.*

*b) To integrate the conservation of the cultural and natural patrimony in the tourism planning, paying special attention to the intangible patrimony and to the values, customs and own traditions of the municipality.*

*c) Promote universal accessibility of local tourism resources.*

*d) To promote tourism that respects the environment and its inhabitants, that takes into account the carrying capacity of the destination and is aware of the limited natural resources of the territory.*

*e) To raise awareness among the local population and the assisted tourism population of the importance of responsible tourism practices, promoting egalitarian, educational and outreach activities on tourism and sustainable development.*

It should be emphasized that the reference to the intangible heritage and to the values, customs and traditions specific to the municipality is original, within the framework of the rules of the Autonomous Community on tourism municipality. It is an opening, among others, to the maritime values of tourism municipalities in the coastal area of the Autonomous Community, such as Roquetas de Mar and Níjar in Almería, Tarifa and Conil de la Frontera in Cádiz, as well as Almuñécar in Granada and several localities in the province of Málaga such as Nerja, Benalmádena and Torremolinos. The number of municipalities officially recognized as “Tourism Municipalities of Andalusia” has been 46. However, throughout the decree there is no word “hospitality”, which could perhaps be considered as implicit, among others, in this point. In any case, it is problematic to regulate in detail the category of the tourism municipality, without highlighting the value of human rights and fundamental principles of direct relation with tourism, such as the right to safe travel and the principle of hospitality, while the institution of the tourism municipality, itself, is not institutionalized, at least explicitly, as an authentic “right”.

### **The port entelechy to hospitality**

Instead of giving terms to literature, as Plato did, Aristotle built the terminology of science and philosophy we can hardly speak of any science today without employing terms which he invented; they lie like fossils in the strata of our speech: *faculty*, *mean*, *maxim* (meaning, in



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Aristotle, the major premiss of a syllogism), *category, energy, actuality, motive, end, principle, form* – these indispensable coins of philosophic thought were minted in his mind (Durant, 2006). Besides, development is not haphazard or accidental (else how could we explain the almost universal appearance and transmission of useful organs?); everything is guided in a certain direction from within, by its nature and structure and entelechy (Durant, 2006); the egg of the hen is internally designed or destined to become not a duck but a chick; the acorn becomes not a willow but an oak. It is to underline that Aristotle invented a complex word on the matter, consisting in entelechy (*entelecheia*) – having (*echo*) its purpose (*telos*) within (*entos*); one of those magnificent Aristotelian terms which gather up into themselves a whole philosophy (Durant, 2006).

The entelechy has been recently used to localize the inner destination of harbors (Maniatis, 2024). More precisely, the port has a diachronic, intrinsic purpose, strictly related to the ideal of safety and security of both people and ships, which consists in hospitality, a term thoroughly omitted until the emergence of this theory. Moreover, the principle of hospitality is a taboo, not only in the port context. The concept of the port as a public institution offering hospitality even to foreign-registered ships has been reinforced historically, after the Middle Ages in Europe, on the basis of the gradual improvement of seaports and coastal states. From the 15th century onwards, this is the case with important institutions and developments, such as the domination of ports by European monarchs, the emergence of the territorial sea as a zone of sovereignty of the coastal State and the introduction of maritime cabotage. To the extent that coastal countries with traditional military and maritime power were strengthened in legal and empirical terms, they could transfer their strength to the expression of economic activities, such as fishing and shipping, and above all to hospitality, against natural and social dangers. Hospitality constitutes by nature a form of welcome, inclusion and shelter by a person or a social group that is endowed with sufficient material goods, such as residence, to a person in need.

Besides, the aquatic abysses symbolize the hospitality offered to living species. Throughout the vast isothermal zone, known as the “hypolimnion”, temperatures are extremely stable, ranging from 0.5°C to 4°C (Cabé). The density of water is greater than 4°C and, as a consequence, the temperature at the bottom of a lake or ocean does not drop below 4°C (because colder waters are lighter), something that allowed life forms to survive during the coldest geological periods (Pech). Consequently, the sea or a lake has been a kind of true refuge for biodiversity, so that these aquatic spaces have proven to be hospitable par excellence in situations that are not very favorable for the survival of species. It is worth noting that the Greek word for harbor, namely “limén”, and the word “hypolimnion” share both etymological origin and functioning. In conclusion, hospitality is the entelechy of the port, which serves as a foundation for an anthropocentric and integrative approach to the maritime context.

As far as the word “marina” is concerned, in the tourism field it refers to a port specialized in providing services and facilities for recreational vessels, such as yachts, sailboats and motorboats. The first marinas on a global scale emerged in the second half of the 19th century, coinciding with the rise of luxury tourism and recreational boating among the European upper classes. During the 1950s and 1960s, there was an exponential growth in the construction of marinas in areas of tourist interest, such as the Mediterranean and Caribbean



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coasts, aimed at the growing demand for recreational boating. The concept of the modern marina developed as nautical tourism grew as a recreational activity for economic elites and expanded to broader sectors, becoming an integral part of coastal tourism in many parts of the world.

Unlike commercial or industrial ports, marinas are designed specifically for private vessels and offer a suitable infrastructure for nautical tourism. It is a tourism port that has facilities for mooring and berthing recreational boats, and services such as fueling, electricity, drinking water and boat maintenance. It should be emphasized that the marina is not merely intended for individuals with tourist boats, but is also combined with leisure infrastructures, such as restaurants, nautical stores, and in some cases, nearby hotels or resorts. In many cases, marinas offer boat rentals and other recreational activities centered on sailing.

These public spaces promote the constitutional right to teaching and education, and also indirectly the related right to research, in the field of marine-related leisure and maritime tourism. Hobbyists have the opportunity to attend specialized schools there, such as sailing or diving, which can contribute to the ecological and cultural awareness of the participants. This development is comparable to a project of the French State, within the framework of the second National Strategy of the Cuesta Sea, which covers the period 2024-2030. This project consists in “*Using tourism, leisure activities and MEAs (educational marine areas) to turn the coastline into the first space for environmental education*”(Gouvernement)

The operation of a marina is sometimes not without problems, such as coexistence with the inhabitants of the city of reference. For example, a measure was implemented to prohibit nighttime access to the marina in the Greek city of Kalamata. This ban resulted from a court decision in the first half of the 2000s, but did not become permanent practice. Finally, the company entrusted with the management of the marina opted for a liberal approach, so that today it guards the area, through its own personnel, thus ensuring safety. It is noticeable that in reality there is a risk, not only at night but also during the day, of crimes being committed against the interests of the private individuals involved. It is not first and foremost the local businesses, such as restaurants, but the property of the users of the marina facilities that are at risk. It is the general principle of hospitality and above all the people’s right to the city that emerged victorious in this case, which has an unusual jurisdictional dimension, if not unique, at least as far as Greek marinas are concerned.

## Conclusion

The aim of this study was to investigate certain city-related values, illustrated by urban maritime values. It ends up to the conclusion that the right to the city is an important guarantee, which recently has gained territory. This is true even at the constitutional level, for the first time in the 21st century. It is about a realistic, inclusive approach to cities, especially to industrialized big cities which constitute an important place of attraction for both immigrants and tourists, such as Paris. The French capital—and more specifically, the transformations it underwent in the 19th and 20th centuries—provided a critical backdrop for Lefebvre’s reflections on urban space, capitalism, and social struggles.

Furthermore, although the concept of tourism municipalities is not often explicitly mentioned within the doctrine of the right to the city, there is a clear relationship between the

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two phenomena, for example, in the sense of how citizens participate in the planning and management of their environment. Tourism municipalities are localities whose economic development is centered on tourism, which can generate tensions with respect to the rights of permanent residents. In this context, the right to the city could be interpreted as the defense of the interest of local inhabitants against the effects of tourism exploitation that, in some cases, prioritizes the needs of visitors over those of residents.

In the Spanish legal system, there is no direct reference between the right to the city and tourism municipalities, but the regulations institutionalize public open spaces as one of the criteria for a municipality to qualify as a “tourism municipality”, while the question of people’s access to the city’s public spaces is a key element of the content of this right in comparative law. Spanish regulations aim to manage the impact of tourism and balance it with the rights and quality of life of residents, something that could be considered aligned with the principles of the right to the city insofar as they advocate an equitable use of urban space and citizen participation in its development. It should be emphasized that some of the aforementioned obligations of the Tourism Municipality of Andalusia, particularly obligation number e), are very indicative of the need to develop responsible tourism, compatible with the rights of the inhabitants of the city visited, essentially their right to their own city.

To the extent that the port is part of a tourism municipality, it is endowed with the two above-mentioned urban values. In any case, it includes its own value, which is the Aristotelian magnificent invention consisting in entelechy. The telos of entelechy is a rather marginal and controversial ideal, hospitality to various entities, such as inter alia persons and ships. This form of entelechy is a self-existent guarantee, which is not limited to the rights of the persons involved or to a mere principle.

The intrinsic character that is typical of the philosophical concept of entelechy ties in with the natural character of the hospitality offered by the waters of the sea or the lake towards biodiversity in the hypolimnion zone while the etymology of the Greek words for port and lake suggests the contribution of both entities to hospitality.

Such an approach is accentuated with regard to the tourist port par excellence, which consists in marina. Not only the marina but also the other types of port would deserve a sustainable development approach, against phenomena of multipurpose deconstruction, which diminish their usefulness and prestige.

All in all, we must emphasize that the present work highlighted the existence of a system of novel city-centered values, with philosophical background, which are much or less recognized at juridical level. Furthermore, it puts the stress on the concept of entelechy, which should gain territory at the constitutional level, as a new term, especially as far as the category of constitutional guarantees are concerned. For instance, it is recommended to preview that “*Hospitality is the entelechy of the port*”. In such a case, the novelty would be double, given that no Constitution on global scale makes an explicit reference to hospitality...

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Hospitality is not only the entelechy of the port, but also the offer of nature.

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### THE ELLINIKON: A CASE STUDY OF SUSTAINABLE URBAN REGENERATION AND DEVELOPMENT

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#### **Abstract**

The Ellinikon project, known as "The Ellinikon", is the largest urban regeneration project in Europe, transforming the site of the former Ellinikon International Airport into a modern, sustainable city. The project includes the creation of a 2,000,000 sqm coastal park, neighbourhoods with state-of-the-art residences, shopping destinations, gastronomy and entertainment options, luxury hotels, casinos, business offices, conference centres, education, sports and cultural centres

The methodology of the study includes a comprehensive review of existing literature on urban regeneration and sustainable development, as well as a case study analysis of the Ellinikon project. The review will examine theories and practices of sustainable urban development, while the case study will focus on the design, implementation and challenges of the project.

Expected outcomes include the emergence of Ellinikon as a model of sustainable urban development, with an emphasis on the creation of green spaces, the integration of new technologies and the promotion of the circular economy. In addition, it is expected to contribute to the economic development of the area, creating new jobs and attracting tourism. The study will provide valuable insights for the implementation of sustainable practices in future urban regeneration projects.

**Key words:** Ellinikon project, sustainable urban regeneration, economic development, case study.

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# FROM AUTOTROPH SYSTEMS TO CITIES. RETHINKING TERRITORIAL METABOLISM TOWARDS URBAN SUSTAINABILITY.

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## Abstract

The relationship between territories and energy has long been a subject of interest in urban studies. This study revisits paradigms that have historically influenced this relationship, while adopting a conceptual approach analogous to autotroph systems—self-sustaining processes capable of generating energy internally without significant reliance on external inputs.

Territorial spatial organization and administrative boundaries are typically not structured with regard to the dynamics of energy consumption and production. By reinterpreting territories through an energy-balance perspective, this paper explores the potentiality of energy autonomy through dynamic exchanges among the territorial components.

To initiate a dialogue on such a redefinition that could stimulate a transition in energy distribution, a case study linked to the ideal capacity of a territory to self-sufficiency is interrogated. This reading proposes a reinvention of territorial organization—one that evolves as a dynamic system interwoven within interconnected complex relationships.

Using the Île-de-France region in France as a case study, the research employs GIS tools to translate various types of land uses into energy-producing and energy-consuming spaces. It further identifies sub-spaces and zones at different scales that bear energy balance characteristics. This reinterpretation of the territorial limits and peripheries, lean towards a new cartography of the territory in question.

The proposed experimental approach envisions thus an energy mix analogous to land-use mixes, suggesting a transformative framework for territorial organization. Such a potential paradigm shift in a territory's metabolic processes could lead towards a framework focused on conserving energy cycles and achieving sustainability, drawing an analogy with the autotroph systems.

**Key words:** urban metabolism, energy autonomy, autotrophic systems, territorial organisation

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# GOVERNANCE AND SUSTAINABILITY OF SPECIAL URBAN PLANS IN THESSALONIKI: PUBLIC PARTICIPATION AND URBAN TRANSFORMATION

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## Abstract

The financial crisis in Greece highlights the urgent need for reforms to promote development. A central pillar of these reforms has been the promotion of strategic investments and the introduction of innovative tools in urban planning, such as Special Urban Plans (SUPs). These plans aim to address urban challenges by offering flexibility and adaptability. However, their complexity and novelty have made it challenging to draw definitive conclusions about their impact on urban space. Are SUPs effective in fostering sustainable urban development as intended? To what extent do they engage citizens in their processes and ensure high-quality urban planning?

Thessaloniki, Greece's second-largest city, serves as an ideal case study for exploring these questions. The city faces pressing challenges, including population density, environmental degradation, and insufficient infrastructure, making SUPs a critical strategy for urban transformation.

This paper evaluates the sustainability of SUPs in Thessaloniki using a multidimensional approach that combines qualitative and quantitative analyses. It focuses on sustainable strategies by examining policies, urban interventions, and their socio-environmental impacts. The findings contribute to a deeper understanding of the effectiveness of Thessaloniki's SUPs, offering actionable insights for improving their implementation to achieve more inclusive and sustainable urban development. Evidence suggests that SUPs have the potential to foster urban resilience and enhance quality of life. However, challenges such as limited public engagement and inadequate sustainable outcomes persist, highlighting areas for improvement.

**Key words:** SUPs, Urban Sustainability, Urban planning, Socio-environmental Impact, Thessaloniki



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Session:

**“Circular Economy and Sustainable Development”**

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### THE CIRCULAR ECONOMY - A RESPONSE TO CLIMATE CHANGE

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#### **Abstract**

Circular economy - an economic system aimed at eliminating waste and continuous use of resources. It includes sharing, reusing, repairing, renovating and recycling to create a closed system. All waste becomes a resource or raw material for the next process, thus contrasting with the traditional or linear economy, in which the production model is take - make - use - throw away.

Municipalities have the greatest influence on outcomes – by setting an example and shaping the environment.

Considering Latvia's unique characteristics and the role of local governments in the circular economy, their importance has been established.

This article will tell about the methodology development and results of the first Latvian Circular Economy Index. It is commendable that all Latvian municipalities have been evaluated.

Self-assessment of municipalities and population surveys are included in the methodology. The resident's survey was conducted online (CAWI) using a closed, representative respondent panel. The survey asked residents about the municipality's and their own activities in the field of circular economy.

The Circular Economy Index for municipalities, developed for the first time in Latvia, will provide an opportunity to self-assess the processes and results in the work of institutions, organizations and municipalities. It will also be possible to follow the dynamics of your performance by years or periods and compare it with the results of others. At the same time, it will be possible to receive expert recommendations on priority processes to be improved, as well as promote success stories and examples of good practice.

Based on the self-assessment and index methodology, it will be possible to better understand the role of the circular economy in the work of institutions and organizations, in the performance of municipal functions, and in cooperation with interested parties.

Recommendations for more responsible behaviour, support mechanisms and fundraising are available for municipalities.

**Key words:** Circular economy index, Municipalities, Latvia

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### INTEGRATING CIRCULAR ECONOMY IN TO SUSTAINABLE DEVELOPMENT GOALS: INSIGHTS FROM LIFE CYCLE IMPACT ASSESSMENT

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#### **Abstract**

The integration of the circular economy into sustainable development goals offers an approach to sustainable resource management and economic growth, with Life Cycle Impact Assessment (LCIA) as a tool for evaluating environmental and socio-economic outcomes. This study investigates how LCIA methodologies can drive circular economy strategies within the textile industry, addressing sustainable development goals and targets such as responsible production and consumption and climate action. Textile production, which accounts for approximately 10% of global carbon emissions and 20% of industrial water pollution, presents significant opportunities for circular economy practices like recycling, reusing, and material innovation. Case studies from European textile manufacturers demonstrate the potential of LCIA in optimizing resource use, minimizing waste, and reducing greenhouse gas emissions by up to 50% when transitioning from virgin polyester production to closed-loop recycling systems. LCIA software tools such as OpenLCA and GaBi were employed to assess the environmental impacts across lifecycle stages, including raw material extraction, manufacturing, distribution, and end-of-life disposal. Results indicate that incorporating recycled fibers can lower energy consumption by 30–40%, while water usage can be reduced by as much as 70% compared to conventional production methods. Furthermore, the adoption of eco-design principles, supported by LCIA insights, showed a potential reduction in landfill waste by 25% through product lifecycle extension initiatives such as repair and reuse programs. This research highlights the socio-economic implications

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of circular economy adoption, including job creation in recycling and upcycling sectors, which could increase by 15% in regions implementing waste management systems. Policy recommendations emphasize the importance of regulatory frameworks that incentivize sustainable practices, such as extended producer responsibility and subsidies for green technologies. The findings show the value of cross-sector collaboration, combining insights from LCIA with circular economy strategies to improve sustainable consumption patterns and support the transition towards a low-carbon textile industry.

**Key words:** circular economy, life cycle impact assessment, resource management, recycling and reuse

### Introduction

The global textile industry is one of the most resource-intensive and environmentally damaging sectors, contributing to 10% of global carbon emissions and 20% of industrial water pollution (Ellen MacArthur Foundation, 2019). As concerns over environmental sustainability intensify, circular economy principles have gained momentum as a transformative approach to addressing the industry's environmental and socio-economic challenges. The circular economy promotes closed-loop systems that minimize resource extraction, optimize waste recovery, and extend product lifecycles. In the textile sector, this translates into strategies such as fiber-to-fiber recycling, eco-design, and sustainable material innovation. However, effectively integrating these principles into industry practices requires quantitative assessment methodologies to evaluate their environmental and economic benefits. This is where the Life Cycle Impact Assessment is most commonly used. LCIA represents an analytical tool used to quantify the environmental impacts of a product or process across its entire lifecycle, from raw material extraction and manufacturing to use and end-of-life disposal. With LCIA, industries can identify environmental hotspots, optimize resource efficiency, and compare the sustainability performance of different circular economy strategies. Despite the increasing relevance of LCIA, its integration with CE strategies within the textile industry remains underexplored, particularly in the context of achieving sustainable development goals. This paper aims to bridge this gap by analyzing the role of LCIA in driving circular economy transitions within the textile industry. By focusing on sustainable development goals targets such as responsible production and consumption (SDG 12), climate action (SDG 13), and sustainable industry innovation (SDG 9), this study analysis how LCIA methodologies can improve decision-making for sustainable textile production (Hales & Birdthistle, 2022), (Küfeoğlu, 2022). The United Nations Sustainable Development Goals (SDGs) provide a global framework for sustainable economic, social, and environmental progress. The textile and apparel industry, valued at approximately \$2.4 trillion, is a driver of economic growth and employment, yet it remains one of the largest contributors to pollution, carbon emissions, and resource depletion (UNEP, 2022). The integration of circular economy principles within the textile industry aligns directly with sustainable development goals, specifically: (1) SDG 12 - Responsible consumption and production, meaning reducing textile waste through recycling, reusing, and material recovery; (2) SDG 13 - Climate action,

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meaning that lowering carbon emissions through LCIA-informed eco-design and closed-loop production systems; (3) SDG 9 - Industry, innovation, and infrastructure, meaning encouraging sustainable industrialization through innovations in textile recycling technologies. However, the successful implementation of circular economy strategies requires a scientific, data-driven approach that goes beyond theoretical sustainability goals. LCIA enables a systematic evaluation of environmental trade-offs, ensuring that CE transitions lead to measurable sustainability benefits rather than unintended environmental consequences. LCIA provides quantitative insights into the sustainability impacts of different production methods, material choices, and waste management strategies. LCIA pinpoints high-impact processes within the textile lifecycle, such as dyeing (responsible for 20% of global industrial water pollution) and polyester production (generating 1.5 kg CO<sub>2</sub>e/kg of fabric). It enables industry stakeholders to prioritize mitigation strategies, such as adopting waterless dyeing techniques or shifting to recycled polyester. Conventional textile production follows a linear “take-make-waste” model, where raw materials are extracted, processed, and discarded. But on the other hand, LCIA allows for the comparison of linear and circular production models, demonstrating how closed-loop systems reduce carbon footprints by 40-60% and cut energy use by 30-50% (Hammar, Peñaloza, Hanning, 2024), (Lozano-Oviedo, Cortés, Rey, 2024). LCIA determines the most sustainable textile materials by assessing factors such as energy intensity, water use, and recyclability. LCIA studies show that mechanically recycled polyester emits 50% less CO<sub>2</sub> than virgin polyester while organic cotton consumes 91% less water than conventional cotton (Periyasamy, Militky, 2019), (Kamble, Behera, 2021).

The objectives of this paper are to analyze how LCIA methodologies influence circular textile decision-making and to quantify the environmental benefits of circular economy textile strategies using LCIA data.

## Literature Review

LCIA evaluates environmental impacts associated with all stages of a product's life cycle, from raw material extraction to disposal. In textiles, LCIA identifies environmental hotspots and informs sustainable practices. A systematic review (Bianco, et al., 2023) analyses studies on LCIA applications in textiles, revealing that the production phase, particularly raw material extraction and manufacturing, contributes significantly to environmental impacts. Cotton cultivation accounts for approximately 90% of water consumption in the life cycle of cotton garments. Additionally, the dyeing and finishing processes are responsible for about 20% of industrial water pollution globally. The paper (Bicalho, et al., 2017) compared LCIA methodologies, highlighting discrepancies in data quality and system boundaries. It found that using site-specific data reduced uncertainty by approximately 10% compared to generic datasets. This shows the importance of accurate data collection in LCIA studies to improve reliability.

The circular economy model aims to minimize waste and maximize resource efficiency by creating closed-loop systems. In the textile industry, circular economy frameworks have been adopted to address sustainability challenges. The review (Ramírez-Escamilla, et al., 2024) analyzed articles on circular economy strategies in the textile sector, identifying reuse, recycling, repair, and reduction as primary strategies. The study emphasized that

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implementing these strategies could reduce greenhouse gas emissions by up to 30% and decrease water consumption by approximately 50% (Ramírez-Escamilla, et al., 2024). Moreover, the paper (Furferi, Volpe, Mantellassi, 2022) proposed guidelines for textile industries transitioning to circular economy practices, for efficient use of natural resources, adoption of renewable energies, waste reduction, and effective end-of-life product management. Implementing these guidelines could lead to a 20% reduction in production costs and a 25% decrease in environmental impact.

The paper (Edirisinghe, de Alwis, Wijayasundara, 2024) highlights that the textile sector is responsible for 8-10% of global greenhouse gas emissions and 20% of worldwide wastewater pollution. The authors analysed that the most significant environmental impacts occur during the fiber production and wet processing stages. For instance, cotton cultivation in countries like India and Turkey is associated with high water use, pesticide pollution, and soil degradation, scoring up to 10 in environmental significance. Wet processing, particularly dyeing and finishing, is water-intensive and contributes substantially to chemical pollution and energy consumption. Lifecycle thinking and hotspot mapping revealed stages, such as raw material extraction, fabric dyeing, and end-of-life disposal, where circular economy strategies like water recycling, renewable energy adoption, and sustainable farming can be most effective. The paper's qualitative methodology, based on expert input from professionals and guided by UNEP's 2021 Eco-I Manual, offers a practical, low-cost alternative to conventional LCA software for identifying hotspots and proposing targeted circularity interventions across the product lifecycle.

It is important to emphasize that the textile and clothing industry is among the five most polluting and resource-intensive sectors globally, contributing significantly to water pollution and greenhouse gas emissions. While the concept of the circular economy offers a promising alternative to the traditional linear model, its practical implementation remains limited. The paper (Salmi & Kaipia, 2022) found that incumbent textile firms face path dependencies due to legacy product portfolios, product-oriented business cultures, and limited control over supply chains. In their case study of seven Finnish companies, only one was classified as a “circular incumbent,” while others struggled to shift from selling low-cost, short-lived fashion items to service-based or recycled offerings. For example, a company specializing in affordably admitted that its product prices were too low to make rental models viable. Conversely, “born circular” companies successfully used waste materials like safety belts and cutting scraps to drive sustainable design. The paper highlights the importance of dynamic capabilities, such as sensing regulatory shifts, seizing design opportunities, and transforming supply chains, for enabling this transition. It emphasizes that firms with strong internal control and RFID-enabled tracking of garments were better positioned to implement circular business models and reduce waste through repair and reuse strategies.

Applying LCIA methodologies and circular economy frameworks is important for the textile industry, given its substantial environmental footprint. Textile production is responsible for about 20% of global clean water pollution from dyeing and finishing products.

Implementing zero-waste fashion strategies, such as zero-waste pattern design, can significantly reduce the average 15% textile waste generated during standard garment production. Furthermore, adopting circular fashion models, which emphasize designing for



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longevity, using sustainable materials, and promoting recycling, can contribute to a more sustainable and resilient textile industry.

### **Analysis of case studies**

The following detailed analyses of case studies provide insights into the environmental footprints of different textile products. Bianco et al. (2023) conducted a cradle-to-gate LCA of a woollen undershirt produced in Italy, aiming to identify environmental hotspots in its production process. The study revealed that the total global warming potential of one undershirt is 11.7 kg CO<sub>2e</sub>, with the sheep farming phase contributing 88% of these emissions. Energy consumption during the wool transformation process accounted for 11% of the total emissions, partially mitigated by the use of electricity from photovoltaic panels. Materials such as chemicals and transportation had negligible contributions to the overall environmental impact. The paper highlighted that user habits influence the environmental impact during the use phase of the undershirt.

Cotton Incorporated conducted a comprehensive LCA to evaluate the environmental impacts of cotton fiber and fabric production, covering stages from cultivation to finishing. The study found that producing 1,000 kg of woven cotton fabric requires approximately 8,000 cubic meters of water, with irrigation during cultivation being the primary contributor. The total energy consumption for producing the same amount of fabric was found to be significant, with notable contributions from both agricultural and textile processing stages. These findings underscore the importance of focusing on the cultivation stage to reduce water and energy consumption in cotton textile production (Barnes, et al., 2010).

The paper (Sandin et al., 2024) evaluated the environmental impacts of a garment made from chemically recycled fibers, considering stages from raw material extraction to end-of-life. The study demonstrated that using chemically recycled fibers resulted in a 60% reduction in energy consumption compared to virgin polyester production. Additionally, there was a 50% decrease in global warming potential, equating to a reduction of 2.5 kg CO<sub>2e</sub> per garment. Water usage was also reduced by 70%, saving approximately 150 liters per garment. This case study highlights the environmental benefits of incorporating recycled materials into textile production.

### **Digital tools used for LCA analysis in the textile industry**

LCA software tools are important for evaluating the environmental impacts of products within the textile industry. A comparative analysis of LCA software tools shows the features, strengths, and limitations of this sector (Table 1). SimaPro is the most frequently used LCA software in textile-related environmental assessments. In textile LCAs conducted with SimaPro, a wide range of system boundaries were applied, most notably cradle-to-gate and cradle-to-grave, enabling evaluations from raw material extraction to end-of-life stages. SimaPro supported assessments with standardized units (e.g., kg CO<sub>2e</sub>/kg of material), allowing direct comparisons. For example, in the paper (Fonseca et al., 2023) wool yarn production evaluated using SimaPro revealed a remarkably high global warming potential of 95.70 kg CO<sub>2e</sub>/kg, while silk fabric production showed a similarly high global warming

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potential of 80.9 kg CO<sub>2</sub>e. Cotton fabric, by contrast, had lower emissions, averaging 14.9 kg CO<sub>2</sub>e/kg of material. In cradle-to-grave analyses supported by SimaPro, polyester showed the highest impact, with an average global warming potential of 40.28 kg CO<sub>2</sub>e/kg, compared to cotton (31 kg CO<sub>2</sub>e/kg) and wool (30.94 kg CO<sub>2</sub>e/kg). These values reflect the broader capabilities of SimaPro to integrate life cycle inventory data, including energy use, raw material extraction, use-phase activities (e.g., washing frequency), and end-of-life treatments such as reuse or incineration. SimaPro's compatibility with diverse impact assessment methods like IPCC, ReCiPe, CML, and TRACI further strengthens its versatility. For instance, TRACI was applied in studies using SimaPro 8.5.2, while ReCiPe and IPCC methods were applied in studies using versions ranging from 7.3 to 9.3. This flexibility enables detailed assessments of climate change impacts, energy demand, and water usage. Overall, SimaPro emerges as a validated tool for LCA in the textile sector, supporting evidence-based decision-making aligned with eco-design and circular economy principles.

The other software tool, GaBi is used in the textile industry to evaluate environmental impacts in different stages of textile production and recycling. In the paper (Sulochani et al., 2022) GaBi version 8 was used to model the environmental footprint of repurposing textile waste into composite materials. This application underscores GaBi's capability to handle complex recycling processes, offering insights into potential environmental benefits of innovative waste management strategies. The paper's findings, supported by GaBi's databases and modeling tools, highlight the software's role in promoting sustainable practices within the textile sector. However, specific quantitative impact values from this study are not provided in the available information. The paper (Dani and Shabiimam, 2024) aimed to evaluate the environmental impact of a textile company's operations. The GaBi 9.2.1 software was used in a gate-to-gate LCA of a Surat-based viscose textile company to evaluate its environmental performance across manufacturing stages, gray cloth production, dyeing, printing, and finishing. Using primary data collected directly from the facility and validated through mass and energy balances, the study revealed that the dyeing process accounted for the highest environmental impact. Dyeing alone contributed 38.04% of total energy demand and 28% of total water consumption, with a global warming potential of 5.37 kg CO<sub>2</sub>-equivalents per kg of product. The weaving and finishing stages followed closely, with global warming potential contributions of 5.382 kg and 5.535 kg CO<sub>2</sub>-eq, respectively. Atmospheric impacts assessed using CML 2001 and Environmental Footprint 2.0 methods showed that the dyeing stage also had the highest ozone depletion potential ( $3.32 \times 10^{-16}$  kg R11-eq) and acidification potential (0.0475 kg SO<sub>2</sub>-eq). Power-intensive sub-processes like thermosetting and jet dyeing were identified as hotspots due to their high steam and electricity requirements. For photochemical ozone creation potential, dyeing contributed 0.0472 kg ethene-eq, followed by weaving at 0.0133 kg. GaBi's weak point analysis module enabled identification of these specific contributors, allowing targeted recommendations such as implementing cool pad dyeing to reduce energy use, installing zero-liquid discharge systems, and adopting renewable energy. Overall, this case study highlights GaBi's capability to model complex textile operations and support strategic environmental management through quantified, process-specific impact assessments.

OpenLCA, an open-source software, has been applied in the textile industry to evaluate environmental and social impacts throughout product life cycles. A case study of an organic

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cotton hooded sweatshirt produced in India and used in Germany (GreenDelta, 2025a), (GreenDelta, 2025b). The study conducted a cradle-to-grave assessment, encompassing raw material extraction, manufacturing, distribution, use, and end-of-life stages. The findings revealed that the use phase, specifically the washing process, contributed to environmental impacts such as climate change and freshwater eutrophication. Scenarios altering user behavior, like reducing washing frequency or washing at lower temperatures, demonstrated potential for impact reduction. Additionally, a Social Life Cycle Assessment (S-LCA) using OpenLCA highlighted social risks associated with labor practices in the Indian textile sector, emphasizing issues like low wages and extended working hours. These insights show OpenLCA's capability to integrate environmental and social dimensions, aiding stakeholders in making informed decisions to improve sustainability in textile production and consumption.

Ecochain Mobius represents an environmental intelligence platform that enables companies to conduct LCA and measure the environmental impact of their products and processes. In the textile industry, Ecochain Mobius has been employed to assess and improve sustainability practices (Khanna et al., 2022), (Koščáková et al., 2024), (Pamu & Alugubelli, 2023). Dutch textile company, Schijvens Corporate Fashion, used Ecochain Mobius to analyze the environmental footprint of their workwear production. By inputting data related to raw material sourcing, manufacturing processes, transportation, and end-of-life disposal, Schijvens was able to identify significant environmental hotspots within their supply chain. The LCA revealed that fabric production and dyeing processes were major contributors to carbon emissions and water consumption. Armed with these insights, Schijvens implemented strategies such as selecting more sustainable materials, optimizing dyeing techniques, and improving logistics to reduce their overall environmental impact. This case demonstrates how Ecochain Mobius facilitates data-driven decision-making, allowing textile companies to pinpoint areas for improvement and track the effectiveness of sustainability initiatives over time. Similarly, the Belgian textile manufacturer, Beaulieu International Group, applied Ecochain Mobius to evaluate the environmental performance of their flooring products. The platform enabled Beaulieu to conduct comprehensive LCAs, uncovering that the use phase of their carpets had a substantial environmental impact due to maintenance requirements. As a result, the company focused on designing products that required less frequent cleaning and utilized materials that extended the product's lifespan, thereby reducing the overall environmental footprint.

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Table 1. Comparative table with features of LCA software tools

| Feature                             | SimaPro                                                                                                                                           | GaBi                                                                                                       | OpenLCA                                                                                                  | Ecochain Mobius                                                                                                                                                | OneClick LCA                                                                                                                          |
|-------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------|
| <b>User-friendliness</b>            | Designed for LCA professionals; may have a steeper learning curve for beginners.                                                                  | Comprehensive features suitable for detailed analyses; may require extensive training.                     | Open-source platform with a user-friendly interface; suitable for both beginners and experts.            | Built for business users with an intuitive interface, facilitating quick and reliable footprint assessments.                                                   | User-friendly interface customized for the construction sector; may require adaptation for textile applications.                      |
| <b>Database integration</b>         | Integrates with extensive databases like Ecoinvent and Agri-footprint, providing a wide range of data for various industries, including textiles. | Offers a comprehensive Life Cycle Inventory database, beneficial for detailed textile industry analyses.   | Supports multiple databases, including Ecoinvent and ELCD, offering flexibility in data selection.       | Provides access to extensive environmental impact databases, such as Ecoinvent and the Dutch Nationale Milieudatabase at no extra cost.                        | Contains a vast database of construction materials; may require additional data integration for comprehensive textile assessments.    |
| <b>Cost</b>                         | Pricing starts at approximately €5,900 per year; offers a free demo version for evaluation.                                                       | Pricing details are not publicly available; interested users need to contact the provider for a quote.     | Open-source and free to use, making it a cost-effective option for organizations.                        | Annual subscription at €3,120; offers a free trial for users to explore its features.                                                                          | Annual subscription priced at €3,720; provides a free trial for potential users.                                                      |
| <b>Textile industry suitability</b> | Suitable for detailed LCA studies in the textile sector; widely used by professionals for in-depth analyses.                                      | Well-suited for comprehensive LCA analyses in the textile industry; offers detailed modeling capabilities. | Versatile tool applicable to various industries, including textiles; supports comprehensive LCA studies. | Customized for product footprinting in industries like apparel, consumer goods, and electronics; facilitates sustainable product design in the textile sector. | Primarily designed for the construction industry; may require customization for effective application in textile-related LCA studies. |

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|                      |                                                             |                                                                    |                                                                                                   |                                                                                      |                                                                                    |
|----------------------|-------------------------------------------------------------|--------------------------------------------------------------------|---------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------|------------------------------------------------------------------------------------|
| <b>Accessibility</b> | Desktop application; may have limited cloud-based features. | Primarily a desktop application; cloud-based features are limited. | Desktop application with capabilities for collaborative work; supports various operating systems. | Cloud-based platform, ensuring accessibility and ease of collaboration across teams. | Cloud-based solution, offering accessibility and real-time collaboration features. |
|----------------------|-------------------------------------------------------------|--------------------------------------------------------------------|---------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------|------------------------------------------------------------------------------------|

The translation of these insights into actionable strategies requires a multi-level governance and market-oriented approach. In high-impact sectors such as textiles, which contribute nearly 10% to global carbon emissions and over 20% to industrial water pollution, systemic change cannot be achieved through voluntary commitments alone. Therefore, a structured and enforceable policy framework is needed to scale circular practices, institutionalize sustainability metrics, and bridge the gap between assessment tools and industry-wide transformation. At the regulatory level, mandatory life cycle reporting and environmental product declarations should be introduced across textile value chains. Governments can require companies above a certain production threshold to disclose LCIA-based environmental performance indicators for lifecycle stages (e.g., raw material sourcing, dyeing, and end-of-life disposal). This aligns with the European Commission’s Sustainable Products Regulation (2022), which mandates digital product passports and traceability, particularly for textiles. Such regulatory frameworks would improve transparency and comparability across supply chains, incentivizing lower-impact materials and processes. Extended producer responsibility schemes should also be expanded and refined to include LCIA-based benchmarks. For instance, producers could be taxed or subsidized based on their cradle-to-grave environmental footprint. This would encourage design for disassembly, modularity, and the use of recyclable or biodegradable fibres. The LCIA metrics, as outlined in this study, offer quantifiable thresholds for these performance-based incentives. For example, textiles emitting below 20 kg CO<sub>2</sub>e/kg and using less than 4,000 Liters of water/kg during production could qualify for green-labelling or reduced compliance fees. Such economic instruments are vital in levelling the playing field and reducing the cost barriers to circular economy innovation. From an industry standpoint, LCIA provides companies with a strategic lens for eco-design, supply chain optimization, and innovation investment. Firms that integrate LCIA tools like SimaPro, GaBi, or OpenLCA into their R&D pipelines can prioritize raw materials with lower environmental intensity (e.g., mechanically recycled polyester, organic cotton) and identify high-impact production stages. The insights gained through LCIA can guide the development of closed-loop systems, such as take-back programs and fiber-to-fiber recycling, which not only reduce emissions but also open new revenue models (e.g., subscription-based clothing, resale, and remanufacturing). Case studies reviewed in this paper indicate that incorporating recycled fibers can cut GHG emissions by up to 50% and water usage by 70%, making a compelling business case for sustainable innovation. Capacity building and knowledge transfer must be prioritized, particularly for small and medium-sized enterprises in developing and transition economies, which often lack the technical and financial resources to implement LCIA tools. Governments, NGOs, and

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academic institutions should collaborate to establish LCIA training hubs and develop open-access circular economy toolkits. Policymakers and business leaders must act in concert to institutionalize lifecycle thinking and embed circularity across all levels of the textile ecosystem. This approach is needed for meeting international climate targets, decoupling growth from environmental degradation, and achieving long-term socio-economic resilience.

## Conclusion

This paper provides a comprehensive assessment of how LCIA methodologies support the integration of circular economy principles within the textile industry, in alignment with the United Nations sustainable development goals. The findings demonstrate that LCIA is a critical decision-making tool that enables the identification of environmental hotspots across the textile lifecycle, from raw material extraction to end-of-life disposal, supporting evidence-based sustainability strategies. Quantitative insights from case studies show that transitioning from linear to circular models, specifically through fiber-to-fiber recycling and eco-design, can reduce greenhouse gas emissions by up to 50%, energy consumption by 30–40%, and water usage by as much as 70%. The use of LCIA tools such as SimaPro, GaBi, OpenLCA, and Ecochain Mobius shows their effectiveness in modelling complex processes, validating impact reductions, and guiding product development aligned with circular economy strategies. In addition to environmental benefits, circular economy adoption has socio-economic implications, including the potential to increase employment by 15% in the recycling and upcycling sectors. However, the analysis also reveals challenges in practical implementation, especially among incumbent textile companies facing organizational inertia, technological limitations, and supply chain fragmentation. These findings underscore the need for policy frameworks that incentivize sustainable practices, foster innovation, and enforce extended producer responsibility. LCIA, when coupled with circular economy, offers a scientifically grounded pathway for the textile industry to transition toward low-carbon, resource-efficient, and inclusive production systems that support the 2030 Agenda for Sustainable Development.

## Acknowledgments

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### STAKEHOLDER PERCEPTIONS ON BARRIERS AND DRIVERS FOR THE ENHANCEMENT OF CIRCULAR ECONOMY IN THE CONSTRUCTION SECTOR

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#### **Abstract**

Circular Economy (CE) is regarded as a key strategy for achieving climate change mitigation. Applying CE principles in the construction sector is of great importance with regard to the sector's substantial CO<sub>2</sub> emissions. To achieve this goal, it is important to engage the key stakeholders and explore their views on the financial, environmental, social, and policy aspects of CE practices in this sector.

The scope of this study is to identify the perceptions of key stakeholders on the most important barriers for the adoption of CE, and on the strategies needed to transition to a CE in the construction sector. To this end, a workshop entitled “Working with stakeholders on CE practices enhancement” was organized in Brussels in June 2024, bringing together key stakeholders from the research, academic, industrial, and policy areas.

During the workshop, the stakeholders participated in small group discussions, and through a brain-storming process, they identified i) the specifications/requirements of the CE

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construction products, ii) the barriers against the adoption of CE practices, and iii) the drivers that would help transition towards CE. Then, the stakeholders selected and ranked the most important financial, political, environmental, social, and technological aspects for the above three topics. Based on the above process the most significant specifications/requirements, barriers, and drivers were identified.

The findings of the above methodology revealed that the stakeholders highlight the importance of reducing the prices of CE materials and technology, the need to increase the demand for such products, and the importance of imposing regulatory and financial incentives to enhance CE in the construction sector.

**Keywords:** Circular economy, construction sector, barriers, drivers, strategies, stakeholders, perceptions

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### **CIRCULARITY IN THE BUILT ENVIRONMENT: INSIGHTS FROM ALBANIA**

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#### **Abstract**

The construction sector, a significant contributor to global resource depletion, waste generation, and carbon emissions, is facing a growing pressure to transition to Circular Economy (CE). This study investigates the dynamics of CE adoption in Albania's construction industry, highlighting the barriers, drivers, and stakeholder roles essential for this transformation. Positioned within the broader context of the Western Balkans, the research addresses the region's unique challenges and opportunities in aligning with global sustainability goals and European Union (EU) standards.

Using a mixed-methods approach, including a systematic literature review, policy analysis, and semi-structured interviews, the study identifies the significant challenges of waste management, recycling, and energy consumption patterns, alongside the opportunities for sustainable development within the Western Balkans. Simultaneously, it explores critical drivers such as economic incentives, advanced technologies, institutional collaboration, and public awareness campaigns that support the sector's transition toward sustainability.

**Key words:** Circular Economy, Built Environment, Construction, Albania

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### EDUCATING FOR A CIRCULAR ECONOMY: POLICY AND PRACTICE IN WESTERN BALKAN HIGHER EDUCATION

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#### Abstract

This paper explores the integration of Circular Economy (CE) principles into higher education systems as a pathway to fostering sustainable development, economic resilience, and climate adaptation in the Western Balkans. The region, encompassing Albania, Kosovo, Bosnia and Herzegovina, North Macedonia, Montenegro, and Serbia, faces significant environmental, economic, and societal challenges, exacerbated by limited awareness, fragmented policies, and slow adoption of sustainability practices. Higher Education Institutions (HEIs) are uniquely positioned to address these gaps by equipping students with the skills and knowledge needed for a green economy and embedding CE principles into curricula, research, and community engagement.

The paper conducts a comprehensive need analysis, focused on selected HEIs within the region, identifying barriers such as a lack of interdisciplinary approaches, educator capacity, and alignment with labour market demands. A strategic framework is proposed to integrate CE into HEIs through curriculum development, capacity building for educators, industry partnerships, and the establishment of CE hubs. The framework emphasizes interdisciplinary learning, hands-on experiences, and collaborations with societal stakeholders to foster innovation and align education with regional and global sustainability goals. To support this transition, this paper will provide policy recommendations for regional cooperation, funding for CE initiatives, public awareness campaigns, and alignment with labour market needs.

**Key words:** Circular Economy, Higher Education, Western Balkans



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### **TOWARD A REGENERATIVE FUTURE: CIRCULAR ECONOMY, ECOSYSTEM CONSERVATION, AND THE CO-EVOLUTION OF SOCIAL-ECOLOGICAL SYSTEMS.**

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#### **Abstract**

The paper focuses on circular economy and novel design methodologies for sustainable housing development and urban linkages. Its point of departure is the hypothesis that the key principle of Sustainable Development is ecosystem conservation. It will investigate methods conserving the ecosystem and biodiversity because living organisms will cease to exist without these. The engagement of community-based organisations, savings and building groups, or small-scale housing cooperatives is also essential for supporting identity formation, social cohesion, empowerment and shared ownership. In the framework of this paper, a unified theory of the built environment will be formulated. The built environment will be understood as a complex social-ecological system where multiple related metabolisms interact at different scales. Particular emphasis will be placed on analysing the methods of regenerative design, considering that a key notion in regenerative design is the co-evolutionary, partnered relationship between socio-cultural and ecological systems. Regenerative design embraces ‘place’ as the fundamental foundation for design, fostering a connection between people and the spirit of that place, which energizes them and instills a genuine motivation to nurture it. Regenerative design is based on acknowledging the complex and continually evolving interrelationship between socio-cultural and environmental systems and reorientating the understanding of the role of building within this changing context. At the core of this paper is the analysis of the distinction between green and regenerative approaches to design. A digital twin is a digital representation of a physical environment that collects real-time data. Nowadays, urban-scale digital twins are used during the decision-making process in urban planning to test scenarios concerning their impact on the circular economy and sustainability. The paper also examines how digital twin–circular economy integration makes it effective for construction to overcome circular economy barriers or challenges, reduce waste, and increase salvage value. It places particular emphasis on the following 5R principles: (1) Rethink, which targets the maximum efficiency of resource utilisation through innovation; (2) Reduce, which targets the minimum usage of resources through production and consumption; (3) Reuse, which targets the maximum usage of a product through relocation or resell; (4) Repair, which targets the maximum lifespan of a product through repair and maintenance; (5) Recycle.

**Key words:** circular economy, regenerative design, place, urban-scale digital twin, adaptive reuse

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# THE CONTRIBUTION OF SUSTAINABLE ARCHITECTURE TO SOCIAL RESILIENCE ACHIEVEMENT

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## **Abstract**

The leading global challenge is achieving the UN Sustainable Development Goals (SDGs) for a more sustainable and inclusive world by 2030. Architecture may sufficiently contribute to this. In particular, buildings and open spaces that respond to citizens' evolving needs, even in extreme conditions, lead to higher social resilience. Therefore, the efficient management of these issues enforces sustainable growth for the benefit of all stakeholders and should be a target.

Based on experts' perspectives in Greece, the present study examines the impact of buildings and open spaces on social resilience.

A hybrid focus group discussion was conducted, with half of the participants meeting in a classroom and the other half joining via Zoom. Ten (10) experts from diverse and relevant to the examined issue fields, each with extensive experience, engaged in in-depth discussion.

The study's main findings highlighted the importance of architecture and its contribution to sustainable development. Well-designed buildings and open spaces that effectively meet citizens' needs in regular and challenging conditions are essential for enhancing well-being, fostering social interaction, and building resilience. Renewing old buildings and industrial areas may offer valuable services to local communities. A more holistic and proactive approach with the participation and collaboration of all stakeholders should be applied to manage crises better. It is essential to consider the needs of minorities in the design and use of infrastructure. The study is limited as it focuses solely on Greek participants, which introduces bias in their perceptions and may not represent a broader perspective.

**Keywords:** Sustainable Development Goals, social resilience, sustainable architecture, sustainable buildings, open spaces, extreme events, sustainability in Greece.

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### Introduction

Addressing current global challenges necessitates contributions from individuals, communities, and governments alike. ‘The 2030 Agenda for Sustainable Development’ outlines 17 Sustainable Development Goals (SDGs) that form a crucial global framework. Developed and developing countries must unite in a strong partnership to implement strategies that enhance health and education, eradicate inequality, drive economic growth, protect the environment, and ensure the successful attainment of these targets (UN, nd). The social targets play a crucial role in fostering progress and positive change. Social resilience achievement, including the community's capacity to sufficiently respond to various challenges, is vital. According to Adger (2000), social resilience is defined as “*the ability of groups or communities to cope with external stresses and disturbances as a result of social, political, and environmental change*” (p. 347). Thus, the social, political, environmental, and economic aspects are related, and their efficient management leads to social resilience. Keck and Sakdapolrak (2013) pointed out the following three essential parts to achieve social resilience: a) coping capacities of social actors to cope with and solve all kinds of problems; b) adaptive capacities, using their ability from their experience and adjust their actions to handle future challenges in their daily lives successfully; and c) transformative capacities to equip institutions with the required resources to improve ‘individual welfare’ and achieve sustainable societal robustness to manage future crises successfully. Therefore, achieving social resilience benefits all stakeholders, and the appropriate tools are critical. Architecture plays a key role in designing cities, including buildings and open spaces that are friendly to citizens, considering possible adverse events and uncertainty from climate change. Adaptive reuse architecture (or building reuse) renovates old buildings into new use, mainly from real estate businesses that have the financial resources and expertise is essential (Master Class, 2021). Among the stakeholders in this effort, the role of individual citizens and personal and societal growth are crucial to achieving SDG progress. Inner development is critical to social resilience; it concerns personal development in a ‘sustainable future’ and requires a holistic transformation (Meridian University, 2024). Adopting a more holistic and proactive approach with the involvement of all stakeholders to improve daily life and successfully respond to uncertainty is imperative. Also, digital technologies provide early warning information, optimise resource distribution, and facilitate remote collaboration, all of which are important to mitigate inequalities and successfully handle extreme events (Vincent & Cull, 2014).

This paper explores how architecture contributes to building sustainable social resilience. It highlights the necessity of integrating social, economic, environmental, and institutional elements to promote adaptive architecture. To effectively promote sustainability and address extreme physical events with significant social, economic, and ecological impacts, buildings and open spaces must be designed and utilised with maximum efficiency.

The current study followed a hybrid focus group where half of the respondents met in a classroom, and the rest participated through Zoom services. Ten (10) experts, mainly from the social and architectural fields, discussed the above issues and generated beneficial outcomes.

The study's main findings proved the importance of architecture and, in particular, the design and use of buildings and open spaces in achieving social resilience, which leads to progress in achieving SDGs. Towards this, the active involvement of all stakeholders,

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particularly individual citizens, through profound awareness and personal growth is recommended. In addition, a more holistic and proactive approach is required to manage crises better. There should be greater emphasis on regenerating old buildings and repurposing unused industrial areas. Although the study participants had extensive knowledge of the subject, their concerns were primarily local, as they were based in Greece and requested to focus mainly on locally relevant issues.

### **Literature review**

This section of the paper briefly outlines the fundamental issues surrounding the study of social resilience and architecture.

#### ***Social resilience***

Social resilience assists people in sufficiently responding to external shocks, stress, and stressors (Kwok et al., 2016; resiliencelinks, nd). It contributes to the phases before, during, and after the disaster through preparedness, response, and recovery, and its main attributes are the community gathering place, social support, risk awareness and impact, collective efficacy, and a strong community sense (Kwok et al., 2016). In addition, human capital (skills and knowledge), social capital, psychosocial dynamics (self-efficacy, aspiration, and confidence), and social protection are important elements of social resilience (resiliencelinks, nd). The involvement of several organisations at global, national, and local levels is required to address community vulnerabilities, enforce social networks, and build capacity to handle economic, social, and environmental challenges efficiently. At the top level, the ‘Sendai Framework for Disaster Risk Reduction 2015-2030’ supported by the United Nations Office for Disaster Risk Reduction (UNDRR) set ambitious goals to minimise disaster risk globally by providing the required support to countries (UNDRR, nd). Next, governments play a key role in promoting resilience by applying the proper policies, efficiently allocating available resources, and supporting systems that assist communities to withstand and handle emerging challenges. The government increasingly operates as an enabler in cases of emergency, mainly coordinating other actors and less directly intervening to control the situation. At the same time, many responsibilities are increasingly moved to local communities and individuals (O’Grady & Shaw, 2023). Local communities are fundamental in minimising vulnerability and achieving community resilience as the first response line. Their active involvement, local knowledge, and social networks are vital for building adaptive capacity and enforcing sustainable development (UNDDR, nd). Finally, individuals acting independently can be prepared to efficiently manage extreme situations like educating their children or keeping the roads safe. Individual resilience is closely associated with the community’s ability to prepare, adapt, and respond to extreme events (Norris et al., 2011). The coordination of these three levels and the clear responsibilities to successfully manage external extreme events are critical. The term ‘responsibilisation’ as a process that facilitates the responsibilities’ shift from state to individuals and communities is widely used (van Bommel & Höffken, 2021). The willingness and capabilities of the local actors to manage and support ‘certain responsibilities’ and whether these are the appropriate ones are critical (Mustalahti et al., 2020).

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The social dimension of resilience and emphasis on social factors for recovery is essential. Thus, social networks, social groups, and their relationships play a key role in how communities “*plan for, adapt, and recover from crisis or climate disaster*” (resiliencelinks, nd). The elements that support social resilience at individual and group levels are the following: information and advice, resources, management capacity, personal and community support, and higher involvement. In the broader context of community support, this can be provided by the following: high knowledge of hazards, shared community values, establishing functional social infrastructure, positive social and economic trends, good partnerships, sufficient resources, and competent skills (Buckle, 2006).

Therefore, individuals' and local communities' role in successfully handling extreme events and contributing to social resilience is vital.

The continuous assessment of the community's resilience to find weak points, improve them, and analyse various relevant factors that show how individuals, groups, and systems respond to extreme events are highly required. It is recommended to use indicators that encompass physical (such as buildings and infrastructure), social, and economic systems (such as the natural environment), as proposed by the assessment methodology (NIST, n.d.). Below are the most important indicators presented.

Social Vulnerability Index (SVI) is a web-based mapping tool that measures social vulnerabilities and assists communities in managing these (Bureau of Transportation Statistics, nd).

**The Resilience Analysis and Planning Tool (RAPT) is a GIS-based mapping mechanism that uses over 100 preloaded layers and was developed by the Federal Emergency Management Agency (FEMA).** RAPT aims to assist everyone in understanding its communities, providing information on population demographics, community infrastructure, hazards, and other related issues (FEMA, nd).

The PEOPLES is a multi-dimensional, holistic framework for defining, assisting, and enhancing communities' disaster resilience. It focuses on the following seven dimensions of resilience represented by the acronym PEOPLES: Population and Demographics, Environmental/Ecosystem, Organized Governmental Services, Physical Infrastructure, Lifestyle and Community Competence, Economic Development, and Social-Cultural Capital. Combining the above-mentioned dimensions, this framework can be the basis for developing quantitative and qualitative models that may continuously measure the communities' resilience (Renschler et al., 2010).

**The Baseline Resilience Indicators for Communities (BRIC) framework** was developed by the University of South Carolina's Hazards & Vulnerability Research Institute and aims “*to assess attributes of resilience to natural hazards*” at the country level and applied initially in the USA and then to other countries. The BRIC uses 49 variables grouped in the following six dimensions: **human well-being/cultural/social, economic/financial, infrastructure/built environment/housing, institutional/governance, community/capacity, and environmental/natural** (University of South Carolina, College of Arts and Science, nd).

**In addition, the relevant literature proposed more resilience assessment tools such as the Community Resilience Measurement Tool (CRMT), the Community Resilience**



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### **Index (CRI), the Climate Disaster Resilience Index (CDRI), the Disaster Resilience of Place (DROP), etc.**

Identifying disaster phases and applying specific actions to improve the situation is essential. In particular, in the phases of reduction, trying to minimise risk and disaster consequences, readiness developing operational capacity, and preparing to handle unusual conditions, response emphasising the protection of lives and infrastructure, and recovery coordinating efforts on a holistic regeneration and improvement of a community (National Emergency Management Agency, 2020).

The governance of social resilience is a fundamental issue, ‘complex and often multidirectional’, and as governance ‘super factors’ are mentioned, the “*control of corruption, societal trust, and high-quality political leadership*” (Brown, 2022). The governance of disaster management, particularly the coordination, arrangements, and processes concerning all the involved actors and the proper decision-making, are critical (Tierney, 2012). Finally, gender equity, broad inclusion of young people and minorities, appropriate infrastructure such as public spaces and parks serve the recreation and cultural purposes, and community institutions are essential for social cohesion that creates resilience (resiliencelinks, nd). Architecture must be prioritised because it is crucial for creating a sustainable environment.

### ***Architecture and Social Resilience***

The role of architecture in creating a sustainable built environment, social cohesion, and resilience is excellent. The recent pandemic showed the importance of the management of buildings due to the time people spend in these and their impact on their health and well-being (Lipinski et al., 2020). “*By designing buildings and public spaces that encourage social interaction, community engagement, and a sense of belonging, architecture can contribute to the well-being of individuals and society as a whole*” (De Burca, 2023). The built environment facilitates people's connection, adaptation, and recovery. Understanding the relationship between buildings, spaces, and people is critical. The first two issues' design and use impact people's interactions, behaviours, and experiences, creating collaboration and mutual support opportunities (Larsen, 2013). In addition, implementing practical, proactive, and tailor-made policies and practices that meet people's needs is essential (Barham, 2017). Importantly, offering buildings and environments that promote people's well-being is vital. Rashidfarokhi and Danivska (2023) highlighted the following factors that facilitate well-being: a) socio/demographics, b) material living conditions (income, wealth, housing, education, access to services, etc.), c) psychological traits, d) physical and mental health, e) meaning of life, f) security, and g) connectedness. These issues should be considered when designers and policymakers construct buildings, neighbourhoods, open spaces, and cities. Architecture and style in buildings and spaces at individual and community levels, neighborhood distinction, street width and layout, green spaces, house distance to street, parking areas, porches, flexible space, and layout are all essential. Apart from well-designed buildings, offering clearly defined gathering places such as schools, squares, local businesses, and other community centres is a critical issue that creates social capital, enhances community connection, supports disaster response and recovery, and actively reinforces the ‘social fabric of communities’ (Kwok et al., 2016). Those places should be designed considering community needs and

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aspirations, and the close collaboration and engagement of architects, community members, and other stakeholders is essential (De Burca, 2023).

Sufficient urban spaces such as healthcare services, cultural and religious facilities, recreational and civic centres, improved infrastructure and accessibility (suitable street design, availability of walkable areas, good public transportation, and pedestrian-friendly services), technical infrastructure (availability of the proper technology, access to the valuable services such as water, air quality, wastewater management, solid waste management, view daylight cycles, easy contact with the nature and views of natural scenery), and functionality and aesthetics (ergonomics, used colours, decor, and fabric and materials) are all important (Rashidfarokhi & Danivska, 2023).

Therefore, special emphasis should be placed on the building and open spaces design to serve better people's needs in regular and extreme conditions. Community social resilience is focused on satisfying the needs and aspirations of the community's members “*to create sustainable and resilient architecture*” that contributes to social cohesion. The two concepts can be integrated to provide substantial sustainability benefits to the community. The following strategies facilitate community resilience: a) sustainable design that supports social, economic, and environmental resilience, b) multi-functional spaces that facilitate social cohesion and community engagement, and c) disaster preparedness that creates resilient structures to natural and human-made extreme events (De Burca, 2023).

The eight fundamentals of ‘Resilient and Climate Adaptive Design’ to minimise harm and possible property damage and better adapt to evolving conditions must be “*place-based, risk prepared, equitable, precautionary, system-centric, ready, service-life focused, and adaptive*” (AIA, nd).

The specific characteristics of each area should be considered, as the requirements in cities and rural areas in architecture and social resilience differ. More than half of the population currently lives in urban areas (4.52 billion is the urban population, and 3.43 is the rural population), which is increasing. Specifically, in high-income countries (Western Europe, America (USA and Canada), Japan, and the Middle East), more than 80% of the population lives in urban areas; in most upper-middle-income countries (Eastern Europe, East Asia, North and Southern Africa and South America) between 50% to 80% of people live in urban areas. In low-income countries, many people live in rural areas (Ritchie et al., 2024). Architectural solutions provided in an urban context require more density, innovation, and efficiency, and those in rural areas are focused on tradition, sustainability, and higher integration with nature. In both areas, buildings and open spaces should be created that enhance people's well-being and resilience and mitigate risk from extreme events.

The emphasis on sustainability in buildings and open spaces designed to endure extreme events is essential for a resilient and responsible future. Sustainable and regenerative designs are two interrelated approaches that promote environmental protection, social growth and well-being. ‘Sustainable design’ is focused on creating products, buildings, and systems that consider energy efficiency using renewable energy sources, environmentally friendly materials, waste management, and social responsibility, where the following design is adjusted to human needs and facilitates social justice. ‘Regenerative design’ is looking to regenerate natural and social resources. Its four main elements include the restoration of the ecosystems that promote natural vegetation and biodiversity, autonomy supporting the local

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economy and minimising dependence on external resources, the circular economy emphasising efficient waste management, and social participation encouraging the involvement of communities in the decision-making and design processes (Hariramet al., 2023).

The active involvement of minorities in the achievement of social resilience is a critical issue. They have specific needs that should be respected in buildings and open spaces design. Disabled people are the largest minority group in the world population, and over 1.3 billion people live with some disability. In addition, over 20% of the population will be over 65 by 2050 (WHO, 2021). These people require adequate support from other stakeholders, mainly governments, and a more holistic approach to achieving higher inclusion and participation (Poli & Malagas, 2024). Also, other minorities, like children, immigrants, tourists, etc, should participate in daily social life. Architecture must prioritise the design of buildings and open spaces that meet all citizens' needs while proactively addressing the challenges posed by extreme events. Effective urban design that emphasises inclusivity, safety, and flexibility may assist communities to thrive against crises and challenges.

## Methodology

Qualitative research was applied in the current study, and it is an exploratory approach that examines people's experiences, perceptions, social phenomena, and cultural meanings using non-numerical data (Creswell & Poth, 2018). It introduces the observer to the real world and makes it visible (Denzin & Lincoln, 2018). The main qualitative methods used are interviews, focus groups, textual analysis, and observations to gain in-depth analysis of a specific issue.

In particular, the focus group method was used in the current study. This is a non-standard technique of information gathering based on apparently informal discussion and interaction among a group of people, where the role of a moderator, who is mainly the researcher and leads the discussion, is critical (Acocella, 2012; Morgan, 1997). The hybrid focus group discussion was implemented as half of the participants were in the same room discussing the examined issue, and the other half were discussed through Zoom services. The discussion meeting lasted more than three (3) hours and took place in the Department of Interior Architecture, University of West Attica, in Athens, Greece. The discussion focused on Greek reality but presented some general related perspectives. Ten (10) experts from various relevant fields discussed the examined issue. The participants' jobs were a Social Science Professor, an Architecture Professor, a Manager from Civil Protection, a Sociology Professor, a Major from a Big City, a high ranked Manager of Attica Prefecture, a Firefighting Commander, a Sociologist, a Manager of Public Health Services, and a disabled people. All the participants had a rich experience in the examined subject. The first author of the study was the discussion moderator. Initially, the moderator presented the examined subject in detail, while ten (10) days before the discussion meeting, all the participants received an email with the study's details and objective.

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### The Outcomes of the focus group discussion

All the study's participants initially agreed that architecture and built environment significantly contribute to higher social resilience. Buildings and open spaces should consider citizen needs, respect the environment, encourage social interaction, promote well-being, and protect people from extreme events. In Greece, the fundamental issues concerning people are related to climate change, such as water scarcity, floods, and fires, while efficiently handling earthquakes is critical. Improvements in water and waste management are proposed. The use of fire-resistant materials in buildings and open spaces construction in areas near forests is critical. In addition, implementing zoning policies that restrict construction in high-risk areas and promote green buffers can help the creation of safer urban landscapes. They emphasised that more efforts are needed to raise awareness and create additional neighbourhood open spaces.

An efficient and effective governance and proactive action are required to handle the above-mentioned issues. Adopting a more holistic approach with the active participation of all stakeholders, such as government, local communities, research institutions, and individuals, is essential. The high participation of individuals in decision-making and problem-solving processes is imperative. The unambiguous assignment of roles and responsibilities is important, as there are cases in which central government, regional/prefectures, and local municipalities are in conflict to handle specific cases. The continuous training of leaders and citizens is vital. The **timely provision and dissemination of critical information** regarding crisis management, business operations, public health, and governance are essential. Through these, the various stakeholders may make informed decisions, respond quickly, achieve higher involvement, and minimise risks.

A big city's Mayor mentioned the importance of regenerating old buildings and unused industrial areas to offer valuable services to local communities.

The Social Science Professor pointed out that the greater use of technologies such as Artificial Intelligence (AI) and big data is vital, as these contribute to higher information circulation and prediction of some extreme events.

The Manager of Public Health Services emphasised strengthening healthcare infrastructures and workforce preparedness and more in primary health services. Telehealth services are essential to healthcare delivery, especially after the COVID-19 pandemic, significantly contributing to their adoption. It assists in providing remote patient care, improving patients' convenience, access, and efficiency, and minimises health system strain and cost.

The disabled person pointed out that minorities like the disabled community have specific needs that should be taken into account in **urban planning, architecture, and infrastructure design**. The design of buildings and open spaces must respond to disabled people's requirements. Inclusive design, where buildings and open spaces are fully accessible and functional for everyone, mainly for those with disabilities, is essential.

### Discussion and Conclusions

In the last years, economic crises, energy problems, pandemics, wars, earthquakes, and events related to climate change have occurred more often. Architecture and the built environment

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are related to these extreme events, require proper design innovation, and substantially contribute to the enforcement of social resilience (AIA, 2023). Therefore, particular emphasis should be placed on the design of buildings and open spaces to facilitate social interaction, well-being, and environmental protection, contributing to better handling of crises.

The active involvement of citizens in the built environment design, decision-making, and problem-solving processes facilitates a sense of ownership and empowerment. The regular feedback and assessment of the various infrastructures should be applied. Towards this, workshops, focus groups, and ‘design charettes’ are essential to achieve feedback and collect and incorporate ideas from residents (De Burca, 2023). The timely circulation of critical information for effective reaction, enhancing collaboration, risk mitigation, and public safety is vital. In this vein, applying digital communication platforms, AI, the Internet of Things (IoT), and robotics significantly improve recovery and disaster preparedness.

Social networks are more significant than formal humanitarian aid (resiliencelinks, nd). Thus, emphasis on the identification and efficient use of informal and formal social networks that facilitate quick reactions in extreme events is essential. In designing buildings, open spaces, and infrastructure to successfully handle crises, adopting a more holistic and proactive approach with the active participation of all stakeholders, such as governments, local communities, universities, and individuals, is recommended. Buildings and open spaces must enforce social interaction and well-being, mitigate risk, and protect all in extreme situations. Renewing old buildings and unused industrial areas to benefit local communities by supporting sustainable development and economic growth and preserving heritage is also critical. These infrastructures' adaptive reuse and restoration to revitalise urban and rural areas and meet the citizens' current and future needs are important. The extensive collaboration of public and private organisations to promote social resilience through sustainable architecture is recommended. Also, effective waste and water management significantly impacts the health of communities. Public buildings may strengthen social resilience by supporting community needs, emergencies, and social interaction. Well-designed and adaptive public spaces may assist communities to **withstand, recover from, and adapt to challenges** such as natural disasters, economic downturns, and social disruptions. The higher involvement of the neighbourhood in daily social life is recommended (Purdue, 2001).

Hospitals and primary health services must be prepared to handle extreme events efficiently, and the recent pandemic provided helpful guidance. Also, buildings and open spaces must sufficiently respond to the specific needs of minorities. Disabled people are the highest minority group and must equally participate in daily social life, and the offered infrastructure may respond to those people's needs. Tourists, immigrants, Romani, and other minorities also having diverse needs must be included in the provided services.

The efficient implementation of architecture in buildings and open spaces is related to higher social responsibility and more or less to the achievement of several United Nations sustainable development goals (SDGs), such as good health and well-being (SDG 3), gender equality (SDG 5), clean water and sanitation (SDG 6), affordable and clean energy (SDG 6), sufficient industry, innovation and infrastructure standards (SDG 9), reduced inequalities (SDG 10), sustainable cities and communities (SDG 11), responsible consumption and production (SDG 12), improved life on land (SDG 15), and partnership for the achievement of these goals (UN, nd).



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Conclusively, the active participation of all stakeholders in designing and using buildings and open spaces to accommodate all citizens' needs and respond to extreme events is imperative. Individuals must be aware of all relevant issues, have enough training, and receive the proper governance to contribute more to social resilience. Unexpected events have distinct characteristics that demand specific actions and policies. All stakeholders must stay well-informed about these issues and take proactive measures. Resilient design in high-risk areas requires specific architectural design and materials that can withstand natural disasters. Therefore, the future of architectural resilience is bright, with more developments in areas such as sustainable materials, innovative technology, viable reconstruction, and adaptive reuse of old buildings. With these advancements, we can create buildings that are not only attractive and functional but also robust and resilient in the face of unexpected challenges.

### Limitations of the current study and suggestions for further research

The current study presents significant limitations as all the participants are based in Greece, and their perceptions mainly concern the Country. Thus, the generalizability of the study's outcomes is limited. Also, more in-depth qualitative and quantitative approaches to gain more insights are recommended.

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### THE USE OF UNMANNED SYSTEMS AND SWARM TECHNOLOGY IN CRITICAL SITUATION MANAGEMENT IN URBAN AREAS

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#### Abstract

There are regions that have a combined maritime and territorial space, there are various risks that threaten the local society, economy and market, due to climate change, technological or natural disasters or other dangerous situations. In such cases, there is a need for technological tools to prevent, manage and reduce risks, while at the same time requiring low costs in order to be accessible to an increasing number of local communities. Thanks to the fourth industrial revolution, which includes emerging and disruptive intelligence and information technologies (artificial intelligence, Big data, the internet of things-IoT, autonomous vehicles, robots, 3D printing, 5/6G, etc.), there is now the potential to dramatically affect economic, social and environmental sustainable development. In addition, new capabilities in data collection, processing & analysis are offered, while correspondingly, capabilities in autonomous observation, surveillance and intervention systems have increased thanks to autonomous vehicles (UxVs).

The aim of this work is to highlight the value of unmanned vehicles of all types (UAV, UGV, USV, UUV), while utilizing swarm technology in emergency management in a local community that includes marine and territorial space, based on the use of renewable energy sources. The goal of such an application will be the early detection of events hazardous to the local society, economy and environment, their management with the ultimate goal of reducing the potential impacts.

**Keywords:** UxVs, swarm, emergency management, urban areas

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## QUANTIFICATION OF URBAN AND COMMUNITY RESILIENCE

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### Abstract

In view that cities will continue to house the majority of the world's population at an increasing rate in the face of climate change, this paper studies urban and community resilience by examining the response history of the mean-square displacement of the citizens of large cities and smaller communities prior to and upon historic natural hazards strike. The recorded mean-square displacements of large numbers of cellphone users from large American cities that were struck by recent hurricanes suggest that large cities of average to high population density when struck by natural hazards exhibit a remarkable inherent resilience. The recorded mean-square displacements presented in this study also validate a mechanical model for cities, previously developed by the authors that is rooted in Langevin dynamics and predicts that, following a natural hazard, large cities revert immediately to their initial steady-state behavior and resume their normal, pre-event activities.

**Keywords:** Urban Resilience, Natural Hazards, Ensemble Averages, Normal Activity

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### **“TURN AROUND, DON’T DROWN”; LESSONS LEARNT FROM THE 2023 FLOOD IN MAGNESIA, GREECE**

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#### **Abstract**

In recent years, climate change has become more and more noticeable as weather conditions are hazardous to human life and settlements. As a result, cities and their municipal authorities need to deal with the various risks related to natural disasters that are enhanced by the pressure of urbanization. The European Union (EU) and the United Nations (UN) are leading the states to such a resilience-oriented planning policy focusing on promoting environmental,

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social, economic and technological sustainability in terms of preventing a disastrous effect and restoring the damages during the post-crisis period.

In this context, this paper focuses on floodings which are a type of environmental crisis that affects local economy and society. The regional unit of Magnesia has been selected as a case study as its northern part has been vastly effected by a flood during 2023 and a series of socio-technical problems have been emerged. Based on this case study, we have tried to identify the causes that have led to this crisis in order for an action plan to be formulated to (a) improve the resilience level of the area and (b) draw conclusions in developing ideal strategies that eliminate the effects of flooding phenomena. To gain this goals, a comprehensive analysis of the study area has been implemented; more specific, geomorphology, residential networks and urban form of settlements, technical and social infrastructure as well as environmental characteristics have been examined. Following an assessment process, based on the SWOT analysis method, an action plan has been proposed.

Finally, conclusions came to the fore including directions for spatial planning process while the role of specific planning tools, like the Special Urban Plans (SPP), has been critically appraised.

**Key words:** climate crisis, flooding risk, urban resilience, Magnesia, SWOT analysis.



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### **SUSTAINABLE DEVELOPMENT OF HISTORIC CITIES: FLOOD MANAGEMENT STRATEGIES AND RESILIENCE**

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#### **Abstract**

Floods are among the most catastrophic events for contemporary cities, impacting populations, economy and infrastructure while highlighting the urgent need for mitigation and preservation strategies. For historic cities with significant cultural heritage, the need for preservation is even more critical.

This paper aims to examine flood risk management strategies for historic cities, which are highly vulnerable to natural phenomena such as floods that are increasing in frequency and intensity due to factors such as climate change and urbanization. Through a systematic literature review of 70 case studies and relevant theoretical contributions, it categorizes the key causes of flood risk into natural, anthropogenic, endogenous, and systemic factors, emphasizing the complex interplay among them. The paper then evaluates a broad range of flood risk management strategies, including structural and technological solutions, policy integration, blue-green infrastructure, and community-based approaches.

It highlights how successful resilience planning requires not only technical innovation but also cross-sectoral cooperation, local knowledge, and inclusive governance. The findings advocate for a multidimensional, place-based approach that balances risk mitigation with the preservation of cultural identity, supporting sustainable development in heritage-rich cities facing increasing climate-related threats.

**Key words:** Historic Cities, Flood Risk Management, Cultural Heritage, Climate Change, UNESCO World Heritage Sites

#### **The Rising Threat of Floods in Heritage Urban Landscapes**

Floods have been one among the most devastating natural hazards, that affect contemporary cities on multiple levels: population, economy and facilities. In the case of historic cities, urban areas that are recognized for their historical, cultural, and architectural value, the threat is even greater. Those cities typically contain well-preserved heritage sites, such as ancient monuments, historic buildings, and cultural landscapes, reflecting their historical importance, that are particularly vulnerable during and after the floods. Last decades, the intensity and

frequency of those flood phenomena have been increased due to climate change, and rapid urbanization that has led to an artificialization of the natural ground. This situation requires modern, innovative techniques of preservation and restoration for both historic and non-historic cities.

This paper explores management strategies for flood risk in historic cities, in order to highlight best practices and technologies that could ensure sustainable development and adaptation to this increasing threat while preserving the cultural identity of those places.

**Literature Review and Data Analysis: Methodological Approach, Case Selection, and Geographic Trends**

The data collection was conducted using various academic publishing platforms, including MDPI, ScienceDirect, Taylor & Francis Online). Keywords such as “historic cities” and “flood risk”, were used to identify studies that explore the concept of historic cities and flooding.

The following criteria were applied in order to include the papers in the meta-analysis: thematic relevance was the primary factor, with priority given to studies focusing on vulnerability, impacts, and flood risk management in historic areas or cities. Language and availability were also key considerations, as only papers that were fully accessible for review and written in English were selected to ensure consistency in the analysis.

According to these criteria, a sample of 70 cases was selected for the state-of-the-art analysis.

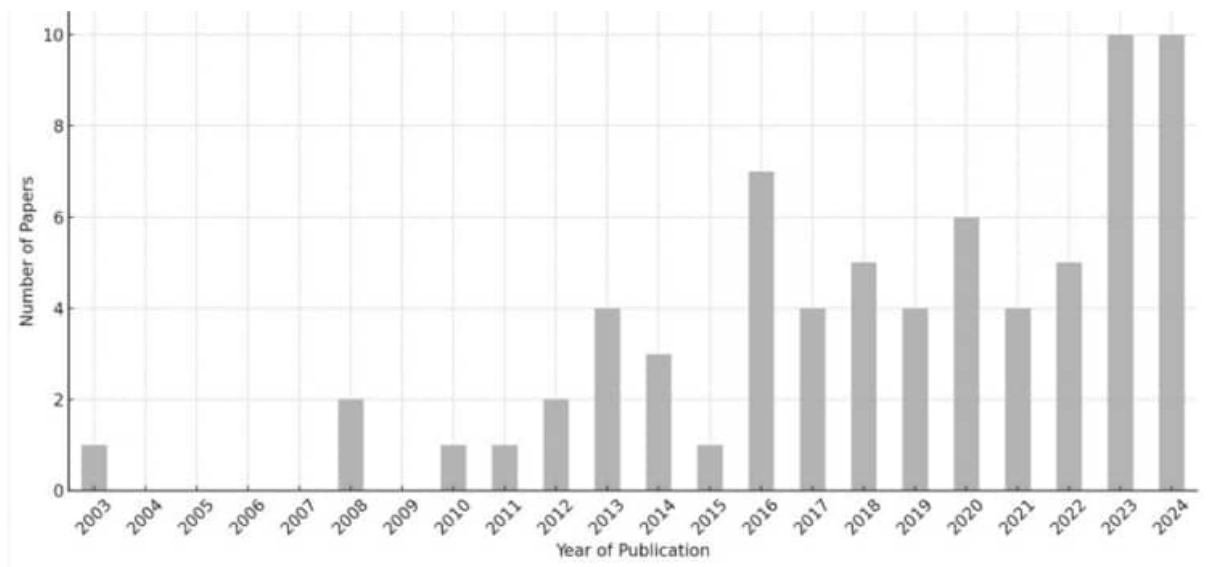


*Table 1 Number of analysed papers per year (2003-2024)*

As shown in Table 1, the number of analyzed published papers per year shows a clear increase in recent years, particularly over the last decade. This trend is mainly attributed to the overall rise in academic publications across research databases, driven by the growing frequency and severity of flood events due to climate change. At the same time, the urgency

to protect and preserve cultural heritage has become more urgent and well known. Additionally, technological advancements in the past decades have become indispensable tools for flood risk management, enabling more accurate analyses and assessments. As a result, more recent publications are often more relevant to current challenges and methodologies, which justifies their prioritization in this review.

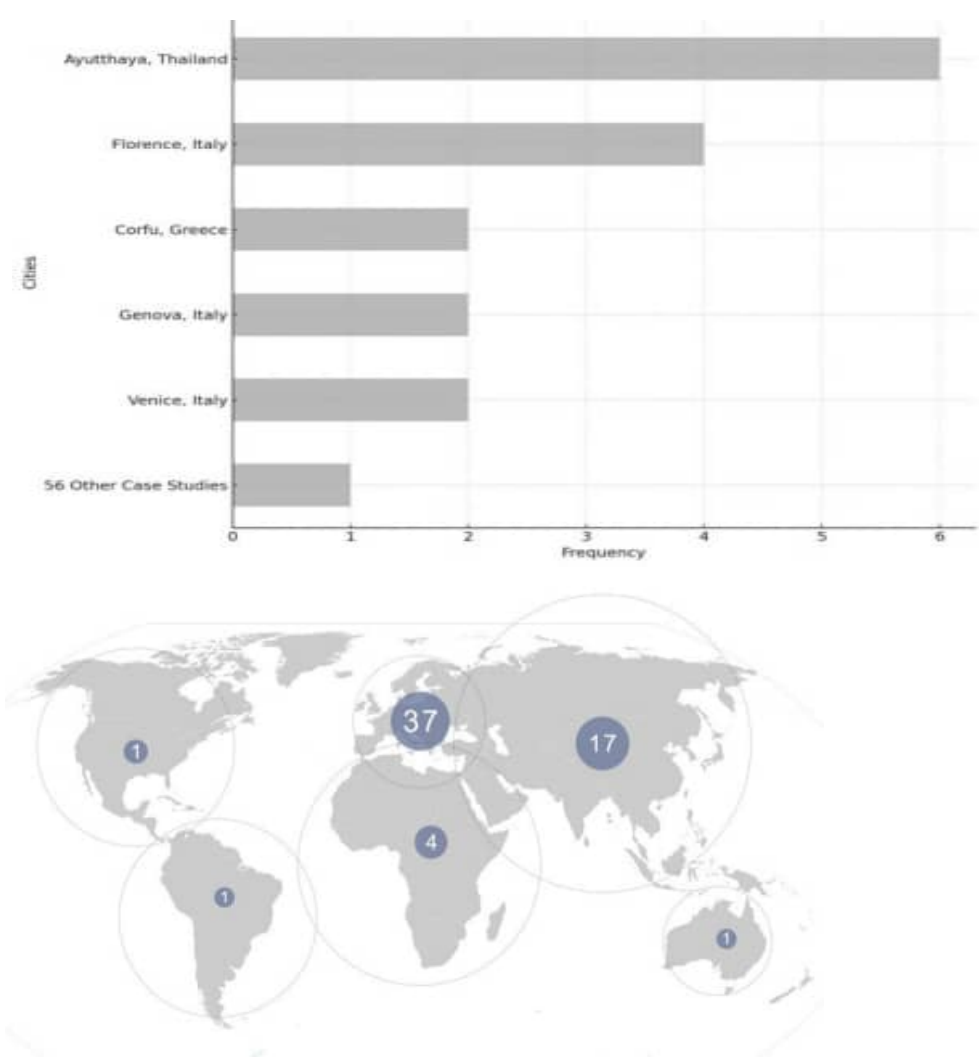


Table 2 Most frequently examined sites

Table 3 Geographic distribution of case studies

The vast majority of the reviewed papers -87% (61 out of 70)- focus on specific case studies, while the remaining publications adopt a more general, theoretical approach to flood risk and heritage preservation, without reference to particular locations. The most frequently examined sites (Table 2) include Ayutthaya in Thailand (6 mentions), Florence in Italy (4 mentions), and Venice, Genoa (Italy), and Corfu (Greece) with 2 mentions each.

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Among the selected case studies, nearly half (31 papers) focus on areas that are either entirely UNESCO World Heritage Sites or include such sites. More specifically, 18 papers examine cities whose historic centers are officially named as UNESCO World Heritage Sites (Florence, Rome, Krakow, Prague, and more), while 13 analyze monuments or areas that belongs to UNESCO-listed sites (Athens, Seville, Valencia, Nicosia, and more).

Regarding geographic distribution (Table 3), the 61 case study papers show a notable concentration in Europe (37 papers), followed by Asia (17 papers). The remaining publications are spread across other continents, with each contributing between 1 and 4 papers. This reflects probably the high density of ancient cities with rich architectural, cultural, and archaeological heritage in Europe and Asia. It also indicates a stronger governmental and institutional prioritization in these regions toward the preservation of cultural heritage, supported by broader access to research data, often through open-access platforms. Additionally, many European historic cities were originally established near rivers or coastal zones for strategic trade and defense purposes, which today contributes to their heightened vulnerability to climate change-related flood events.

### **Flood Risk in Historic Cities: A Literature-Based Categorization of Vulnerability Factors**

Historic cities are increasingly facing flood risks due to a combination of internal and external factors. Table 4 presents the most frequently cited factors across the analyzed papers, with the most common being increased rainfall, poor or insufficient urban planning, outdated infrastructure and drainage systems, natural topography, and urban expansion or high-density development.

For the purposes of this analysis, the paper categorizes these factors into four main groups: natural, endogenous, anthropogenic, and systemic. While examples of each category appear in the majority of the reviewed literature, it is the interaction and overlap among them that truly defines the current flood risk in historic urban environments.

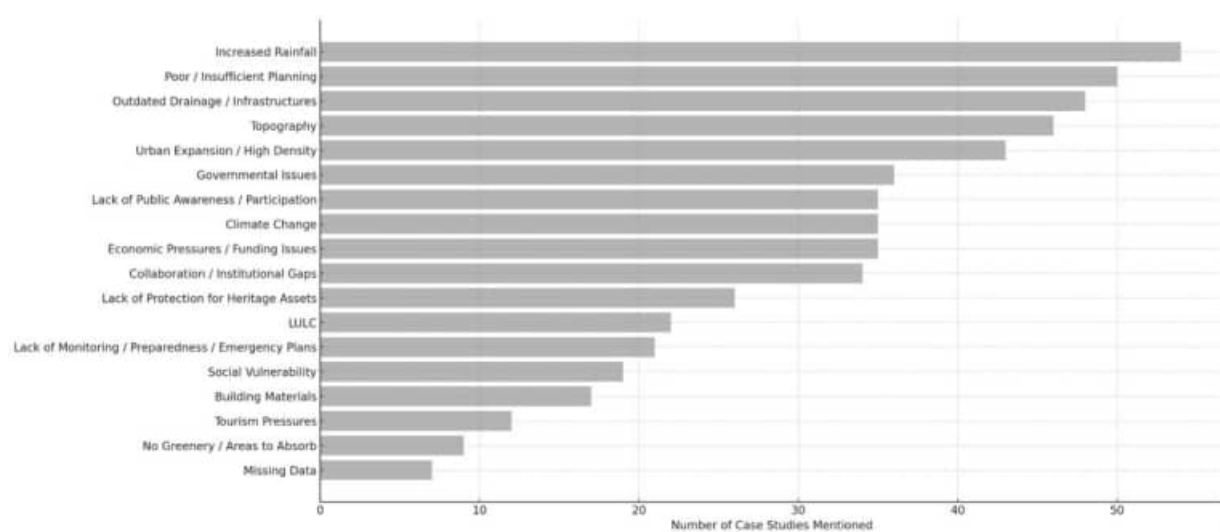


Table 4 Mentions of Flood-Related Factors Across Case Studies

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### **Natural factors: Climate Change and Environmental Conditions**

Natural factors refer to environmental and climatic conditions beyond human control that contribute to flood risk—such as heavy rainfall, sea-level rise, and geological processes. Among the 70 reviewed papers, 57 identify increased rainfall as a key factor of flood vulnerability in historic cities.

A major contributor to these natural hazards is climate change, which is intensifying both the frequency and severity of extreme weather events. It is cited in 34 papers as a main factor behind more intense rainfall patterns and long heatwaves. These heatwaves dry out the soil, reducing its ability to absorb water and thereby increasing surface runoff during heavy rain event. (Brokerhof et al., 2023; Cisse et al., 2022; Gizzi and Porrini, 2017; Porębska et al., 2019)

Climate change also provokes rising sea levels, due to the thermal expansion of seawater and melting polar ice caps. According to the Intergovernmental Panel on Climate Change (IPCC), global mean sea level rose by 17 cm over the twentieth century and keeps rising at an accelerating rate. (IPCC, 2022) This rise threatens places and World Heritage sites that were not previously vulnerable and can also raise river levels -such as the Thames in London or the Liffey in Dublin)- leading to significant loss and transformation of their cultural landscapes (Gruber, 2008; Nicolini, 2024; Perez-Alvaro, 2016)

Venice is an interesting example where natural factors are the primary cause of flooding, as the city was built at low elevation within a shallow lagoon, making it especially susceptible to high water events (locally called ‘acqua alta’). (Balan and Bordelon, 2021; Giupponi et al., 2024; Gruber, 2008; Indirli et al., 2014) Despite centuries of engineering efforts to manage acqua alta, Venice still faces severe flood risks due to rising sea levels (from climate change-driven thermal expansion and melting ice), compounded by local subsidence caused by tectonic activity, sediment compaction, and past groundwater extraction.

Similarly, New Orleans is naturally vulnerable to flood events due to its natural position of low altitude near the Mississippi River and the Gulf of Mexico. It is exposed to rising sea levels, land subsidence, and coastal erosion, which together amplify its flood risk. (Balan and Bordelon, 2021; Genova et al., 2020).

### **Anthropogenic Factors: Urbanization and Poor Water Management**

Anthropogenic factors refer to those related to human activities or decisions that have directly or indirectly increased flood risk over the years. Urbanization and land use changes have significantly affected the vulnerability of historic cities to flood events.

Urbanization is considered as a critical factor in many papers (identified in 42 papers), as it often leads to reduced green areas that would normally absorb rainwater (mentioned in 9 papers). More specifically, many studies underline how the artificialization of zones has often led to the loss of natural land barriers -such as wetlands, mangroves, or floodplains- which previously helped absorb or slow down floodwaters. (Balan and Bordelon, 2021; Thanvisitthpon, 2019) In Florence the growth of impervious surfaces because of artificialization reduced the natural infiltration and increased the surface runoff. (Caporali et al., 2023)

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Poor or insufficient urban planning (mentioned in 50 papers) -such as building in vulnerable zones, illegal construction, or informal settlements- and changes in land use (mentioned in 24 papers) have also been identified as factors that have increased the urban vulnerability. For instance, in Cesky Krumlov, a historic medieval town in the Czech Republic, ground floors were historically used for service spaces to minimize flood losses, but today they are occupied by shops, hotels, and restaurants, making them more vulnerable to damage. (Nedvědová, 2013)

Canalizations and river modifications, initially intended to reduce flood impacts and regulate water flow, were often poorly studied or underestimated, sometimes leading to the opposite effect. A clear example of how human interventions increased flood risk can be found in Poland. In the 19th century, following severe floods with high casualties, engineers artificially narrowed the Vistula River by 40% and altered its course to protect urban areas. (Cyberski et al., 2006; Porębska et al., 2019; Starkel, 1982) However, these changes reduced the river's natural flood-absorbing capacity and increased flood risk, putting Krakow's historic UNESCO-listed center at greater risk today. According to Grela (2023), the false sense of security created by embankments and river modifications led to dense urban development in formerly flood-prone areas of Krakow. His research shows that today, over 32% of the population—more than 250,000 people—are at risk in the event of dam failures or extreme flood scenarios. (Grela, 2023). In Genova, Italy, the modification of natural streams and their transformation into sewers and hydraulic structures, during the last two centuries has significantly increased flood risk and is now considered the primary cause of flooding in the city. (Lanza, 2003)

In the context of heritage sites, there are cases where protective measures are insufficient or poorly maintained. The absence of flood defense infrastructure leaves sites vulnerable to inundation during extreme weather events. (Cuca and Barazzetti, 2018; Forino et al., 2016; Garrote et al., 2020) Tourism pressure also affects the implementation of protective measures, as historic urban fabric is often repurposed for tourism without consideration for climate-related risks. In many cases, preservation requirements driven by heritage or tourism value can limit the possibility of introducing effective flood-proofing interventions. (Bianco and Montedoro, 2023; Pakdeeburee et al., 2011)

### **Endogenous factors: Inherited Urban Form, Infrastructure, and Material Vulnerabilities**

Endogenous are the factors refer to the internal characteristics of a city, including its socio-spatial structure - such as unequal development, marginalization and social vulnerability (19 papers), outdated infrastructure and drainage system (59 papers), topography (mentioned in 49 papers) and materials used in traditional construction (16 papers). These factors developed over centuries and are not necessarily the result of recent human decisions, but rather reflect the historical and spatial evolution of a city.

The drainage system plays a pivotal role into the flood resilience In many historic cities, drainage infrastructures were designed for earlier urban scales and climatic conditions and cannot withstand today's increased rainfall intensity and urbanization. Approximately 70% of the reviewed papers identify old infrastructure and drainage systems as key flood risk factors



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in contemporary historic cities. For example, the drainage system at the Roman Agora of Athens in Greece, once pioneering and functional, is now ineffective because it is old, partially non-functional, limited in capacity and overwhelmed by the increased runoff due to climate change. (Iliopoulou et al., 2023) A similar situation is observed in Corfu, Greece, where the historic drainage system dates back to the Venetian era, was not designed to accommodate modern extreme weather events (Dimitriou, 2022; Maistrou et al., 2023).

Historic cities, from Rethymnon in Greece to York in the United Kingdom, or the temples of Bagan in Myanmar, often used locally available materials for construction that are highly susceptible to water damage. These include soft calcareous stones, porous masonry, earth-based materials, limestone, and timber (Chitty and Sprega, 2018; Li, 2024; Ravankhah et al., 2019; Stephenson and D’Ayala, 2014)

The organic growth and morphology of the heritage cities, also affect their vulnerability. **Narrow streets**, a common urban language in heritage sites due to their historical urban benefits, today directly affects how water flows, drains, and accumulates within the city, decreasing the runoff and leave little room for structural adaptations.(Dimitriou, 2022; Maistrou et al., 2023).

In addition to physical characteristics, socio-spatial factors also shape flood risk. Several articles highlight that areas with vulnerable populations—such as the elderly—or the presence of critical infrastructure, like health facilities, increase the level of risk. (Apro et al., 2016; Di Salvo et al., 2018; Foudi et al., 2015; Gandini et al., 2017; Su et al., 2024)

Quito is a strong example of a city where flood vulnerability stems primarily from endogenous factors. Located in a steep Andean valley, the city’s natural topography direct intense rainfall straight into its urban fabric, heightening the risk of flash floods. While some anthropogenic changes—such as the covering of natural ravines during urban expansion—have worsened runoff, the core drivers of Quito’s flood risk lie in its internal characteristics. These include its historical development pattern, dense urban form with narrow streets, and the use of traditional building materials like adobe and timber, that are especially vulnerable to water damage. These features, shaped over centuries, were not designed for extreme rainfalls, due to climate change conditions. The big 2022 flood, led to many casualties and economic losses, revealed how this inherited urban structure and setting contribute to the city’s fragility in the face of increasingly intense weather events. (Trizio et al., 2022; UNESCO World Heritage, 2024)

### **Systemic factors: Governance, Policy Gaps, and Institutional Failures**

Systemic factors include the broader political, economic, and governance-related issues that affect the decision-making in flood management. It is about the lack of sufficient long term management plans against flood risk, the cooperation among the stakeholders or the economic structures and funding projects for infrastructure maintenance.

35 papers highlight how governmental issues, such as politician collusion, law system or regulations are playing a pivotal role into the flood risk management as main factors of flood risk response, while others explain the importance of missing important data (7 papers), or slow or even nonexistent monitor and early-warning systems or emergency plans (21 papers)

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while others explain the importance of national fundings or economic pressures in the risk management plans (34 papers).

Others point to the lack of education; including its capacity to understand, prepare for, and respond to risks like floods as a major systemic factor that affect emergency plans today. (Ginzarly et al., 2024; Munpa et al., 2024; Potdar and Verbakel, 2022)

A widely cited example of systemic failures in flood management is that of New Orleans during Hurricane Katrina in 2005. Despite repeated warnings about the city’s vulnerability, government agencies failed to act in advance. The levee system, which was intended to be completed in 13 years at a projected cost of \$90 million, ultimately took 40 years and cost nearly \$700 million, and yet it remained incomplete at the time of the disaster. When the hurricane struck, poorly designed and maintained levees failed catastrophically, specifically, 170 miles out of 350 miles of protection, were breached or destroyed. Simultaneously, disaster response between the U.S. Army Corps of Engineers (USACE), local levee boards, and state authorities was slow and uncoordinated, leaving many residents—especially in low-income areas—without evacuation assistance. Critically, the USACE relied on outdated storm data (the 1959 Standard Project Hurricane), ignoring more recent forecasts and expert recommendations. (Genova et al., 2020; Heerden et al., 2006)

### **An Example of All Factors**

Although in most cases it is not only one category of factors responsible for the increased flood events in the historic areas, rather the combination of them. Most flood risks are due to multiple overlapping factors, as seen in Ayutthaya, a UNESCO World Heritage Site in Thailand. In that case study, flood risk is due to a combination of natural geography, historical urban design, human-induced changes, and systemic governance failures:

Naturally, the city is located on a low-lying floodplain surrounded by three rivers -the Chao Phraya River, the Lopburi River and the Pa Sak River- making it highly vulnerable to seasonal flooding. The basin area is flat, with an average elevation of 1 to 2 m above mean sea level with certain even lowered down to sea level due to land subsidence. (Natural Factors). Human activities such as rapid urbanization, deforestation, and river modifications have reduced natural water absorption, increasing flood risk in the area. Also, the pressure from tourism has led to more construction and paved areas around the heritage sites, which makes it harder for water to drain and increases the risk of flooding. (Anthropogenic Factors). Historic temples were made of vulnerable materials like laterite, stucco, and wood, so they currently suffer severe water damage during floods. (Endogenous Factors) (Daungthima and Kazunori, 2013; Pakdeeburee et al., 2011; Thanvisitthpon, 2019) The 2011 floods have been devastating for a large number of cultural heritage sites in the area (including museums, temples, archaeological sites, cultural landscapes, and historic landmarks) leading the governance to consider for new flood policies. The governmental policies included flood walls, levees, and an improved drainage system that managed to protect the UNESCO site sufficiently, but ultimately, the measures redirected the floodwaters to surrounding peri-urban areas like Bang Ban, Phak Hai, and Sena, worsening flooding there. (Munpa et al., 2024; Thanvisitthpon, 2019) Finally, a lack of public participation and sufficient coordination between stakeholders, have been continually highlighted in various articles as a critical factor

for flood resilience. (Systemic Factors) (Huyakorn et al., 2012; Pakdeeburee et al., 2011; Thanvisitthpon, 2019)

**Toward Resilience: Strategies for Flood Risk Management in Historic Cities**

Flood risk management in historic cities is particularly challenging, as these areas possess high cultural value and are especially vulnerable to natural disasters. Additionally, the implementation of conventional flood protection solutions is often difficult, as they may compromise the historic character of the sites.

The literature typically addresses these challenges through either targeted strategies or holistic approaches. Targeted strategies focus on mitigating specific and immediate problems, such as the protection of critical infrastructure and heritage monuments. In contrast, holistic approaches aim for integrated management, considering cultural, social, environmental, and economic dimensions.

The choice between these approaches depends on local conditions, the nature of the risks, and the availability of resources. Many studies advocate for a combined application of both strategies to achieve the most effective results.

This paper categorizes flood risk management solutions into five main groups: Structural Measures, Technological Measures, Blue-Green Infrastructure, Planning and Policy Strategies, and Social Awareness, Cooperation, and Coordination.

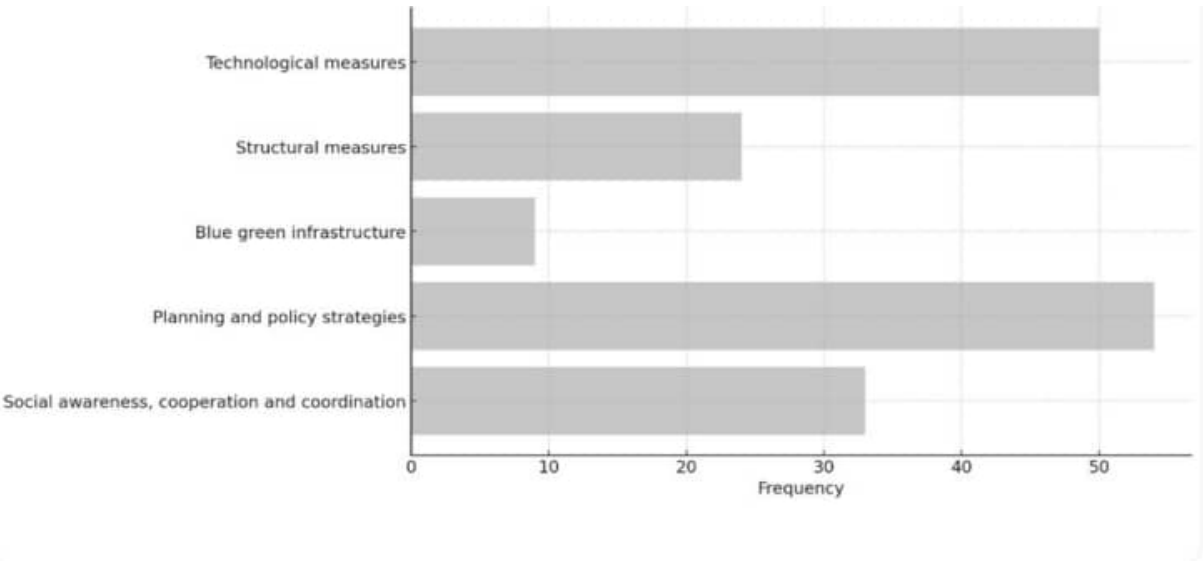


Table 5 Distribution of Categories in Flood Resilience Solutions

**Structural Measures: Physical Interventions**

Structural measures as proposed solutions for flood risk mitigation include physical infrastructure at the urban level -such as flood barriers, dikes, retention basins, or upgrades to drainage systems- and building-level measures -such as reinforcements, flood doors, and building-specific adaptations.

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24 out of the 70 papers included these types of solutions to address flood risk. At least half of them underlined the importance of reinforcing and upgrading the drainage systems in cities to manage large volumes of water, surface runoff, and reduce water accumulation. While some papers propose improvements to the existing drainage systems (Jia et al., 2023; Maistrou et al., 2023; Sesana et al., 2018), others propose alternative approaches. For example, Lanza (2003) suggested the rehabilitation of Genoa’s old cisterns as temporary stormwater storage tanks. This would transform the cisterns into a new, functional component of the drainage system, effectively integrating historic infrastructure into a modern flood control plan. (Brandolini et al., 2018; Lanza, 2003)

The construction of dams and levees is also sometimes recommended in areas of high flood risk. A successful project is the Bilancino Dam in Florence, built after the devastating 1966 floods to regulate water flows from the Mugello basin, that has significantly contributed to the reduction of flood risks in the area. (Coli et al., 2013) On the other hand, research on the MoSE dam system in Venice—which has protected the city from sea level rise for several years—considers it economically successful in the short to medium term, but its long-term viability is uncertain due to ongoing climate change. (Giupponi et al., 2024; Sesana et al., 2018)

At a building level, structural reinforcements are frequently proposed in the literature. In Algira, Spain, it was recommended to reinforce earthen buildings with compatible materials to improve their resistance to water infiltration. (Trizio et al., 2020) In Tomar, Portugal, cost-effective retrofitting measures like flood skirts and replastering were assessed through cost-benefit analysis. (Davis et al., 2023) Keller et al. (2016) also proposed technical reinforcements using natural, eco-friendly materials -such as insulating plasters or reinforced retaining walls with gabions- to enhance energy efficiency, structural stability, and climate resilience, while preserving heritage (Keller et al., 2017) A more extreme solution was proposed by Kurniawati et al. (2020) in a flood prone city in Indonesia, suggesting the **elevation of heritage buildings and critical infrastructure**. (Kurniawati et al., 2020)

Soft capping is another technique that helps preventing flood damage and reduce erosion by using natural, permeable materials -such as soil and vegetation- on the surfaces of the sites. These materials slow runoff, increase water absorption, and gradually reduce erosion, making them a sustainable alternative to traditional materials. Soft capping trials conducted in case studies in Yorkshire and Oxford, showing promising results. However, in some cases, the decision to remove vegetation from historic walls led to local controversy, as some community members perceived the removal of plant growth as neglect rather than a conservation effort. (Hanssen and Viles, 2014; Richards et al., 2024)

### **Technological Measures: The Role of Digital Tools, Monitoring, and Early-Warning**

That category includes techniques such as GIS (Geographic Information System) tools, flood hazard mapping and risk simulation modeling, remote sensing or satellite images, early warning, and real-time monitoring systems. The evolution of technology and the accuracy and effectiveness of simulations in today’s flood management led 50 out of 70 papers to propose these types of solutions.

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Early warning systems and monitoring appeared in at least 25 case studies as possible solutions. Monitoring is used to continuously observe and collect data (such as river levels, rainfall, soil moisture, flow rates), while early warning is responsible for analyzing monitoring data, forecasting possible hazards, and issuing timely alerts to populations and authorities. (Brempong et al., 2023; Coli et al., 2013; Cuca and Agapiou, 2021; Dimitriou, 2022) Wu et al. (2024) developed an early warning system for historic districts, combining building, road, and public evacuation risk models with a 1-hour rainfall intensity index. Using real-time data, it helps protect cultural heritage through targeted warnings and preventive actions. (Wu et al., 2024) Young et al. (2021) developed a color-coded hazard matrix that provides a simple, data-driven early warning tool that links rainfall forecasts to flood risk levels (green to red). It helps authorities and communities in data-scarce cities anticipate pluvial floods and take timely action, enhancing preparedness without relying on physical infrastructure. (Young et al., 2021)

GIS tools were used in one-third of the papers to produce flood hazard and risk maps, explore flood-vulnerable zones, or model future scenarios. For instance, KALOGEROPOULOS et al. (2023) conducted a comprehensive study based on hydrological models using GIS, Digital Elevation Model (DEM), Remote Sensing (RS), Rainfall-Runoff Modelling, and Synthetic Unit Hydrograph (SUH) Development. The goal was to highlight flood-prone areas near the archaeological site of Ancient Olympia, in order to identify vulnerable zones and understand water flow behavior under different rainfall scenarios. (Kalogeropoulos et al., 2023)

AI and machine learning techniques, such as Artificial Neural Networks (ANNs), Machine Learning, Bayesian networks, and Metaheuristics, are newer and continuously evolving approaches proposed in recent papers to deal with missing or complex data, identify patterns, and calibrate the vulnerability of cities to flood events. (Ferreira and Ramírez Eudave, 2022; Grau-Bove et al., 2024)

While technological solutions can offer cost-efficient and rapid means of processing large volumes of data, they still have limitations and risk promoting a purely technical approach that may fail to address the complex, multidimensional challenges of heritage cities in urban environments.

### **Planning and Policy Strategies: Integrating Heritage, Regulation, and Risk Management**

These types of solutions are the most common among the papers, found in at least 54 of them. They include Integrated Management Plan, regulatory framework and tourism impact management.

Integrated Management Plans are at the heart of historic city management strategies. These plans integrate environmental, cultural, social, technological, and institutional parameters, creating a coherent framework that combines flood prevention with the protection and conservation of cultural and historical values. They aim to ensure the sustainability and resilience of historic areas. These plans emphasize a multi-dimensional approach, promoting collaboration between local authorities, communities, and individuals, and they typically incorporate both physical and technological solutions. The literature consistently emphasizes the need to integrate climate adaptation into heritage planning efforts. (Keller et al., 2017; Liu



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et al., 2019; Sesana et al., 2018) To achieve this, scholars frequently propose specific measures such as incorporating flood risk into urban planning and zoning regulations, and applying systematic inundation scenarios and modeling to support both preservation planning and emergency preparedness. (El-Behaedi and Ghoneim, 2018; Ortiz et al., 2014)

Regulatory frameworks form another important pillar of planning and policy strategies since they provide the legal, administrative, and institutional tools, necessary for the management, protection, and sustainable development of areas affected by flood risks. Many studies underline the value of aligning national and local strategies with international regulations, like European Directives about floods, UNESCO Convention on the Protection of the World Cultural Heritage, and Historic Urban Landscape or the Intergovernmental Panel on Climate Change (IPCC) guidelines as an important solution towards flood vulnerability. (Chen et al., 2024; Chigurupati, 2008; Kutut et al., 2021; Perez-Alvaro, 2016; Sesana et al., 2018)

Tourism is a critical factor that can have both negative and positive effects on flood risk management and the sustainability of historic cities. On the one hand, tourism development often increases vulnerability by altering the social identity of cities and shifting resources away from long-term strategies like flood mitigation toward short-term economic gains. It can also intensify pressures on cultural heritage already at risk from climate-related hazards. (El-Behaedi and Ghoneim, 2018; Ortiz et al., 2014) On the other hand, tourism can also support flood risk management when it is well-regulated. The literature proposes various solutions, such as controlling the number of visitors or rerouting tour buses away from flood-prone areas. Tourism may also aid in post-flood recovery by generating financial revenue and increasing media visibility, which can attract attention and external support. (Bianco and Montedoro, 2023; Maistrou et al., 2023; Sesana et al., 2018) Campaigns like #EnjoyRespectVenezia, launched during the International Year of Sustainable Tourism for Development, are aiming to educate tourists on responsible behavior, indirectly promoting respect for fragile, flood-prone heritage. (Balan and Bordelon, 2021) Another innovative proposal is the implementation of voluntary tourist donation systems, such as in Ayutthaya, which offer a low-cost and scalable way to engage visitors in flood protection and heritage conservation. (Sakonnakon et al., 2012)

### **Blue-Green Infrastructure: Nature-Based and Ecosystem Approaches for Urban Resilience**

This category includes softer urban solutions such as eco-corridors and buffer zones, green spaces and wetlands restoration, permeable surfaces, and adaptive urban planning strategies. While structural measures are essential for immediate flood control, blue-green infrastructure offers a more sustainable, adaptable, and environmentally friendly approach. Despite its importance, only 14% of the papers (10 papers) included this type of solution in their proposals. This limited representation is likely due to a combination of factors: historical preference for structural measures, perceived complexity and cost of implementation, limited immediate impact during flood events, integration challenges, and a lack of interdisciplinary expertise. Flood management has traditionally been led by civil engineering and hydrology disciplines, which often favor quantifiable, technical solutions.



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Nature-Based Solutions (NBS) were proposed in case studies such as Florence, Corfu, Hoi An City, and Guangzhou. These include rain gardens, urban wetlands, tree planting, and permeable pavements, all designed to regulate rainwater, reduce surface runoff, and improve water infiltration. Such interventions help restoring the natural hydrological cycles within urban environments without disrupting their cultural character. (Caporali et al., 2023; Dimitriou, 2022; Nguyen et al., 2024; Su et al., 2024) Other projects are recognizing the ecosystem service values and highlight the importance of restoring wetlands and coastal areas to act as natural buffers against storm surges and flooding. (Foudi et al., 2015; Genova et al., 2020; Sesana et al., 2018)

In Romania, one proposal involved the transformation of a breached dam lake to a floating park, that could absorb floodwater while also serving recreational purposes. The park would include elevated alleys accessible after rain, wetland-compatible vegetation like reeds and rushes and terraced slopes planted with trees like willows and cypress. (Keller et al., 2017)

### **Social Awareness, Cooperation and Coordination: Engaging Communities and Promoting Shared Responsibility**

At least 33 papers, underlined the importance of community-based approaches, the public engagement and education, the integration of traditional knowledge and the participatory urban planning.

At least 33 papers underline the importance of community-based approaches, public engagement and education, the integration of traditional knowledge, and participatory urban planning.

There is a recurring question in the literature about the inclusion of local communities in planning due to their intimate knowledge of place, lived experiences of past disasters, and capacity to contribute to more context-sensitive, accepted, and sustainable solutions. (Marchetti et al., 2020; Munpa et al., 2024) Specifically, in the examples of Ayutthaya and Corfu, it is highlighted how local knowledge and traditional adaptation practices can preserve the cultural heritage of the areas. (Dimitriou, 2022; Shirvani Dastgerdi and Kheyroddin, 2023)

Inter-collaboration and cooperation are also considered critical in order to produce efficient flood risk plans while preserving the character of the cities; a flood-resilient plan should be a collaborative plan among engineers, architects, heritage specialists, local authorities, and the public. (Kumar, 2020; Kuźmiński, 2016; Nedvědová, 2013; Ortiz et al., 2016)

Education is also highlighted as a fundamental tool for building long-term resilience, not only as a means of raising awareness of flood risks and preparedness but also because it creates a shared sense of responsibility toward the protection of cultural heritage. Several studies emphasize the need for educational programs targeting both residents and decision-makers. (Daungthima and Kazunori, 2013; Maistrou et al., 2023; Pakdeeburee et al., 2011) Banfi et al. used VR glasses simulations for educational purposes to increase awareness by visualizing flood risks and the structural behavior of heritage sites in various environments. (Banfi et al., 2020)

A case study in Reading, UK, demonstrated how integrating local communities alongside technological tools improved flood risk management. The study proposed flood risk maps that

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combined traditional technical models with participatory insights from local residents in order to create more accurate flood risk maps. The locals were able to better identify areas that had previously flooded, drainage system failures, and social vulnerabilities (such as high-risk, low-income neighborhoods) that purely technical solutions could not evaluate or identify. (Bullen and Miles, 2024)

n Ayutthaya, a Role-Play Gaming Simulation (RPGS) is proposed: a participatory simulation tool where citizens, government, the private sector, and experts take on different roles (such as urban planner, resident, tourist, teacher, merchant) to simulate decision-making for flood management, exchange ideas, brainstorm, and understand the complexity of flood risk management. (Huyakorn et al., 2012)

### **Conclusions: Key Lessons and Future Directions for Sustainable and Resilient Heritage Cities**

Flooding represents an increasing threat to modern societies, particularly to historic cities, where the cultural value of the urban fabric is at risk. In recent years, the academic community has shown growing interest in addressing flood risks in urban environments by proposing sustainable and adaptable solutions.

This paper, through a literature review of 70 case studies, aims to explore the factors that make historic cities vulnerable to flood events, categorizing them into four groups: natural, anthropogenic, endogenous, and systemic. While the boundaries between these categories are often blurred -due to overlapping causes or differing interpretations- the goal is to emphasize how cities with diverse historical, cultural, topographic, and urban characteristics face similar challenges when it comes to flooding. Climate change has intensified natural hazards, particularly rainfall and sea-level rise, while the natural topography of many historic cities, often located near water for strategic or economic reasons, further increases their exposure.

At the same time, anthropogenic and systemic issues such as rapid urbanization, poor urban planning, aging or inadequate drainage infrastructure, lack of public awareness, and insufficient policy coordination significantly contribute to present-day flood risks. Many of these vulnerabilities originate from within the urban systems themselves, suggesting that they can be addressed through sustainable development strategies.

However, standard flood protection measures cannot always be directly applied in heritage contexts, due to architectural, cultural, and legal constraints. Each historic city presents unique geographic conditions, architectural heritage, and socio-economic challenges. Therefore, flood management strategies must be carefully adapted to each context to simultaneously preserve cultural identity and enhance resilience.

The analysis of proposed solutions through the literature reveals that, while structural interventions (such as dams, levees, and drainage improvements) are sometimes necessary, they may disrupt the aesthetic and cultural character of heritage cities. Such measures must be designed with sensitivity by interdisciplinary teams including engineers, architects, urban designers, and conservation experts. Furthermore, grey infrastructure alone is no longer sufficient to address today's flood risks. Long-term mitigation strategies must include green infrastructure -such as vegetated areas, restored wetlands, and natural drainage systems- which can enhance flood resilience while respecting the specific constraints of heritage sites.

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Technological innovations also play a key role in flood prevention, offering tools like GIS mapping, real-time monitoring, and early warning systems. Nevertheless, these must be integrated with local knowledge and cultural heritage considerations to be truly effective.

Community involvement is equally essential. Inclusive, participatory approaches ensure that solutions are not only technically effective but also socially accepted and sustainable over time.

Ultimately, achieving flood resilience in historic cities requires a delicate balance: between modern technologies and traditional knowledge, between hard infrastructure and nature-based solutions, and between international frameworks and local engagement. Only through tailored, context-sensitive strategies can ensure the protection of these invaluable historic cities for future generations.

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# THE PROTECTION AND MANAGEMENT OF COASTAL AREAS IN GREECE. EVALUATION OF RECENT LEGAL FRAMEWORK (L. 5092/2024)

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### **Abstract**

The protection and management of the coast and beach as public goods derives directly from article 24 par. 1 of Greek Constitution. The State is obliged to protect the natural environment, part of which is the coasts and beaches, which belong to the public property (article 967 of the Civil Code). Also, the State should take particularly preventive or statutory measures to preserve the vulnerable ecosystem of coastal areas, to protect their natural beauty and, at the same time, to ensure their public character in a beneficial manner.

After two decades of the implementation of the previous legal framework (L. 2971/2001) regarding the protection of coastal areas, the legislator deemed it necessary to reform it completely. The main goal is to achieve a more integrated and effective framework for the protection and management of coastal environment in Greece. Thus, L. 5092/2024 was enacted in March 2024.

The main objects of the new institutional framework is to ensure, on the one hand, the free access for all citizens to the beaches with the greatest possible assurance of their common character in combination with the protection of the natural environment, and, on the other hand, to allow their exploitation by the State to strengthen the national economy with more transparent and accelerated procedures.

The new Law regulates the conditions and restrictions that can be applied to the coasts and beaches included in the network «Natura 2000» protected areas and introduce the term «trackerless beaches». Also, it establishes a transparent digital procedure for the leasing of beaches, flexible digital tools (drones and satellites) for effective controls, stricter rules and penalties for their management.

In the present article, an attempt is made for a first evaluation for the new rules which were established recently, in combination with the policies and practises that have been applied until the recent revision with L. 5092/2024.

**Key words:** coastal areas, public good, management, protection, revision, legal framework, evaluation, policies

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### Introduction

The protection and management of the seashore and the beach<sup>57</sup> as public goods, derives directly from article 24 par. 1 of Greek Constitution<sup>58</sup>. According to the interpretation of the article, the State is obliged to protect and safeguard the natural environment, part of which is the seashore and the beach, and furthermore, it has the obligation to take special preventive or repressive measures within the framework of the principle of sustainability for their protection. These measures are necessary to preserve the fragile ecosystem of the coasts and protect their natural beauty. At the same time, the measures ensure their public character<sup>59</sup>, because, as it emerges from the above article of the Constitution, unhindered access and enjoyment by all citizens is a right that should be protected. Also, their protection in every beneficial way serves the public interest.

The main legislation that regulated the issues of the protection of coastal ecosystems and included provisions for the definition of the seashore and the beach and the permitted uses of them, was the Compulsory Law (A.L.) 2344/1940 (Government Gazette FEK A 154). The

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<sup>57</sup> Papapetropoulos, A. (2009) "SPATIAL PLANNING OF THE COAST AND THE BEACH. THEORETICAL AND LEGAL APPROACHES (June 2009)", LAW AND NATURE, [nomosphysis.org.gr](https://nomosphysis.org.gr) at <https://nomosphysis.org.gr/11749/o-xorotaksikos-sxediasmos-tou-aigialou-kai-tis-paralias-theoritikes-kai-nomologiakes-proseggiseis-iounios-2009/>: Our country with a coastline length of 15,000 kilometers has the largest ratio of coastline length per square kilometer of land in the world, after Norway. The coasts, therefore, as well as the seashore and the beach, constitute an extremely important national resource and an important comparative national advantage at EU level.

<sup>58</sup> Decision of the Council of State (S.T.E.) 2370/2023: "As it is consistently accepted, with the provisions of Article 24 of the Constitution, the natural and cultural environment have been reduced to independently protected goods. Coastal ecosystems are an essential part of the natural environment, and indeed vulnerable, which, according to the settled case-law of the Court, must, within the meaning of the abovementioned constitutional requirement, be subject to a special regime of mild management and development, in accordance with the constitutionally enshrined principle of sustainable development. This status is usually the subject of a special law, in any case, however, the coasts are directly subject to the protection imposed by Article 24 of the Constitution

<sup>59</sup> The coasts and beaches are public (except for transactions) and for public use. Their main purpose, as public use, is "the free and unhindered access of the public to them, as well as the communication of the land with the sea, lake or river". In accordance with the provisions of Article 967 of the Civil Code (CC) and Articles 1 and 5 of the Compulsory Law (Law 2344/1940) and Article 2 of Law 2971/2001, the seashore and the beach are included in the common property, which are intended for the direct service of a public purpose, and their management is an exercise of public power.

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law was applied for sixty (60) years and regulated with its provisions issues and problems that arose only along the coastline towards the land area, that is, at the point where the sea meets the land. With this institutional framework, there was no comprehensive framework for the overall planning and management of the coastal zones. According to Kokosis, X, Beriatos, H., (2016:7) «The practical result of its application, for over half a century, was the demarcation (topographic demarcation) of the seashore on only 12% of the Greek coastline». The above law was repealed in 2001 by Law L.2971/2001 (Government Gazette FEK A 285). The philosophy of this institutional framework has also failed to address the important issues of coastal zones management as a whole. However, it set a more integrated framework for the seashore and the beach, for the process of delimitation of coastal zones, for the ownership and permitted activities on the seashore and on the beach. Law 2971/2001 was amended in some of its provisions, in part, by various pieces of legislation (Law 4281/2014, 4321/2015, 4607/2019, 4676/2020, 4787/2021). After two decades of implementation of the above law, it was necessary to reform the institutional framework for a more integrated and effective framework for the protection and management of the coastal natural environment. This because the new legal framework had to be adapted and comprehensively solve the problems caused to the seashore and the beach by the great environmental and man-made pressures, the major natural disasters due to climate change and also, it was necessary to rationalize and prudently manage the exploitation of the natural wealth of the seashore and the beaches of the country by the intense tourist activities. At the same time, to contribute economically to the national economy and to adapt to European standards and global data for the management of the coastal areas.

The new institutional framework (L. 5092/2024 Government Gazette FEK A 33), repealed most of the provisions of the previous law (2001). It includes provisions that ensure the free access of citizens to the seashores and the beaches enhance their public character and protect them as sensitive ecosystems. Also, provisions set for their simple use by the State in order to strengthen the national economy with transparent and expedited procedures.

The reforms of the new law concern the redefinition of the concepts of the seashore and the beach, define the terms and restrictions to be applied for seashores and beaches that are included in the "Natura 2000" protection areas and introduce the term «trackerless beaches». It also introduces a transparent digital procedure for the lease and economic exploitation of beaches and stricter rules for their management. Furthermore, the framework of penalties becomes stricter when the law is violated by the offenders. New, flexible digital tools (drones and satellites) are being introduced to make them more efficient.

In this article, an attempt is made to study and record the new provisions of the L.5092/2024 and demonstrate the spirit of the new institutional framework compared to what the previous institutional framework provided. Also, a first assessment is made, in relation to its policies and applications.

### **The public character of the seashore and the beach according to the long-standing legislation in force**

The public character of the seashore and the beach has already been determined by the basic institutional framework of Law 2344/1940 (FEK A 154). It was a post-war law and the first to



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describe that the seashore is a public good, belongs to the State, which manages it.<sup>60</sup> The concept of the public character of the seashore and the beach and its acquisition by the State of the above law was maintained with the force of the Civil Code and the latter includes in its provisions the elements of public use and the public acquisition and management of the seashore and the beach until today.

The provision of Article 966 of the Civil Code<sup>61</sup> stipulates that things outside the transaction are common to all and are intended to serve public needs (public, municipal, community, religious). These needs serve the general interest of the population. As goods (things) outside the transaction, they are not the subject of real relations and their exploitation is subject to restrictions.

The provision of Article 967 of the Civil Code<sup>62</sup> provides that seashores are public things that can be natural or artificial and are available for free access and use by an indefinite number of people. These public spaces are used freely, unhindered, with accessibility. In this way, a public law relationship is created between the citizen and the State and the citizen's relationship with the common use of the seashore and the beach with their public character. Article 968 of the Civil Code<sup>63</sup> public property belongs to the state and only when it is defined by law can they belong to a Municipality, a Community, a private individual. In the above sense, the use of the seashore and the beach may be public for the citizens, but the latter can't be the owners in terms of ownership. This because the seashore and the beach belong to the public property of the State which includes things that serve purely public purposes. Any right in rem of the citizen to them (seashore and beach) will be determined only by a special law. Thus, according to Article 971 of the Civil Code,<sup>64</sup> things outside the transaction, such as the seashore and the beach, lose their public character only when they cease to serve public purposes. Also, as public property, they are not subject to special rules to determine their public character. No special administrative Act is required. Seashores and beaches are included in the public property of the State.

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<sup>60</sup>Compulsory Law 2344/1940 (FEK A 154): "The seashore, i.e. the land zone surrounding the sea, which is wet from the largest but usual waves rises, is common property, belongs as such to the State and is protected and managed by it".

<sup>61</sup>According to Article 966 of the Civil Code: "Things other than transactions are those common to all, those common and those intended to serve public, municipal, community or religious needs".

<sup>62</sup> According to Article 967 of the Civil Code: "Things of common use are in particular waters with free and perpetual flow, roads, squares, seas, ports and bays, banks of navigable rivers, large lakes and their banks".

<sup>63</sup> According to Article 968 of the Civil Code: "Public utilities, if they do not belong to a municipality or a community, or the law does not stipulate otherwise, belong to the State".

<sup>64</sup> According to Article 971 of the Civil Code: "Things outside the transaction shall cease to have this status from the moment they cease to be intended for common use or for public, municipal, community or religious purposes".

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In the urban planning legislation of Law 1337/1983 (Government Gazzete FEK A 33), which is the first integrated legal framework for the urban planning organization for the cities, there is a special reference to its provisions for the seashore and the beach.

Thus, Article 23 of the law refers to a variety of regulations that protect the coasts and consequently the seashore and the beach from building within them and from their land development and use by the owners who own real estate near the coast. The construction of buildings within the seashore and the beach is not allowed and if such buildings are constructed are demolished. Also, in areas that there is no approved urban plan or in cities or settlements that have been anointed before the year of 1923 and within a zone 500 meters wide from the shores of the sea (or from the shores of public lakes), fencing is not allowed and demolished as arbitrary. Only in exceptional cases can fencing be allowed and if a presidential decree is issued with terms and conditions. Furthermore, the right granted by the basic Compulsory Law (L. 2344/1940) to the owners to erect villas for private use and to construct kiosks, or to install tents on the seashore, was prohibited. It was also defined that the beach zone starts from the fixed boundary of the seashore to the land. In cases where the seashore cannot, due to the nature of the continuous land, serve the rules of urban planning of an area to be built, it can be widened and built from the adjacent land after a width of 50 meters and not 20 meters as was the case in basic Law 2344/1940.

The construction on the seashore and on the beach and the cancellation of their communal character was the subject of appeals by the owners of properties they owned near or next to or on the coast. These issues were decided by the Supreme Court of the Council of State (STE), which with numbers of decisions examined the cases in accordance with the provisions of Article 24 of the Constitution for the protection of the natural environment, and, consequently, the coast, the seashore and the beach. The Supreme Court (STE) applied the principle of proportionality and the condition of compliance with urban planning legislation on the way that a real estate can be built in coastal areas, in conjunction with Article 17 of the Constitution, which protects the right to property. In any case, it was decided that the State should take care of the organization and the operation, recording, management, supervision and control of the coasts and that there should be an integrated planning system for the coastal area of the country.

### **The institutional framework for the seashore and the beach from Law 2971/2001 to Law 5092/2024**

As mentioned, Law 2971/2001 repealed the Law 2344/1990, systematically and comprehensively regulated the framework for the seashore and the beach. The concept of the seashore and the beach, the procedure by which the coastal zones are demarcated, the ownership and the permitted uses of the seashore, i.e., the process of granting the simple use for the exercise of activities within the seashore to serve the widest number of persons (tourist activities, public recreation) has been redefined.

Article 1 state that the seashore is the zone of land that is washed by the sea during the longest and usual waves of its waves. Also, the seashore is an essential element of the natural environment, which is protected by the State, which manages it, according to its nature and its communal character. It's meaning and content is the same as the basic Law 2944/1940.

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In Article 2, the beach is the land zone that is added to the seashore to serve the communication of the land with the sea and vice versa, as well as for the preservation and protection of the coasts from erosion and the protection of the seashore in general. A newer addition was made with an amendment by article 23 par. 2 of Law 4607/2019 (Government Gazette FEK A 65), which determined the minimum and maximum width of the beach from the shoreline, which cannot be less than 30 meters and more than 50 meters from the line. There was also an exception by which the Determination Committee (provided for in article 3 of the law) could, after examining every parameter and with a reasoned judgment, determine a smaller width for the beach. Also, it is reiterated in the amendment that these are common things (goods) that belong to the State, according to the principles of sustainability and spatial planning. For the first time, this provision should draw up a list of the prices of the concession of the simple use of the seashore for economic activities in order to have a uniform policy on concessions throughout the country. Their shared use ensures the unhindered access of an indefinite number of people to the seashore and the beach. Also, the construction of buildings and structures on the seashore is prohibited. Exceptionally, only the execution of projects and the facilitation of access for persons with disabilities are allowed. Arbitrary buildings are demolished (article 27 of the law) and a demolition protocol and an administrative fine are issued by the Land Service. Also, in addition to the demolition protocol and the imposed administrative fine in case of violation of the provisions of the law on illegal construction, prison sentences of at least one year are also provided.

The seashore and the beach are mapped in accordance with the provisions of articles 3 and 4 of the law, through administrative procedures through the Mapping Committee. This is the Committee, which is constituted by decision of the Minister of Finance and consists of members of the public administration (head of the Land Service, engineer of the Land Service, the competent Port Authority, the director of the Urban Planning Directorate, etc.). The elements that the Commission takes into account in determining the boundary line of the seashore are, in addition to the orthophotomaps (technical maps), the geomorphology of the soil, the natural boundary of the vegetation, the boundaries and type of coastal natural resources, the findings from the assessment of the meteorological data of the area, the morphology of the seabed, the sector of wave development in relation to the coastal front, the existence of technical works in the area, which legally exist, any approved spatial planning directions and land uses affecting the coastal zone, the existence of public lands of any category that are in the immediate vicinity of the coastal zone, any existing Land Registry and the existence of vulnerable ecosystems and protected areas. The inspection also requires an autopsy in the determination area. The drawing is done ex officio either by the Determination Committee, or after an application submitted by each interested party.

Also particularly important are the regulations for the definition of the old seashore in a coastal area, when it results from movement coastline to the sea and which is due to natural silts or legal technical works. It is determined by the new shoreline and the boundary of the previously existing shoreline (Article 6 of the Law). The Commission determines the old location of the seashore that existed until the year 1884, if there are occupations by private individuals, but also before, if there are no such occupations, provided that the location of the old seashore results from indications on the ground or other evidence, with the exception of witness testimony. It also seeks and takes into account all the elements required for the exact

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delimitation of the old seashore which it cites in its report, in particular natural indications (such as sandy, marshy or swampy areas contiguous of the seashore), aerial photographs, maps and geological studies of various years.

The Commission also defines the beach zone and draws the boundary line in yellow, either on its own initiative or at the request of the interested party (Article 6). The rights in rem of private individuals over the properties of the beach are expropriated due to public benefit on the condition of compensation. Legal entities under public law (N.P.D.D.) grant to the State their rights in rem over real estate located on the beach without compensation. An exception exists for hotels, organized tourist camps (camping) and complex tourist accommodations which can apply for the expropriation of the part of the beach zone, located in front of and along the property of the hotel accommodation and pay the entire compensation provided for by them, without the obligation of the relevant Municipality or the State to compensate the owner. In addition, under Article 10, where individuals assert ownership rights over land designated by the Commission as belonging to the seashore, those rights are to be regarded as necessarily expropriated in favour of the State in order to be included in the seashore. Compensation is determined in accordance with the legislation applicable to forced expropriations.

Its redefinition of the seashore, the beach and the old seashore, can be done when the boundary line has been incorrectly defined, or when the boundary line has been changed due to natural or technical works. The procedure is carried out either ex officio or upon request of each interested party to the competent Land Service. All documents proving the error of the initial demarcation of the boundary line (Article 7) are required.

Article 13, as amended by subsequent provisions of law and before 2024, regulates the issues of the simple concession of the seashore and the beach. Simple use is that by which they are not intended as common things and there is no alteration in their physical morphology and their biotic elements. The concession is made for a fee; the concession of the simple use is made for the purposes of leisure of the public on the beach and for related activities. The law mentions the placement and rental of umbrellas, marine recreation, umbrella seats and a canteen. The area of each concession may not exceed five hundred (500) square meters and must remain a free area of the seashore at least fifty percent (50%) of its total area, depending on the quality characteristics of the seashore. The space does not include spaces that are inaccessible and cannot be used. In neighboring businesses, businesses located towards the seashore and the beach can be made a simple concession without an auction, for a period of up to three (3) years. The limitation of the area of each concession for the simple use of the seashore, beach, of five hundred (500) meters does not apply to concessions adjacent to the public area of hotels, organized tourist camps (camping) and complex tourist accommodations that operate legally. Each business should leave a free zone of at least two (2) meters from the boundaries of the other. If the façade of the business is less than six (6) meters, the free zone is reduced by fifty percent (50%) at its limits.

In addition, special cases of simple concession of use for financial consideration are provided and the Placement in the sea, without intervention on the coast, of floating platforms with a surface area of up to one hundred and fifty (150) square meters for seasonal use up to nine (9) months each year, for cultural purposes and for recreational purposes. It is forbidden to use the platforms for the installation and operation of restaurants or leisure centers.

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Concessions, except in the cases of neighboring businesses, are made through an auction which can also be electronic. These can be done by decision of the Minister of Finance and a reasoned opinion of the Municipality. Furthermore, a direct concession of use can be made by a joint ministerial decision of the Minister of Finance and Foreign Affairs, when a concession is made to Municipalities. And the Municipalities can grant the use of the seashore and the beach by auction and financial consideration.

The coasts and beaches that belong to the European Ecological Network "Natura 2000" are not completely excluded from the concession process. A special protection regime is provided and the concession of their simple use is allowed, provided that only 30% of the concessional space can be covered with umbrella seats.

### **The new regulations of Law 5092/2024 "Terms of Use of Public Property in Coastal Areas and Other Provisions" – Similarities and Differences with the Previous Legal Framework**

The new provisions of the law were enacted in order to modernize the institutional framework for the management of the country's coastal areas, based on the public interest and the most advantageous use of the coasts. The new law is more coherent and simplified than the previous law. It includes innovative regulations in terms of transparency and the acceleration of the procedures for the concession of the simple use of the seashore and the beach for the enhancement of the economy, new digital technologies for the delimitation and control of violations, prohibits the concession for economic exploitation of beaches belonging to the European Network "NATURA 2000" and introduces the term "untouched beaches", stipulates that these should be recorded in a national list and urbanizes the fines for violators of the legislation. At the same time, it maintains and restores older provisions regarding the private possession of the old seashore.

The concepts of seashore, beach and old seashore still remain the same with some variations. According to Article 2, the seashore is defined as the zone land "washed by the sea during the longest and usual waves. The seashore is an essential element of the natural environment, protected by the State, which manages it, according to its nature and its communal character.". The beach has the same meaning and purpose as the previous law. Thus, a beach is defined: "The land zone, continuous towards the coast, which is defined for the purpose of preserving and protecting the coasts from erosion and to serve the communication of the land with the sea and vice versa, which may not extend more than fifty (50) meters from the boundary line of the seashore". The only difference is that the provision for the minimum width of 30 meters is abolished. The old seashore is: "The land zone, which results from the displacement of the coastline towards the sea, is due to natural causes (natural silts) or legal technical works and is determined by the new coastline and the boundary of the previously existing coastline». The definition remains the same as the pre-existing institutional framework.

In Article 4, a new classification is introduced in the protection of coasts and beaches located in areas within the European network "NATURA 2000". Innovation is also introduced for the first time in the concept of the "untouched beach". These are coasts and beaches of high protection which are of special aesthetic, geomorphological or ecological value. On



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trackerless beaches, the concession of simple use is prohibited, as well as any other action that may endanger their morphology and their integrity in terms of their ecological functions. 238 untouched beaches have already been recorded and included in the lists. In contrast to the previous regime of Law 2971/2001 which allowed the concession of their use provided that the objectives of conservation and protection of these beaches are not affected, in these areas (untouched beaches) which were included in the European network "NATURA 2000", the concession of simple use is absolutely prohibited, in contrast to the previous regime of Law 2971/2001.

As far as their ownership status is concerned (article 6), the seashore and the beach remain in the ownership of the State and are public property. They are protected and managed by the Land Service. Especially the coasts and beaches that have been characterized as tourist public estates in accordance with the provisions of the current legislation are managed by the Public Real Estate Company S.A. (E.A.D. S.A.).

The differentiation focuses on the ownership status of the old seashore, which reverts to the previous regime of Law 2971/2001, according to which, the old seashore belongs to the private property of the State. That is, the provision that the old seashore belongs to the property of the state is abolished, i.e., the provision that amended in 2019 (article 24 of Law 4607/2019) the private acquisition of the state by law and which was in force in recent years and reverts to the previous legal status. Thus, with this restoration and in accordance with what is in force in the Civil Code and Article 966, the old seashore is not considered a "thing outside the transaction". Therefore, it can be economically exploited and become the subject of private transactions. Its management is under the control of the Public Private Property Development Fund S.A. (T.A.I.P.E.D.) and the Public Real Estate Company S.A. Therefore, in this sense, their public character is negated and contradicts the requirements of the Constitution of Article 24 for their protection and management by the State and the assurance of their public character, accessible to all citizens. However, if a private property is inserted between the seashore and a public road, the owner is obliged to provide free entry to anyone who requests access to the seashore and the beach. An exception to the transfer of the old seashore to the private property of the State exists only in those cases in which the areas of the old seashore bordering on untouched beaches belong to public property and are public property, ineligible for private rights (Article 5).

The procedure for determining the boundaries of the seashore, the beach and the old seashore is deleted in the provisions of Article 5 (par. 1 to 9), applying the same procedure in cases of redefinition of these sections due to an error or if the boundary line is changed due to lawful technical works or natural causes. The new law, maintains the criteria taken into account for the delimitation of the seashore and the beach and adopts the same indicative enumeration as the previous law (soil geomorphology, vegetation, waves, bottom morphology, etc.). However, a regulation is introduced that the alignment of the beach line cannot exceed the building line in traditional settlements, in settlements before 1923 and in settlements with a population of less than 2,000 inhabitants where there is no approved street plan. It is also provided that where there is a city plan; the boundary line cannot exceed the approved street line. For the definition and redefinition of the old seashore, the law preserves the evidence and scientific indications such as the indications on the ground or the natural indications (sandy, marshy or marshy character of the contiguous areas of the seashore), geological studies,



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diagrams, aerial photographs, autopsy. The time limit of the year 1884 for the characterization and marking of the old seashore is deleted. Instead of this year, it is planned to issue a presidential decree that will determine the entire process of defining the old seashore.

The procedure and restrictions on the concession of the simple use of the seashore and the beach are provided for in Articles 8 to 14. The competent bodies for the concession are the Real Estate Service and the Public Real Estate Company S.A. The difference is that there is no longer provision for the concession by the State to Municipalities, in order for them to proceed with a concession, as was the case with the previous legal regime of Law 2971/2001. The provisions of the concession of simple use refer to the recreation of the public and the service of citizens for leisure activities on the seashore and on the beach, however, there is no indicative enumeration as in the previous Law 2971/2001. The auctions are electronic and are held by the Land Service until March 31 of each year after bidding through the electronic "Register of Concession Contracts for the Simple Use of the Seashore and the Beach". This simplifies the process; there is speed and greater transparency in all procedures.

According to Article 8, concessionaires have an obligation to ensure safe and free passage for all and to install special platforms for access for persons with disabilities. In order to ensure the vertical and parallel passage of the public to the sea and to keep the 4-meter zone free, the umbrella seats can be developed by businesses up to 60% of the area of the concession area or 30% if it is protected seashore. They will also have to post a sign in a prominent place so that the public has access to all the details of the concession, in accordance with the MyCoast digital complaints system, in which citizens can file a complaint for violation of the terms of the concession and the legislation. Also, they should ensure the existence of a lifeguard in case the Municipality has not placed. The costs incurred by the concessionaires for the installation of the special platforms and the lifeguard's remuneration are offset against the concession fee.

Article 9 provides the limitations and conditions for the concession of simple use. Thus, the maximum area of each concession is 500 sq.m. and cannot occupy more than 50% of the area or the length of the front of the discrete section. Between the sections of the seashore and the beach that are allowed to be granted, there is a distance of 6 m., regardless of the time or the procedure. The total number of coastal and beach sections granted in accordance with par. 1 and in accordance with Article 11 it shall not cover more than fifty percent (50%) of the area or length of the front of the distinct section. Seashore and beach are not granted for simple use after a bidding auction when its length or width is less than four (4) meters or when the total area of the seashore is less than one hundred and fifty (150) square meters. The restrictions also apply to concessions of simple use to neighboring businesses or associations. In the event that there are consecutive neighboring businesses, the free zone of 6 m width between their boundaries is observed. The area of the concession space may be reduced by half, so that at least 50% of the area or length of the front of the discrete section is left free. Also, when the business is less than 6 meters long, then the width of the free zone is reduced to 50%.

Article 15 provides the technological tool that monitors the compliance of concessionaires with the terms of the contract. It is about the information system "Register of Concession Contracts for the Simple Use of the Seashore and Beach" which identifies the illegal and arbitrary occupations of the seashores and beaches in relation to the sections that

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have been granted for simple use, in order for public bodies to be informed, either after a complaint by citizens, or automatically. The system keeps the data (descriptive and geospatial) regarding auctions, concessions for the simple use of coastal and beach sections, complaints and autopsies, as well as geospatially determined photographic material that is used to carry out controls.

Public complaints are provided for in Article 16 and shall be made by electronic means in particular by using a "QR code" on software that is freely available and can be installed on computers, tablets, mobile phones and other corresponding devices of the interested parties. The software is interconnected with the electronic platform "Register of Concession Contracts for the Simple Use of the Seashore and the Beach" and concerns the diagram of the part of the seashore and the beach that is granted. The "QR code" corresponding to each concession for simple use is posted on the website of the Ministry of National Economy and Finance and on the website of the Municipality. It is also mandatory to be depicted on the seashore or beach signage and on the website of the Ministry of National Economy and Finance.

Checks for violations are carried out by the Land Service, the Municipalities, which quickly transmit their findings and reports to the Land Service, the tax authorities, the Financial Police and the Ministry of National Economy and Finance. The Greek police authorities and the public prosecutor's offices are responsible for criminal offences (Article 17).

Administrative penalties are particularly severe (Article 19) and administrative fines are determined by a mathematical formula and depending on the type of violation. The fine for obstructing the free access of the public to the sea, the seashore and the beach, range from a fine from two thousand (2,000) euros to sixty thousand (60,000) euros. The fine for obstructing the audit work of any body, a fine of ten thousand (10,000) euros. Failure to post the sign for the type of concession results in the imposition of a fine of one thousand (1,000) euros on violators. The software provides the ability to immediately send a complaint by anyone who notices an arbitrary occupation of the seashore and beach or an exceedance of the concession. Criminal sanctions (Article 20) carry a one-year prison sentence and a fine to anyone who makes any change on the seashore or beach without or in excess of it or with a permit issued illegally, regardless of damage or damage. Furthermore, if the change causes significant ecological, environmental or geomorphological disturbance or damage, it is punishable by a prison sentence of at least two (2) years and a fine.

## Conclusions

As can be seen from the review of the older legislation and the current legislation for the protection of coastal areas, it seems that the new institutional framework modernizes the system of management of coastal areas.

The new law is comprehensive in its provisions and places particular emphasis on the simplification of the procedures for the simple concession of the use of seashores and beaches, through the electronic auction process, which enhances transparency and speed.

The digitalization of the control tools for any arbitrary violation and illegal occupation of the seashores and beaches and its interconnection with the central public administration, simplifies all the lengthy procedures required for the imposition of administrative and

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criminal sanctions and for the collection of revenues from concessions. In this sense, the objective of the law to strengthen the economy in a beneficial way for everyone involved in the concession of the use of the seashore and the beach appears to be fulfilled. Severe fines and sanctions act as a preventive and repressive measure.

As far as the protection of coasts and beaches is concerned, their protection as sensitive ecosystems is strengthened with the institution of trackerless beaches, however, the framework is incomplete and needs improvements. The fact that the old seashore has returned to the private property of the state, this negates the constitutional requirement of Article 24 of the Constitution by which the seashores belong to its public property and therefore cannot be the subject of a private transaction and also negates their public character. Consequently, the unhindered access to the seashore and the beach by an indefinite number of people.

Also, the technological tools for carrying out automated and remote controls, through satellite images, drones and cameras, as well as the use of the "Register of Concession Contracts for the Simple Use of the Seashore and the Beach", contribute decisively to the limitation of the phenomenon of arbitrariness of the seashore and to the protection of the environment. More integrated management is needed, taking into account an integrated spatial marine planning and management for the protection of coastal areas with emphasis on the ecosystem of beaches and coasts, their rapid delimitation and protection, in terms of resilience and in accordance with the natural and unexpected disasters brought about by the climate crisis.

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# THE AXIOS DELTAIC TERRITORY: ESTABLISHING RESILIENCE IN A GRADIENT OF WETNESS

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## Abstract

Coastal wetlands are invaluable ecosystems that provide critical environmental, economic, and social benefits. These habitats, play essential roles in maintaining biodiversity, mitigating climate change, and safeguarding coastal communities. However, they face growing threats not only from the overexploitation due to human activities, but also from the intensification of the various climate change effects. Especially in the Mediterranean basin, which is a climate change and biodiversity hotspot, the lowlands gradually gain importance in future adaptation and mitigation processes. This paper explores the role of the deltaic zone of Axios River in Northern Greece, in climate resilience, while acknowledging the nature of this coastal landscape, as a territory in-between water and land, in a gradient of wetness. The scope of this contribution is to investigate the dual meaning of protection in coastal wetlands: environments which need to be protected and which, at the same time, protect the local communities. How can this role of the wetland as buffer against Sea Level Rise and its effects, and as a natural defense against extreme weather events become part of the future resilient deltaic character?

The intended benefits for the reader include an enhanced understanding of the multidimensional value of coastal wetlands and their critical role in climate change adaptation and mitigation. The paper provides a framework for integrating innovative approaches of wetland conservation into broader climate adaptation plans for Mediterranean coastal territories. The methodological tools involve a comprehensive review of the relevant existing literature accompanied by interpretative mapping and design exercises through scenario development for the Axios Delta complex. Key findings of this study include a new perspective for the role of coastal wetlands in the face of climate change, by identifying their territorial particularities and potentialities. The exercises aim to find new systems to ensure the long-term viability of these ecosystems and the protection of Mediterranean coastal communities that inhabit coastal territories in a gradient of wetness.

**Key words:** coastal wetlands, wetness gradient, deltaic territory, Axios River Delta, protection

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# A REVIEW OF SMART SOLUTIONS FOR SUSTAINABLE WATER MANAGEMENT WITHIN URBAN AREAS WHILE TACKLING WATER SCARCITY IN GREEK CITIES

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### **Abstract**

Most lately, several European and Greek cities face high water scarcity challenges, mostly due to climate change, inefficient resource management and population growth. Issues like those are mixed by aging infrastructure and high urban water demand. To address the phenomena of water scarcity, it is required to transform today's approaches that leverage technology to optimize resource use and ensure sustainable water availability for urban use.

This paper studies and presents the role of smart technologies in advancing sustainable urban water management, specifically in Greek cities, mainly focusing on specific initiatives that integrate Internet of Things (IoT) solutions, advanced metering infrastructure (AMI), and real-time telemetry systems. This study is based on recently EEA Grants funded projects, that played pivotal in this transformation, including the deployment of smart household water meters and city-wide telemetry systems for real-time monitoring and control of water networks. Those projects showed significant work in detecting and reducing water losses, optimizing distribution systems, and promoting efficient household water use. This work, highlights the effectiveness of these technologies towards water scarcity combat and building resilience in urban water systems. In addition to the IoT analysis, this work includes also the socio-economic and environmental impacts of these projects, emphasizing the importance of funding mechanisms, policy frameworks, and stakeholder engagement in their success.

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Summing up, some recommendations are also provided for scaling these solutions to other urban settings, ensuring wider adoption and impact.

The outcome of this study demonstrates the leverage of smart technologies, coupled with lessons from funded projects, providing a sustainable pathway to address water scarcity in Greek cities. This study contributes to the discourse on urban water resilience, offering actionable insights for policymakers, city planners, and water utilities seeking to create water-secure urban environments.

**Key words:** water scarcity, smart water management, IoT, telemetry systems, smart household meters, Greek cities, climate resilience

### Introduction

Lately, water scarcity is addressed as one of the most pressing challenges for urban areas globally, and more specifically at Greece, as a Mediterranean country. With over two-thirds of its territory classified as semi-arid, and with uneven seasonal precipitation, Greek cities are increasingly experiencing the effects of water scarcity problems, both physical and economic (Baltas et al. 2005, Monokrousou et al, 2024). Intensified extreme weather events, prolonging droughts, and altering hydrological cycles, show that climate change has further exacerbated these challenges (Nastos P.T. et al, 2014, Ferdowsi A. et al. 2024). Simultaneously, urbanization and rapid population growth, particularly in coastal regions and tourist hotspots, place unsustainable pressure on outdated water infrastructure (Kofinas et al. 2016).

Greece has some of the oldest urban water networks, which were developed decades ago, and can be characterized by high levels of leakage, fragmentation, and limited automation. According to recent assessments, non-revenue water (NRW) in several Greek municipalities surpasses 50%, resulting in significant economic, environmental, and operational losses (Serafeim 2022; Nastos P.T. et al, 2013; Chasiotis et al. 2023b). In addition to the above, the even high cost of energy for pumping and treatment, coupled with limited financial and technical capacity in small municipalities, severely constrains the ability of local authorities to manage water resources efficiently (Avlonitis et al. 2007, Nastos P.T. et al, 2009).

Following this context, smart water management technologies offer a transformative potential. Leveraging real-time data collection, predictive analytics, and automated control systems, smart solutions enable utilities to detect leaks, monitor quality, and optimize system performance with greater precision and speed (Sophocleous, S et al. 2019; S.H.A. Koop et al. 2019). Technologies working with Internet of Things (IoT), advanced metering infrastructure (AMI), decision support systems (DSS), and digital twins (DT) are already being implemented, tested or deployed in several Greek municipalities through European and bilateral cooperation projects, such as the EEA-funded projects.

Emerging approaches also incorporate nature-based solutions and hybrid infrastructures – combining digital platforms with environmentally sensitive urban design. These integrated strategies are particularly important in the Mediterranean, where seasonal variability requires adaptive design and resilient urban systems.



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However, while the technical capabilities of these systems are proven, their successful implementation depends on multiple factors including institutional readiness, stakeholder engagement, funding accessibility, and regulatory support (Antzoulatos et al. 2018). In some cases, socio-technical barriers such as lack of public trust or data transparency hinder adoption. Additionally, the absence of long-term performance monitoring frameworks prevents municipalities from scaling pilot successes into broader urban policy.

This study contributes to this discussion by examining three projects as municipal case studies —Paramythia, Aigio, and Argos—where smart technologies have been deployed to address water loss and improve system efficiency. The analysis focuses on technological architectures, implementation challenges, achieved results, and lessons learned that can inform future replication across Greece and similar Mediterranean contexts.

### **1. Water Scarcity Challenges in Greek Urban Areas**

Greek urban cities are facing a growing intensity of water scarcity challenges. These challenges are driven mostly by aging infrastructure, but also by elevated levels of non-revenue water (NRW), the impacts of climate change, seasonal demand surges due to tourism, and in many cities, weak monitoring and management systems. The combination of these challenges poses a serious risk to the sustainability of water resources in cities across Greece—from major metropolitan areas like Athens to mid-sized and smaller municipalities such as Aigio, Argos, and Paramythia. (Nastos P.T. et al, 2014)

#### ***1.A. High Levels of Non-Revenue Water (NRW)***

Non-revenue water (NRW) — which is the amount of water being lost before reaching end-users — is the most common, significant and persistent issue in Greek urban water systems. Studies show that in cities like Kozani, NRW exceeds 50%, creating enormous inefficiencies in both resource use and municipal finances (Kanakoudis 2014). In Drama, similar issues were found, where aging infrastructure, inadequate pressure control, and lack of modern network management contributed to significant water loss (Kazana et al. 2021). These findings are consistent across smaller municipalities, where operational budgets are limited, and investments in smart water systems remain insufficient.

In Paramythia, located in the mountainous region of Epirus, water losses previously reached up to 72%. The high NRW was linked to both outdated pipeline infrastructure and lack of systematic monitoring. However, under the SMASH project, the municipality implemented a digital twin model of the water network, combined with local monitoring stations and virtual sensors, to identify hidden leakages and optimize system performance (Chasiotis et al. 2023a). This demonstrates how digital technologies can mitigate deep-rooted inefficiencies when appropriately deployed.

#### ***1.B. Aging Infrastructure and Network Condition***

A considerable portion of Greece’s urban water distribution infrastructure dates back to the 1960s and 1970s. In cities like Athens, the average pipeline age exceeds 60 years, resulting in

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frequent failures, such as pipe bursts and valve corrosion (EYDAP 2023). Network rehabilitation has been slow, especially in smaller municipalities, due to a lack of technical capacity and limited access to EU or national funds. In Aigio, a city in Western Greece, a smart leak detection system was implemented to improve infrastructure efficiency. The deployment of digital meters, hydraulic simulation models, and network visualization platforms reduced undetected losses, particularly during seasonal pressure spikes.

Similarly, in Argos, where NRW was previously estimated at 54%, municipal authorities installed a combination of leak detection sensors, hydraulic modeling systems, and local telemetry units. These allowed operators to remotely monitor flow and pressure conditions, identify anomalies, and reduce water losses across the network. This was part of an effort to rationalize network operations while coping with increasing demand and climate-induced variability (Karavitis et al. 2024).

### ***1.C. Climate Change Impacts on Urban Water Supply***

Climatic variability and long-term warming trends are increasingly undermining the reliability of water supply in Greece. The Aliakmon River Basin—one of the country’s key water sources—has been modeled to experience significant reduction in runoff and groundwater recharge due to climate change (Varanou et al. 2005). Warmer summers and more frequent heatwaves not only decrease water availability but also raise consumption levels, especially for cooling and irrigation in urban settings.

This dual stress—decreasing supply and increasing demand—is especially problematic in peri-urban zones where infrastructure is fragmented and systems are poorly monitored. In Argos, for instance, the over-extraction of groundwater during dry summers led to salinization of aquifers. Seasonal declines in reservoir storage meant that during certain months, tap water quality deteriorated significantly, requiring temporary reliance on bottled water or emergency treatment units (Karavitis et al. 2024).

### ***1.D. Tourism-Driven Demand Peaks***

Tourism remains one of the most prominent socio-economic drivers of seasonal water stress in Greece. On islands like Santorini and Mykonos, annual water consumption has doubled in the past decade, as hotels, resorts, and restaurants cater to large influxes of international visitors (Karavitis et al. 2024). However, the phenomenon is not restricted to islands alone. Cities such as Aigio and Paramythia also see summer demand surges, due to domestic tourism and temporary population increases.

In Aigio city, increase leakage risks are stressed by high summer consumption, which creates pressure differentials that also exacerbate energy use for pumping and treatment. The installation of smart meters and seasonal demand forecasting tools helped moderating these peaks, enabling more responsive supply-side management (Chasiotis et al. 2023b). The same is followed by Municipality of Souli in Paramythia, where the integration of real-time data into the DSS platform helped anticipating pressure drops and adjusting system operations preemptively to avoid service disruptions (Chasiotis et al. 2023a).

## 2. Importance of Smart Water Management Solutions

Aging infrastructure, population growth, climate change, and economic constraints put increasing pressure at urban water systems worldwide. In this context, smart water management solutions have emerged as essential tools for enhancing the resilience, efficiency, and sustainability of water utilities. The installation of technologies like Internet of Things (IoT) devices, Advanced Metering Infrastructure (AMI), Supervisory Control and Data Acquisition (SCADA) systems, and digital twins (DT) enables real-time monitoring, predictive maintenance, and data-driven decision-making.

Smart systems, like the ones described above, significantly reduce non-revenue water (NRW), supports leak detection, and improve service quality. Decision support systems (DSS) based on online data and hydraulic modelling allow Municipalities to prioritize interventions, reduce energy costs, and minimize water leakages (Patelis et al. 2020). These technologies are more valuable in cities with aging infrastructure and limited operational budgets, as they offer targeted and cost-effective solutions to systemic inefficiencies.

The importance of AMI and IoT in household water management is also demonstrated in studies which highlight how high-resolution water usage data from smart meters can facilitate user engagement, early leak detection, and adaptive pricing strategies (Cominola et al. 2015). Approaches like those help foster water conservation and allow for more equitable and transparent billing systems.

In the Mediterranean countries, smart water networks have proven crucial for adapting to climate variability, as it is lately the most common solution. In semi-arid urban areas the integration of SCADA systems and smart leak detection platforms has improved both operational efficiency and water quality (Mertzanides et al. 2010). The Paramythia (Municipality of Souli) pilot case under the SMASH (EEA-Grants) project further illustrates how a digital twin, combined with virtual sensors and a DSS platform, reduced NRW and enhanced service delivery in a region historically affected by water scarcity (Chasiotis et al. 2023a).

Smart water management offers a framework that enables proactive, data-driven control of urban water infrastructure. Key features include:

- **Real-Time Monitoring:** IoT devices and smart sensors provide continuous data on water flow, pressure, and quality parameters. This facilitates instant detection of abnormalities such as leaks or contamination (Savić et al. 2018).
- **Automated Metering and Feedback:** AMI allows for remote meter reading, behavioral nudging, and personalized feedback to users. Studies show how household-level data drives water conservation (Makropoulos et al. 2014).
- **Digital Twins and Simulation Models:** These create virtual replicas of water networks, enabling predictive analytics and scenario testing (Manuel Franco-Torres et al. 2021).
- **Decision Support Systems (DSS):** DSS platforms synthesize data from multiple sources and help operators make informed decisions for operational control, maintenance prioritization, and emergency response.

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Case studies from across Europe, including SMART-WATER (Antzoulatos G. 2019) in Greece and SWAMP in Italy, demonstrate that such systems can reduce non-revenue water by up to 30%, lower energy use by 15–20%, and significantly extend the lifespan of urban infrastructure (Lewandowski et al. 2019; Antzoulatos et al. 2018).

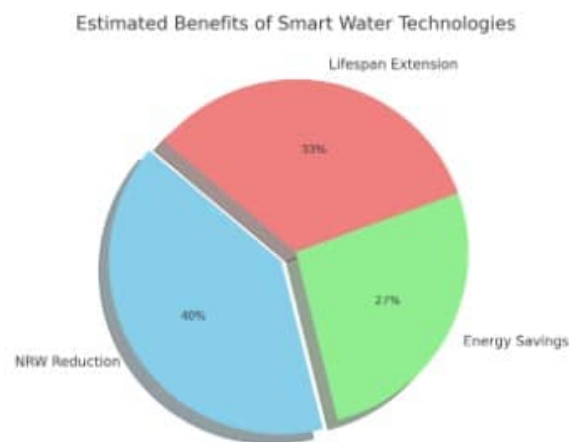


Figure 1: Estimated Benefits of Smart Water Technologies

Smart systems also contribute to environmental sustainability by reducing unnecessary abstraction from stressed water sources. Dynamic pressure management and demand forecasting can align supply with actual consumption, minimizing both water loss and energy use (Dandy et al. 2022).

Given the high levels of water losses reported in many Greek cities—exceeding 50% in places like Aigio and Argos—the adoption of smart water technologies is no longer optional but necessary. When supported by appropriate institutional frameworks and funding mechanisms, these tools can help Greek municipalities move toward climate-resilient and resource-efficient water systems.

### 3. Methodology

The purpose of this review is to evaluate the application and effectiveness of smart water management technologies implemented in urban areas of Greece to address water scarcity. The review adopts a qualitative case-study methodology, analyzing three representative urban pilot projects: Paramythia (Municipality of Souli), Aigio (Municipality of Aigialeia), and Argos (Municipality of Argos-Mykines). These cases were selected based on criteria including high levels of non-revenue water (NRW), vulnerability to climate variability, and recent deployment of digital technologies.

This review adopts a qualitative case study approach, focusing on three completed municipal-level projects funded under national and European calls. Primary data were derived from project reports, academic publications, and technical specifications:

- **Paramythia (Souli Municipality):** Integrated water quality and leak detection system using a digital twin and DSS

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- **Aigio (Aigialeia Municipality):** SCADA-enabled leakage control platform with real-time visualization and sensor analytics
- **Argos (Argos-Mykines Municipality):** Smart leak monitoring stations and digital twin implementation

The selection criteria included:

- Demonstrated impact on water loss reduction
- Use of smart infrastructure (IoT, AMI, DSS)
- Involvement of academic or research partners

Each case was analyzed for its system architecture, technological setup, environmental benefits, and policy or governance frameworks. Lessons learned across the cases inform the discussion on scalability and replicability in other Greek cities.

The review focuses on the integration of Internet of Things (IoT) technologies, Advanced Metering Infrastructure (AMI), telemetry systems, and Decision Support Systems (DSS) to improve water efficiency, service reliability, and system resilience. Particular attention is paid to the institutional and technological frameworks underpinning these implementations, including:

- Digital twins and real-time hydraulic simulation models
- IoT-based leak detection and water quality monitoring sensors
- SCADA systems for operational monitoring and control
- AMI for user-side metering, consumption analytics, and billing
- DSS for predictive and scenario-based decision-making

This approach aligns with research methodologies commonly applied in the evaluation of urban smart infrastructure deployments. For instance, water management strategies using digital twins in European cities emphasizes the need for scenario-based performance evaluation, particularly in aging or semi-arid urban environments (Nydrioti et al. 2024). Furthermore, outline a systems-oriented framework for assessing smart infrastructure integration, which has informed this study’s analytical structure (Antzoulatos et al. 2018).

Additionally, the scope included environmental and socio-economic impact assessments derived from publicly available municipal data and project deliverables. The inclusion of academic and research partners in all these cases supported the development and implementation of advanced analytical tools such as DSS and digital twins, allowing not only real-time control but also strategic planning.

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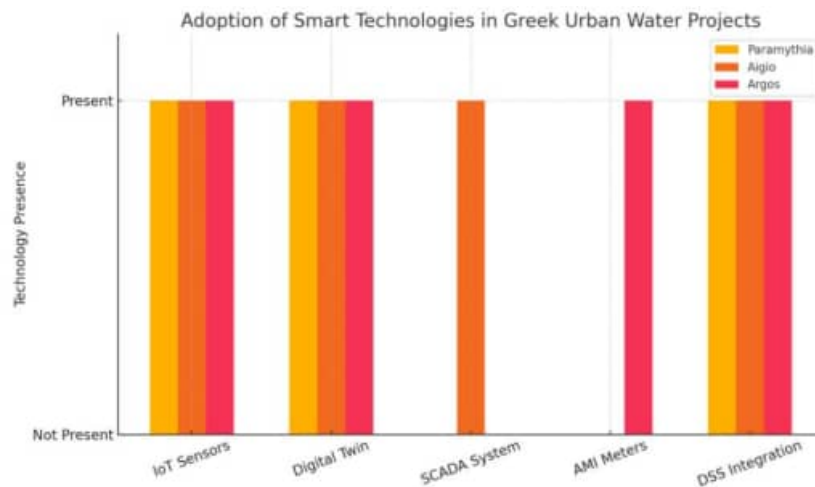


Figure 2: Adoption of Smart Technologies in Greek Urban Water Projects

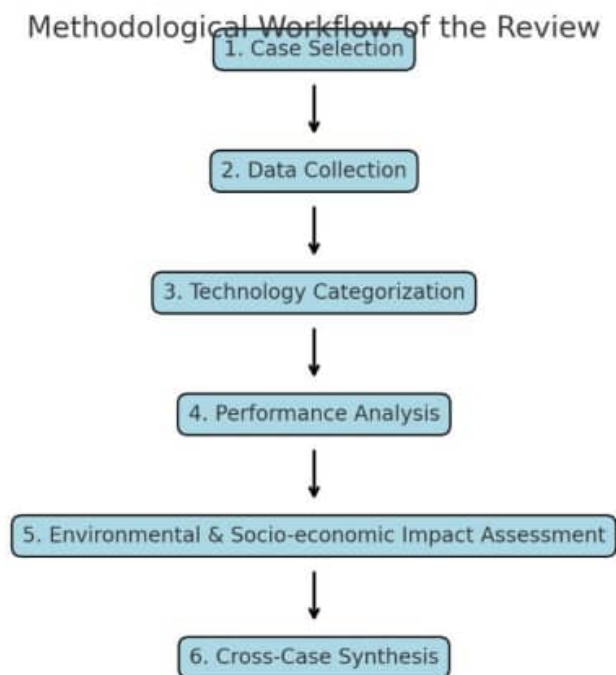


Figure 3: Methodological Workflow of the Review

This review seeks to provide:

- A synthesis of how smart technologies were configured and implemented
- A comparative analysis of technological performance, cost savings, and water savings
- Insight into policy frameworks, funding mechanisms, and stakeholder engagement
- Lessons learned for upscaling and replication in other urban areas



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The outcomes from the selected case studies will be contextualized within the broader challenges of Greek urban water systems, as identified in Chapters 2 and 3.

### 4. Case Study Analysis

This chapter presents a detailed analysis of three municipal-level pilot projects in Greece which are examples of the application of smart water technologies to address water scarcity. These case studies provide information on system architecture, technical implementation, operational outcomes and institutional collaboration. The pilot cases vary in terms of geographical characteristics, population size, water network complexity, and technical configuration. Nevertheless, they reflect common strategic goals: optimizing water efficiency, addressing non-revenue water (NRW), improving operational decision-making, and increasing long-term system resilience.

#### 4.1 Paramythia (Municipality of Souli)

The Municipality of Souli implemented the “Smart Green Leakage Control and Water Quality Monitoring System” in the town of Paramythia, a region suffering from one of the highest levels of NRW in the country—up to 72%. The project aimed to improve water resource efficiency, reduce leakages, and ensure high-quality drinking water through advanced monitoring and simulation technologies.

Key components of the system include:

- Three local control stations equipped with real-time sensors monitoring flow rate, pressure, residual chlorine, turbidity, temperature, pH, and conductivity
- Development of a digital twin for the closed-zone water distribution network
- Virtual sensors for detecting hidden leakages
- A Decision Support System (DSS) that integrates real-time data with hydraulic modeling for operational optimization (Chasiotis et al. 2023a)

The integration of virtual and physical monitoring enabled continuous control of both quantity and quality indicators. Advanced leak detection algorithms allowed early identification of anomalies, which reduced the response time and improved maintenance scheduling. Similar methodologies have been described in studies examining the role of smart platforms in small and medium-sized municipalities (Dandy et al. 2022).

**Outcome Analysis:** The project achieved a substantial 35% reduction in NRW and ensured real-time water quality compliance. Operational expenditures were reduced, while public trust in municipal services increased. Moreover, the combination of Greek and Norwegian institutional partners fostered transnational collaboration and research transfer. The upgrade allowed for more resilient summer-period operation, addressing peak demand challenges in this mountainous community. A noteworthy aspect is the strategic value of DSS integration, which allowed for not only real-time leak localization but also the dynamic optimization of pumping schedules and network pressures. These capabilities are instrumental for areas like Paramythia, where infrastructure was outdated, and terrain variability complicates hydraulic operations.

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### Outcomes:

- Estimated annual water savings: 600,000 m<sup>3</sup>
- Estimated cost savings: €20,000/year
- Reduction in non-revenue water in the city of Paramythia (NRW): ~25%
- Number of direct beneficiaries: 3,032 citizens (8,767 including the broader municipality)
- Improved environmental status of monitored water body

### 4.2 Aigio (Municipality of Aigialia)

In Aigio City, which's water losses reach up to 48%, a smart leak detection system was developed to modernize the municipal network. The pilot project extended the already installed internal leakage control system, integrating SCADA-based control with real-time sensor data and hydraulic simulation models.

Key components of the system include:

- Platform for real-time data visualization and leak detection
- Hydraulic modeling of the closed-zone network using a digital twin
- Pressure and flow rate sensors to support proactive maintenance

This case illustrates how digital platforms can support equitable tariff schemes and improve operational efficiency without increasing financial burdens on consumers. According to S.H.A. Koop et al. (2019), AMI and remote sensor systems are effective in medium-scale networks for balancing user transparency with managerial control (Makropoulos et al. 2014).

**Outcome Analysis:** The installation of a fully integrated control and monitoring system allowed a more balanced distribution of water, reducing significantly response time to failure events. The tools that were implemented (SCADA and visualization platform) enabled the local water operation enterprise to transition from a reactive to a proactive operational model. Combining pressure regulation and reduced pumping hours, the intervention also resulted in energy savings and lower greenhouse gas emissions from pumping stations. In addition, the project contributed to a more transparent interaction between users and the utility through consumption profiling, while the digital twin assisted with operational simulations for future infrastructure planning.

Estimated outcomes:

- Water saved: ~600,000 m<sup>3</sup>/year
- Cost savings: ~€21,000/year
- Noticeable drop in undetected leak events and consumption anomalies

### 4.3 Argos (Municipality of Argos-Mycenae)

In Argos city, which is facing NRW levels up to 54%, smart technologies were applied to update a deficit water balance network. This pilot case included local monitoring stations and real-time telemetry to ensure high service standards and support equitable resource pricing.

Core elements of the system:

- Installation of smart leak detection sensors in critical network points
- Development of a digital twin of the water network

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- DSS integration for real-time operational and billing decisions

Argos is a representative case for semi-arid, agriculturally intensive municipalities facing increasing pressure on water supply due to groundwater over-extraction and climate-induced variability. The real-time monitoring system enabled better protection of vulnerable water sources. These capabilities are essential for long-term planning in urban water systems (Antzoulatos et al. 2018).

**Outcome Analysis:** This project not only reduced natural losses, but also enabled the smart allocation of resources in an urban-rural dual-use context. The system's predictive capability has helped reduce over-extraction and seasonal overcharging of aquifers. As a result, Argos has been able to improve water quality and mitigate the risks of salt intrusion. In addition, increased metering accuracy has helped the municipality move towards fairer pricing models that reflect actual consumption. In addition, the project yielded operational agility by facilitating coordinated decision-making between technical staff and local government, making Argos a testbed for regional replication under similar climatic and topographic pressures.

Estimated outcomes:

- Water saved: ~1,200,000 m<sup>3</sup>/year
- Cost savings: ~€42,000/year
- Beneficiaries: 22,209 residents

**Comparative Summary:** All three case studies demonstrated:

- Effective reduction in non-revenue water
- Deployment of integrated smart systems (IoT, telemetry, DSS)
- Tangible environmental and economic benefits
- Strengthened institutional and academic collaboration

The success of these implementations underscores the replicability of smart water solutions in other Greek municipalities facing similar structural and climatic challenges.

The comparative analysis of the three pilot projects in Paramythia, Aigio and Argos reveals important insights on how smart water management technologies can be adapted to different urban environments. Despite differences in geography, population density and legacy infrastructure, all three municipalities demonstrated measurable improvements in operational efficiency, water conservation and service delivery.

### **Common Outcomes:**

- All cities reported significant reductions in non-revenue water (NRW), with total annual savings ranging from 600,000 m<sup>3</sup> to 1,200,000 m<sup>3</sup>.
- Technological integration (IoT, digital twins, DSS, and SCADA) played a central role in enabling proactive leak detection and informed decision-making.
- Financial savings ranged from €20,000 to €42,000 annually, reflecting not only lower losses but also reduced operational and energy costs.
- Each project achieved high levels of community impact, improving water security for 3,000 to over 22,000 residents.

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| City       | Pre-project NRW (%) | Water Saved (m <sup>3</sup> /year) | Cost Savings (€/year) | Core Technologies Deployed                 | DSS Integration | Beneficiaries |
|------------|---------------------|------------------------------------|-----------------------|--------------------------------------------|-----------------|---------------|
| Paramythia | ~72%                | ~600,000                           | ~20,000               | IoT sensors, Digital Twin, Virtual Sensors | Yes             | 3,032         |
| Aigio      | ~48%                | ~600,000                           | ~21,000               | IoT, Digital Twin, SCADA                   | Yes             | 20,422        |
| Argos      | ~54%                | ~1,200,000                         | ~42,000               | IoT, Digital Twin, Leak Monitoring, AMI    | Yes             | 22,209        |

Table 1: Common Outcomes

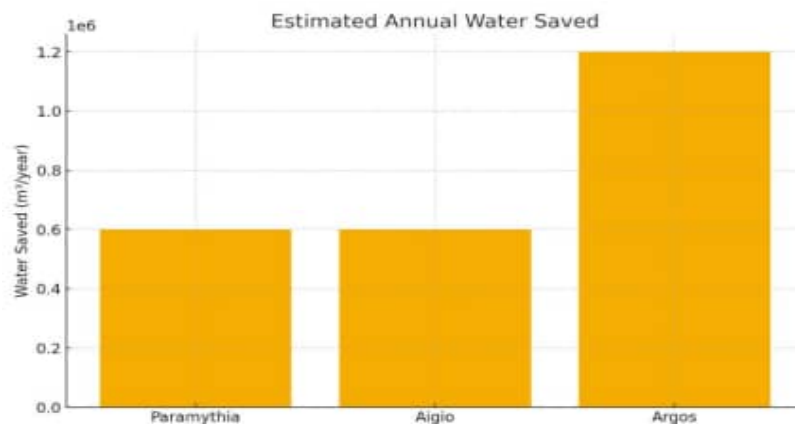


Figure 4: Estimated Annual Water Saved

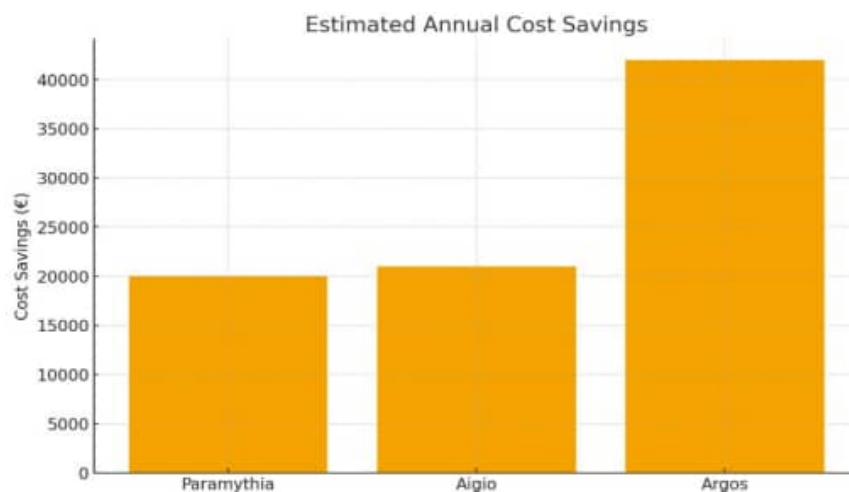


Figure 5: Estimated Annual Cost Savings

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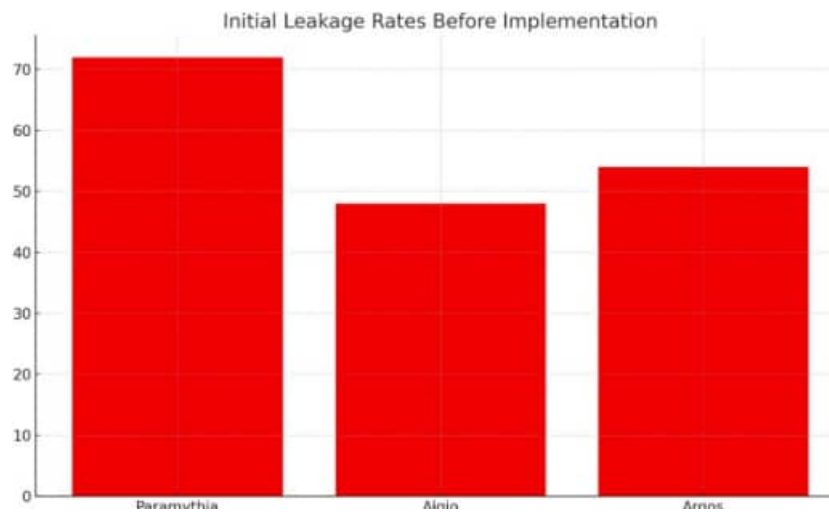


Figure 6: Initial Leakage Rates before implementation

### 5. Key Insights

**5.1. Reduction of Non-Revenue Water (NRW):** All three municipalities achieved substantial reductions in NRW, ranging from 35% to over 50%. This result confirms earlier findings that digital water monitoring systems equipped with real-time sensors and hydraulic modeling can effectively reduce natural and apparent water losses. At Argos, the deployment of AMI contributed to pricing accuracy and better demand-side management, enhancing retention.

**5.2. Enhancement of Operational Efficiency:** The use of Decision Support Systems (DSS) in all three cases enabled the operators to move from reactive to predictive and adaptive management strategies. With DSS synthesis sensor data and simulation models, municipalities achieved improved pressure control, optimal pump scheduling and faster leak detection.

**5.3. Environmental and Energy Gains:** All three systems contributed to reduced energy use, with shorter pump duty cycles and improved pressure regulation. Smart water networks significantly reduce GHG emissions when integrated with effective pressure management (Dandy et al., 2022). The environmental benefit was particularly evident in Argos, where over-extraction from aquifers was minimized due to better water metering.

**5.4. Cost Savings and Economic Efficiency:** Annual financial savings ranged from €20,000 to €42,000, with cost recovery depending on project scale and key deficiencies. This evidence confirms research that smart metering and leakage reduction programs lead to rapid return on investment when coupled with improved pricing structures and lower maintenance needs (Cominola et al., 2015).

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**5.5. Technological Flexibility and Modularity:** Each city deployed a combination of technologies based on its local needs. Paramythia emphasized water quality and virtual sensing, Aigio focused on SCADA integration, while Argos deployed AMI for end-user analytics. This variation underscores the modular nature of smart infrastructure and the ability to scale solutions progressively—a critical insight for municipalities with limited budgets.

**5.6. Institutional Collaboration and Innovation:** All three pilots included research partners—ranging from national universities to international institutions—playing a vital role in digital twin development, algorithm refinement, and DSS configuration. These collaborations ensured access to scientific tools and training, reflecting the broader recommendation by S.H.A. Koop et al. (2019) on the importance of cross-sectoral partnerships for digital transformation in water utilities.

**5.7. Social Impacts and Consumer Trust:** Improved service reliability, water quality, and equitable billing reinforced citizen satisfaction. In smaller communities such as Paramythia, where water supply challenges historically affected public trust, the visibility of smart technologies and real-time monitoring strengthened institutional legitimacy and public engagement in conservation behaviors.

In summary, these cases collectively demonstrate that the adoption of smart water technologies in Greek cities leads not only to measurable savings and efficiencies but also to more resilient, transparent, and adaptive governance models. The upcoming section will explore policy-oriented recommendations for scaling these innovations across the national water sector.

## 6. Key Differences:

**6.1. Scope and Prioritization of Technologies:** While all three cities integrated digital twins and DSS platforms, the specific technologies prioritized varied significantly. Paramythia invested heavily in water quality monitoring (e.g., turbidity, residual chlorine) alongside leakage detection, reflecting its mountainous location and quality concerns. In contrast, Argos emphasized customer-side analytics through AMI, addressing large-scale water losses and the need for billing transparency in a mixed urban-agricultural context (Makropoulos et al., 2017). Aigio adopted a robust SCADA backbone to modernize network control, with real-time data visualization being a primary operational enhancement.

**6.2. Network Complexity and Legacy Infrastructure:** Argos managed a more complex and spatially extensive network, requiring a more distributed telemetry configuration and a larger number of pressure zones. Paramythia, though smaller, faced severe topographical challenges and older infrastructure, necessitating virtual sensor integration to complement sparse physical instrumentation. The differences in those system conditions affected the design choices and rollout timeline of each solution (Antzoulatos et al., 2018).



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**6.3. Volume of Water Saved and Financial Returns:** Argos demonstrated the highest absolute volume of water savings (though leakages) and cost benefits due to scale and baseline inefficiencies. While Paramythia and Aigio achieved similar volumetric savings, the per capita benefit in Paramythia was proportionally higher, demonstrating the relevance of smart technologies even in small municipalities.

**6.4. Institutional Capacity and Local Governance Models:** Aigio City’s pilot project featured higher levels of operational autonomy within the local water enterprise (DEYA), enabling quicker system reconfiguration and workforce adaptation. Paramythia City, on the contrary, relied more on external expertise and inter-municipal cooperation, reflecting the resource limitations of smaller municipalities. Argos benefited from political continuity and integrated planning between departments, facilitating alignment between technological and policy objectives.

**6.5. Data Granularity and Use in Planning:** The granularity of data use also varied. In Argos, AMI enabled high-resolution demand profiles that supported demand forecasting and tariff reform. In Paramythia, data primarily supported operational alerts and reactive maintenance, with limited downstream planning use. Aigio leveraged SCADA for near-real-time response and asset performance monitoring but did not include consumer-side metering during the project phase.

**6.6. External Collaboration and Research Partnerships:** All three pilots collaborated with academic institutions, but the depth of involvement differed. Paramythia had the most comprehensive research integration, with three universities involved in digital twin modeling, DSS development, and virtual sensing. This facilitated deeper innovation and technical validation, which smaller municipalities often lack the capacity to develop independently (Chasiotis et al., 2023a).

**6.7. Communication and User Engagement:** User interaction varied across cases. Argos leveraged smart metering data for improved communication and awareness among citizens. Paramythia promoted transparency through municipal announcements and real-time monitoring displays, increasing public trust. Aigio focused more on internal operations, with future plans to scale communication features.

These differences illustrate that the pathway to smart water management is not one-size-fits-all. Instead, success depends on adapting technological choices to local priorities, institutional readiness, infrastructure conditions, and governance models. This highlights the importance of flexible frameworks that allow for context-sensitive innovation while maintaining core principles of integration, interoperability, and long-term sustainability.

## 7. Challenges Identified

Despite the demonstrated benefits of technologies (like IoT, DSS and DT) in those Greek case studies, several critical challenges persist that may hinder widespread adoption and long-term

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sustainability. These challenges span across technical, institutional, financial, and social domains, and must be addressed in order to scale smart urban water solutions effectively.

### ***7.1. Technical Integration and Interoperability***

Many municipalities struggle with integrating new technologies into outdated water infrastructure. Legacy systems often lack the capacity to support real-time monitoring or automation, requiring significant upfront investment for upgrades (Romano, M. et al., 2014). In Paramythia, for instance, the introduction of digital twins and virtual sensors necessitated a parallel upgrade in hydraulic models and local data management protocols.

### ***7.2. Data Governance and Cybersecurity***

As smart systems rely mostly on online data collection and cloud-based platforms, concerns over data ownership, cybersecurity, and interoperability remain underregulated. The absence of standardized data frameworks, most commonly in Greece risks data fragmentation and potential vulnerabilities in real-time water management systems.

### ***7.3. Financial Constraints and Uneven Access to Funding***

Smaller municipalities, such as Paramythia, face greater difficulty accessing the capital required to invest in advanced technologies. While EU and national co-financing mechanisms have supported pilots, the long-term financial sustainability of these systems is uncertain without dedicated operational budgets or performance-based funding schemes (Chasiotis et al., 2023a).

### ***7.4. Institutional Fragmentation and Capacity Gaps***

Water utilities in Greece often operate with limited staff, outdated training, and bureaucratic rigidity. The lack of coordination between technical departments, local authorities, and external consultants impedes efficient deployment of smart solutions. Argos and Aigio both reported delays due to administrative approvals and limited staff familiarity with IoT platforms and hydraulic simulation software.

### ***7.5. Limited User Engagement and Awareness***

Although smart systems offer opportunities for behavioral change through personalized feedback and leak alerts, public engagement remains minimal. In Aigio City the benefits of SCADA and real-time information were invisible to end-users. Without communication campaigns, users most likely may not support or fully utilize smart services, reducing their overall effectiveness.

### ***7.6. Environmental Constraints and Climate Uncertainty***

While smart technologies enhance operational adaptability, their effectiveness is still limited by external factors such as drought, aging aquifers, and urban sprawl. In Argos, over-extraction of groundwater remains a long-term threat, despite improved control and monitoring of leaks. Climate variability can also compromise the accuracy of forecasting algorithms without constant recalibration and data enrichment.

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### **7.7. Scalability and Long-Term Maintenance**

Many pilots rely on grant-based funding for their initial deployment but lack long-term operational strategies. Ensuring system continuity, hardware maintenance, and software updates over time presents a considerable logistical and financial burden. Without institutionalized monitoring and reinvestment cycles, these systems risk degradation and underperformance.

In conclusion, while the three Greek case studies validate the potential of smart water solutions, they also underscore the need for robust enabling environments that combine technological, regulatory, and societal innovation. Addressing these challenges is essential to move from isolated pilot projects to widespread, sustainable urban water management practices.

## **8. Conclusions**

### ***Conclusions and Future Work***

Smart urban water management systems leverage an ecosystem of advanced technologies – from pervasive IoT sensors and Advanced Metering Infrastructure (AMI) to real-time control through SCADA, high-fidelity Digital Twins and data-driven decision support systems (DSS). The integration of these elements has begun to transform traditional water utilities into "smart water networks", enabling unprecedented visibility and control over urban water infrastructure (H.M. Ramos, et al. 2019).

This chapter summarizes the global state-of-the-art in these technologies, compares international implementations, and outlines future directions. Emphasis is placed on the **performance gains, integration strategies, and scalability** of such systems in real-world urban settings.

### ***Smart Technologies for Urban Water Management***

Recent years have seen rapid adoption of digital technologies in water distribution networks. **IoT-based sensing** is now central to monitoring water systems: utilities deploy networks of smart pressure, flow, acoustic and water-quality sensors across pipelines and assets. These sensors provide continuous, high-resolution data on system conditions (e.g. pressures, flows, water quality) in real time (Ramos, et al. 2019). For example, Singapore’s Public Utilities Board (PUB) has installed *hundreds* of multi-parameter sensor probes (measuring pressure, flow, acoustic and quality indicators) to continuously detect leaks and water quality issues across its island-wide network. **Advanced Metering Infrastructure (AMI)** – large-scale rollout of smart water meters to customers – similarly offers fine-grained consumption data at hourly or sub-hourly intervals. A growing number of water utilities, especially in the USA and Europe, have implemented AMI to capture detailed usage information from millions of customer meters (Water Research Foundation. 2020.). This wealth of data enables better demand forecasting, quick detection of anomalies (like continuous flows indicating leaks), enhanced customer engagement in water conservation, and more effective policies to reduce non-revenue water. Notably, AMI data proved invaluable during the COVID-19 pandemic to analyze shifting consumption patterns and inform operations (Krishnan, et al. 2022).

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**SCADA systems** (Supervisory Control and Data Acquisition) remain the backbone for water utility operations, providing remote monitoring and control of pumps, valves, reservoir levels, and treatment processes. Modern smart water architectures increasingly integrate SCADA with IoT sensor networks and AMI data, moving from isolated operational control to unified data platforms. This integration is key to achieving real-time management: field sensor and meter data feed into central hubs where they are combined with Geographic Information Systems (GIS) and asset databases. In an exemplary smart distribution network in Spain, a central software platform integrates **remote meter readings, GIS maps, SCADA telemetry, and water quality sensor data**, applying anomaly-detection algorithms (including demand forecasting models) to flag leaks or quality issues in real time. The result is a “digital nerve center” that can alert operators to events like bursts or contamination and even initiate automated responses (such as valve closures) to mitigate incidents (Public Utilities Board Singapore, 2016).

### Future Directions for Smart Water Management

The global trend toward smart water networks is unmistakable and likely irreversible. Moving forward, several key areas of development and research will shape the **next generation of smart urban water systems**:

- **Interoperability and Standards:** To fully realize scalability, the industry must converge on open standards for data and device integration. Standard communication protocols and data models would enable plug-and-play addition of new sensor types and analytics modules. Developing a **systematic framework** for smart water architecture (as called for by recent studies ) will be crucial so that utilities can follow proven blueprints rather than ad-hoc designs. This includes common definitions of data “layers” (from instruments to application layer) and shared metrics for evaluating smart system performance (such as the “smartness” and “cyber-wellness” metrics proposed in literature ).
- **Advanced Analytics and AI:** As data quantity and quality increase, machine learning and AI will play a larger role in water management. Future systems will use **predictive analytics** not only to anticipate leaks or demand spikes but to enable truly **autonomous** control in certain aspects. For example, AI could optimally regulate pressures by learning from historical patterns, or perform real-time water quality anomaly detection using pattern recognition beyond human capability. Early steps in this direction are visible – e.g. some utilities already use AI-based demand forecasting and anomaly detection algorithms– but there is ample room for growth in AI-driven decision support, including the integration of generative AI for scenario planning in digital twins.
- **Digital Twin Enhancement:** Digital twin technology is expected to mature into a core operational tool. Current digital twins primarily mirror hydraulic behavior; future twins may integrate more dimensions (e.g. water quality chemistry models, asset degradation models, financial models for asset management). This would allow holistic decision-making (e.g. choosing an optimal pipe replacement not just on hydraulic performance,

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but also considering water quality impact and life-cycle cost). Greater fidelity and real-time coupling between the twin and field data (via IoT) will move utilities closer to a **“living” model** of their network that is always synchronized with reality . Moreover, linking water digital twins with other urban system twins (energy, wastewater) could unlock cross-sector optimizations in smart cities.

- **Cybersecurity and Reliability:** As water systems become cyber-physical systems, ensuring their security and reliability is paramount. Future work will focus on robust cyber-security measures to protect sensor networks and control systems from hacking or sabotage. Similarly, building redundancy in communications (multiple pathways for critical control signals) and fail-safes in automated control is critical so that increasing automation does not compromise the fundamental reliability of water supply. Research into **resilient system architectures** and anomaly detection for cyber threats is underway as part of making smart water systems safe against new failure modes .
- **Socio-Technical and Organizational Aspects:** A truly sustainable future for smart water management also depends on human and organizational factors. Utilities will need to invest in workforce training – transitioning from traditional operational roles to data-centric roles – and in public communication. Early projects (like Singapore’s) found that staff roles had to evolve and public acceptance of technologies (e.g. smart meters, which sometimes raise privacy concerns) had to be managed . Future research might explore change management, customer engagement strategies, and policy frameworks that facilitate technology adoption (for example, regulations for data sharing and privacy, or incentive schemes for utilities to reduce leaks using smart tech).

In conclusion, smart urban water management systems have demonstrated clear technical advantages and operational benefits in cities around the world, from reducing water losses and energy usage to improving service continuity and decision-making. The global context reveals a spectrum of adoption: some cities (e.g. Singapore) now operate large-scale integrated smart water grids, while others are in pilot phases, gradually upgrading aging infrastructure with smart sensing and control. The coming years will likely see these technologies become standard practice, supported by more refined integration frameworks and powerful analytics. As utilities continue to share knowledge (through pilot projects and research) and technology costs decline, we can expect the performance gaps between “smart” and “non-smart” water systems to drive widespread investment in digital solutions. Ultimately, the future water utility may function as a fully data-driven, self-optimizing network – a digital twin of the physical system that continually adjusts itself to deliver reliable, safe, and efficient water service. Achieving that vision will require continued innovation and collaboration across disciplines, but the substantial progress documented to date provides a strong foundation for these future developments.



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**Special session:**

### **LANDSCAPE AND URBAN SUSTAINABILITY: DISCUSSING THE NATURAL AND SOCIO-CULTURAL FACTORS, IN A POSITIVE OR NEGATIVE MOOD**

Coordinator:

**Dr. Konstantinos Moraitis**  
*Professor Emeritus N.T.U.A.*  
[mor@arsisarc.gr](mailto:mor@arsisarc.gr)

#### **Content:**

We could not discuss and afford sustainability, place-centered sustainability in particular, outside the socio-cultural factors implied by it.

It is in this context of a combined cultural landscape that the natural and social approaches are intensively associated. Cultural landscape in urban or extra-urban formations presents the necessary coexistence, the necessary combination of both groups of influence: no natural ‘more than human’ landscape factor may exist outside the consequences of social and cultural impact. What kind of impact, what kind of influence, nevertheless? Material or immaterial, real or imaginary, positive or negative?

Is landscape interest associated with the ‘flourishing’ of positive cultural apperception, of the ‘emerald necklaces’ and green ‘park movement’ imagery, or with the terrifying aspect of a decaying natural or urban terrifying landscape? Did ‘Les Fleurs du Mal – The Flowers of Evil’ by Charles Baudelaire, blossom in the same urban landscape of the Parisian 19th century parks’ positive intervention? Conclusively: how can we critically comment on the negative social imaginary, or enforce the positive social correlation with natural peri-urban landscape and, especially, with urban public landscape?

**Key Words:** Cultural landscape, cultural sustainability, political sustainability, urban public space, real space social contact, virtual space guidance.

**OPEN-AIR CITIES: COMMON APPROACHES FOR BUILDING,  
LANDSCAPE AND URBAN-SCAPE DESIGN - THE CONCEPT OF  
DESIGN SCHEMATIZATION**

DOI: 10.26341/issn.2241-4010-2025-4a-1-K02025

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*Professor Emeritus N.T.U.A.*

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**Abstract**

It is normal to present, in conferences like the one under the subject “Open-Air Cities,” completed design or built projects. We scarcely discuss methodologies that could offer a didactic approach for students or professional architects. It is against this approach that we shall propose a methodology that could help designers, experienced in architectural projects, to transform their skills and compose, in a way analogous to their building-design awareness, landscape formations with intense plantation ‘green’ identity. To this first approach, we shall add a second one, insisting on the fact that building envelopes may be formed as continuations of the surface of the surrounding landscape. They may be conceived as a “metaphor” of topological folds that could compose open-air landscape formations and building or hard-scape urban structures as well.

The concept underlying the previous didactic or auto-didactic approach has to do with the idea that we do not design and compose reality in its full detailed complexity: building reality, landscape reality or urban-scape reality. What we design and compose is a structured, “schematized” interpretation of the real place formations, an “abstract” schematized interpretation of it; unimportant details have been abstracted, and the remaining principal important characteristics have been restructured in a new conceivable and trustworthy to be applied form.

**Moreover, we shall insist in our presentation on the idea that abstract schemes, in all previous design cases and all previous thematic and scale design approaches, may have common formal references. Building design, landscape design or urban design may be composed on a common or relative conceptual ground of abstract schematized principles, able to produce our “Open-Air Cities” context of compound “landscape urbanism.”**

Plus, a final comment: In which way urban landscape schematization may be positively transformed?

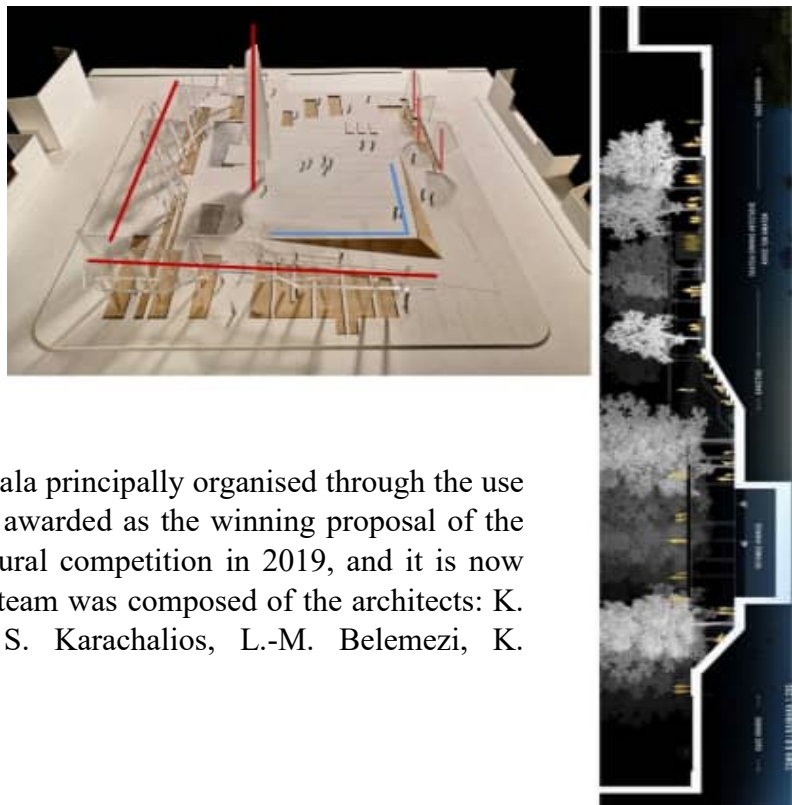
**Keywords:** Schematism, Schematization, abstraction, architectural design, urban design, landscape design, landscape urbanism, didactic methodologies, theory of knowledge, expressive metaphor.

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It is normal to present, in conferences like the one under the subject ‘Open-Air Cities’, completed design or built projects. We scarcely discuss methodologies that could offer a didactic approach for students or professional architects. It is against this approach that we shall propose a methodology that could help designers, experienced in architectural projects, to transform their skills and compose, in a way analogous to their building-design awareness, landscape formations with intense plantation ‘green’ identity. Or we may extend this methodological approach and refer to the earth surface and extend it to create building shells, building envelopes, in a compositional approach analogous to that applied in open-air design projects.



**Img. 1:** A central square in Trikala principally organised through the use of plantations. The project was awarded as the winning proposal of the respective panhellenic architectural competition in 2019, and it is now under construction. The design team was composed of the architects: K. Apostolidis, T. Karachalios, S. Karachalios, L.-M. Belemezi, K. Moraitis, K. Helidoni.

The concept underlying the previous didactic or auto-didactic approach has to do with the idea that we do not design and compose reality in its full detailed complexity: building reality, landscape reality or urban-scape reality. What we design and compose is a structured, “schematized” interpretation of the real place formations, an “abstract” schematized interpretation of it; unimportant details have been abstracted, and the remaining principal important characteristics have been restructured in a new conceivable and trustworthy to be applied form.



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### Initial introductory comments

*Moreover, we shall insist, in our presentation, on the idea that abstract schemes, in all previous design cases, and all previous thematic and scale design approaches, may have common formal references. Building design, landscape design or urban design may be composed on a common or relative conceptual ground of abstract schematized principles, able to produce our “Open-Air Cities” context of compound “landscape urbanism.”*

Plus, one additional introductory comment: In which way urban landscape schematization may be positively transformed?

In which way a supposedly “enclosed” formation, what we describe as “a building,” could be open to the surrounding “open-air” urban scape. In our next image [Image 2], we refer to two emblematic structures by Ludwig Mies Van der Rohe. The *Neue Nationalgalerie of Berlin*, on the left, a cultural building that intended to be open to the city, and on the right, his initial approach of an analogous intention, the famous early 20<sup>th</sup> century avant-garde proposal of the *Barcelona Pavilion*. Insisting on the second project, I may ask: is it a building or a landscape formation, pre-iconizing the contemporary design term “landscape formation” that is used under different formal approaches in closer to us architectonic proposals?



**Img. 2:** The house (or rather the building), as the city, as the landscape. The *Neue Nationalgalerie of Berlin* by Ludwig Mies Van der Rohe (on the left) and the early 20<sup>th</sup> century avant-garde proposal of the *Barcelona Pavilion*, again by Mies Van der Rohe (on the right). The Pavilion could surely be described, using closer to us terms, as a “landscape formation.”

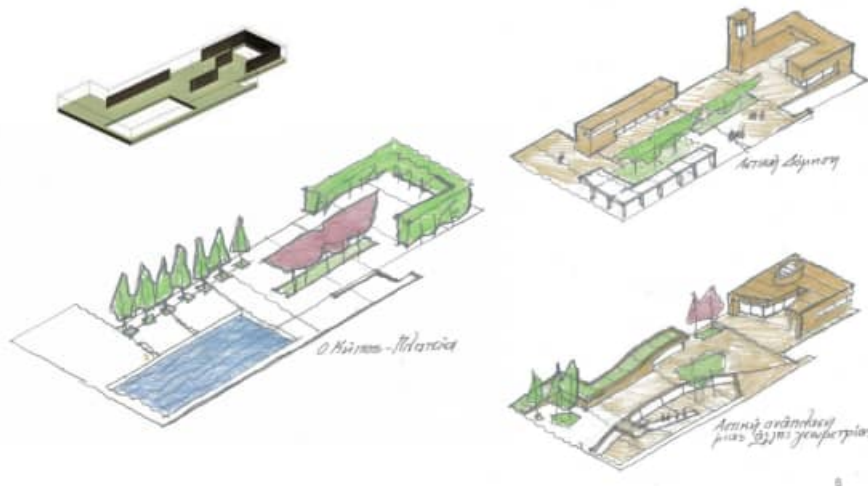
In the next image [Image 3], I insist on the structural decomposition of the Barcelona Pavilion in correlation with a statement by Leon Battista Alberti: “... *as philosophers also admit, the city could be compared to a large house, and the house, in its own turn, could be compared to a small town...*” I could add, “*as architects may also admit.*” How can I decipher the previous statement? Probably insisting on the fact that we may find common schematized, abstract design principles, under the compositional approaches of differentiated design subjects of different scales. In an arrogant way, I have tried to transform the initial design scheme of the Pavilion project into a garden-like proposal or into two hard-scape urban

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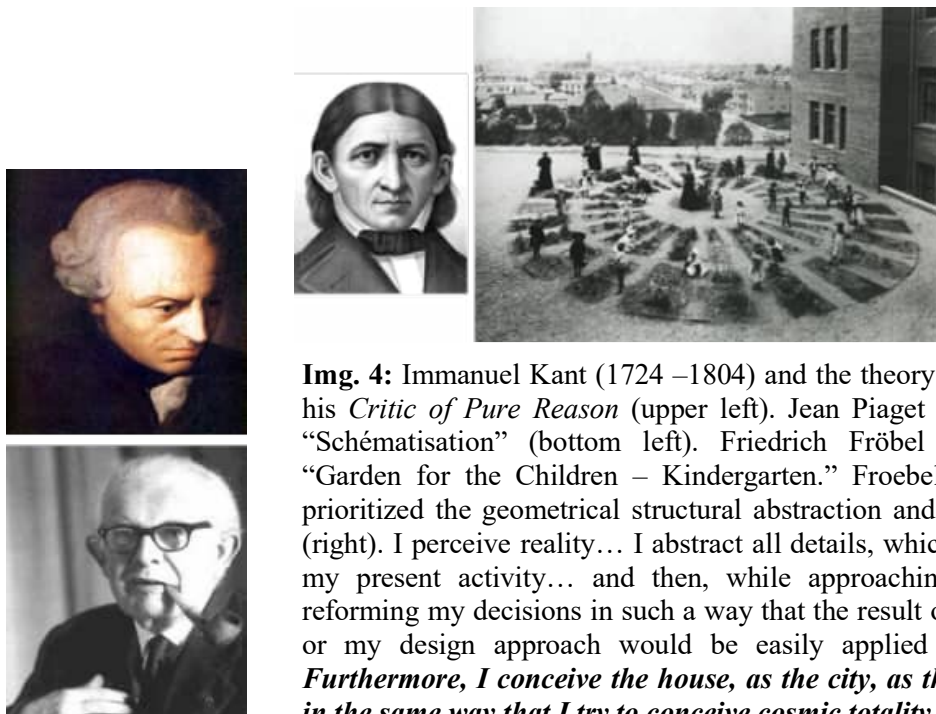
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scape proposals of differentiated geometry. Under all three experimental approaches, a common initial abstract schematized reference exists.



**Img. 3:** In this image, I have tried to transform the initial design scheme of the Pavilion project (upper left), in a garden-like proposal (bottom left), or in two hard-scape urban scape proposals of differentiated geometry (right side of the image).

Immanuel Kant and Jean Piaget, each one in his own way, explained this mental achievement of abstraction and schematism or schematization, and Friedrich Froebel, the initiator of the “Kindergarten,” tried to use this theoretical approach, concerning cognitive abstraction and schematization, as a didactic method for the education of the young children.



**Img. 4:** Immanuel Kant (1724 –1804) and the theory of “Schematismus”, in his *Critic of Pure Reason* (upper left). Jean Piaget and his own theory of “Schématisation” (bottom left). Friedrich Fröbel (1782-1852) and his “Garden for the Children – Kindergarten.” Froebel’s educative approach prioritized the geometrical structural abstraction and its reference to nature (right). I perceive reality... I abstract all details, which are not necessary for my present activity... and then, while approaching again reality, I am reforming my decisions in such a way that the result of my mental formation or my design approach would be easily applied and more successful. *Furthermore, I conceive the house, as the city, as the landscape, probably in the same way that I try to conceive cosmic totality.*

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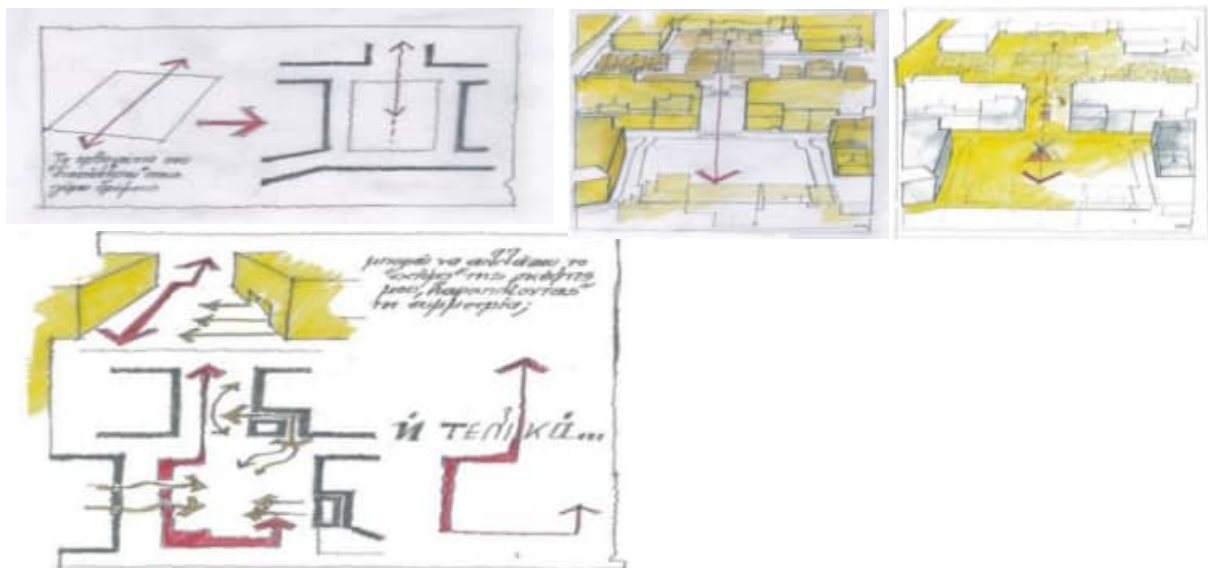
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A number of important modern painters or architects were taught or instructed on a methodology for the creation of abstract and schematized forms, through the didactic methods of Fröbel’s kindergarten. We may enumerate Wassily Kandinsky, Frank Lloyd Wright and Le Corbusier. Piet Mondrian was an instructor in a Froebelian kindergarten, as was Johannes Itten, who organized his “Vorkurs,” his introductory lessons for Bauhaus first-year students, in accordance with Froebel’s didactics.

### My motive

...has to do with the design of landscape in the same schematized and abstracted way that I design buildings. Thus, my motive refers to an autodidactic method, for landscape or urban-scape design, in accordance with what I already know: building architectural composition. It is surely important to participate in high-level conferences, presenting high-level texts about “open-air” public places, or final well-promoted projects in seductive 3D presentations, BUT how can I teach myself about the central compositional approaches? My text displays a didactic proposal, which I have introduced firstly in my postgraduate courses at N.T.U.A. and, afterward, after the theoretical formation of my approach, in the undergraduate program of the School of Architecture at N.T.U.A.



**Img. 5:** Klathmonos Square in Athens: transforming the initial symmetrical formation to an asymmetrical one, using, as depicted in the next Image 6, urban plantation or open-air urban “hard” structures, or “mixed” proposals.

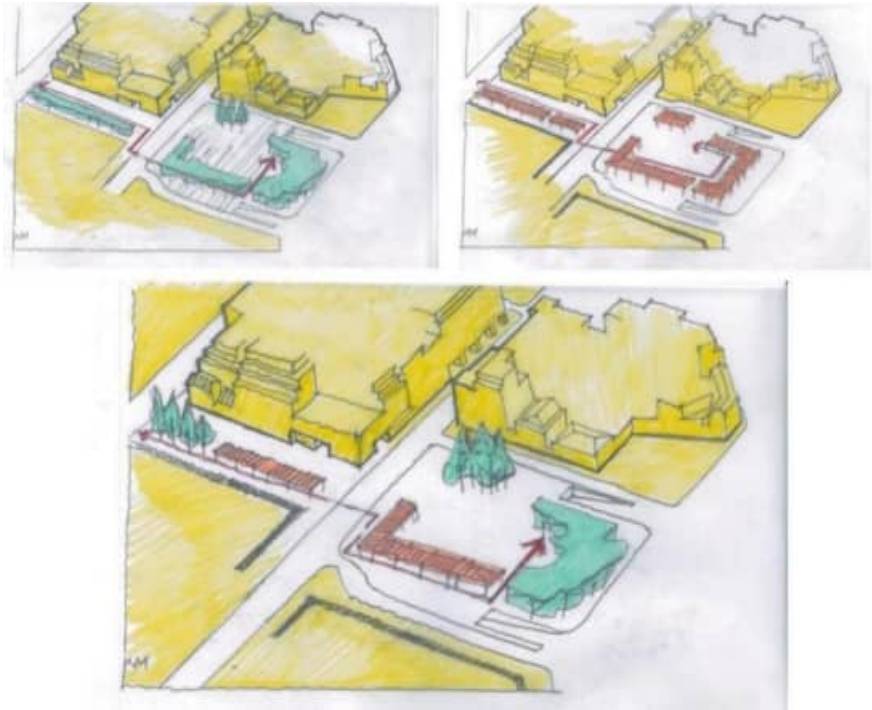
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### Exemplary students’ projects, in undergraduate design lessons

Let us offer a simplified approach to this methodology, as introduced in an undergraduate lesson, concerning the intervention at the Klathmonos Square in Athens. You may see abstract diagrammatic analyses of the place [Image 5], and a sketch of a compositional comparison between abstract geometrical forms and compositional formations of plantation, of different volumes and colours - *different volumes and colours composed* [Image 6].



**Img. 6:** Usage of urban plantation or open-air urban “hard” structures (upper exemplary sketches), or “mixed” proposals (bottom sketch), to transform the initial symmetrical formation to an asymmetrical one,

Let us insist on the previous diagrammatic approaches of the square using urban plantation or open-air urban “hard” structures, or “mixed” proposals, and compare them to an exemplary students’ proposal for the square insisting on the flooring material structure of the square AND on the composed plantation formations of it [Image 7] <sup>65</sup>

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<sup>65</sup> Klathmonos Square in Athens. Pre-graduate project by K. Lambrou, A. Drivas, A. Lekou. Tutors: Prof. N. Belavillas, Prof. K. Moraitis, acad. year. 2012-2013.



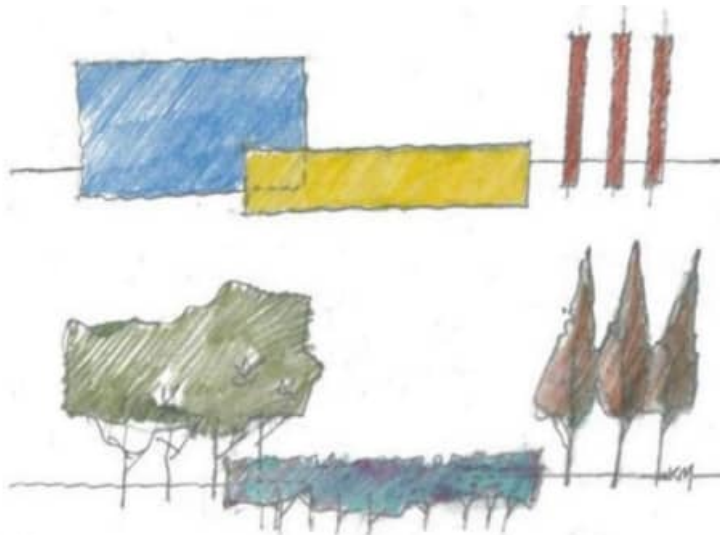
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**Img. 7:** Re-designing Klathmonos Square, using urban plantation and flooring material.



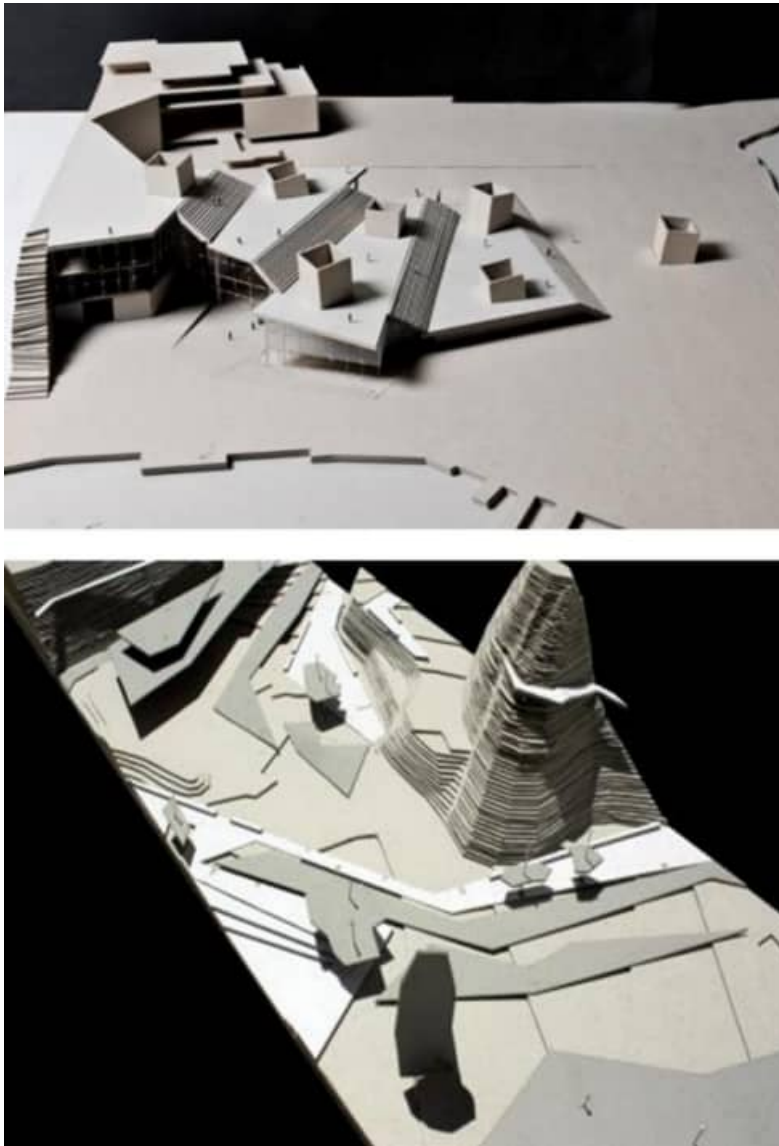
**Img. 8:** A diagrammatic explanation of the methodology proposed: abstract schematized forms (upper sketch) may be transformed into a composition of different vegetal species presenting different plantation volumes and colours. The same diagrammatic sketch could represent two building volumes, a blue and a yellow one (left and middle part of the sketch), associated with three chimney-like vertical red structures (right part of the sketch).

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In Image 9, we present analogous schematized approaches, concerning a building-oriented urban-scape design (on the left), and open-air landscape design using schematization of plantation elements (on the right). We may go on and present a combination, a combined compositional effect, a compositional synergy between hard building urban scape, and urban plantation. ***Hard scape building formations and green-scape formations may be correlated and composed in an analogous schematized way*** [Image 10], ***as presented in the example of a 9<sup>th</sup> semester lesson concerning urban intervention at the territory of Plato’s Academy.***



**Img 9:** Analogous schematized approaches applied in pre-graduate students’ proposals in the School of Architecture at N.T.U.A. Building oriented design of “hard scape” composition (upper example – 7<sup>th</sup> and 8<sup>th</sup> semester lesson), and open-air landscape design using schematization of plantation elements (bottom example - 7<sup>th</sup> and 8<sup>th</sup> semester lesson).



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**Img. 10:** Urban intervention at the territory of Plato's Academy – 9<sup>th</sup> semester, 2012-2013: Hard scape building formations and green scape formations are composed in an analogous schematized way. Moreover, the plantation's compositional contour duplicates and strengthens the compositional form of the buildings' structure. Proposal by pre-graduate students S. Anagnostopoulou, H. Ziova, A. Kyriakou. The lesson was organized by professors, H. Chaniotou, D. Isaias, V. Karvoutzi, K. Moraitis.

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**Img 11:** Trans-thematic and trans-scale design approaches by Zaha Hadid and Zaha Hadid Architects. A sequence of design experiments on different scales of approach, indicating common design principles, a common expressive code of design response. Upper row from left to right - *The Peak Leisure Club* in Hong Kong, China (1983), *Landscape Formation One*, a garden pavilion, in the city of Weil am Rhein in Germany, (1999) and *The Masterplan of the City of Appur* in India (2008). Bottom row from left to right - *Stuart Weitzman Flagship Store*, Milan, Italy (2013) and *Celeste Necklace and Cuff*, designed for atelier Swarovski (2008).

### **Trans-thematic and trans-scale design approaches and their correlation with the conceptual and expressive procedure of “metaphor”**

In reference *to landscape formations and topological folding forms*, Zaha Hadid Architects have presented an extended number of *trans-thematic and trans-scale design approaches* (Moraitis, 2019: p. 24). In accordance with this multi-thematic formal experimentation, we shall introduce the important methodological term “metaphor” as a possibility of inspiration, transcending different expressive structured systems. We strongly believe, this is a central theoretical statement of ours, that metaphor is not an expressive condition associated with literature and poetic approaches solely. It is not solely a figure of speech (de Man, 1978 & 1999) that, for rhetorical reasons, directly refers to one thing by mentioning another. In a much more extended connotational approach, metaphoric transcription may bring together concepts from different conceptual domains, from different domains of cultural expression and activity.

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It is in the previous interpretative context that the French psychoanalyst Jacques Lacan, follows the definition of the term by the pioneer linguist and literary theorist Roman Jakobson, and accepts metaphor as the substitution of one signifier for another. We could thus identify metaphor “with the substitutive axis of language” (Evans, 1996: p. 114), and further explain that it provides a formula of the trans-conceptual and trans-expressive formation of individual cognition, as well as an important theoretical approach of the possible multiple reciprocal exchanges among different versions of the collective cultural activity. It is in the same context that we could also describe our methodological didactic approach of abstraction and schematization, as a conscious or unconscious process that underlies our expressive compositional and design correlations and produces conscious or unconscious “metaphors” between different design topics. We could be even more radical in our theoretical statement and speak about conceptual exchanges between representational practices, theoretical influences and, even, general socio-political approaches. In the case of Renaissance garden art, a constitutive economic and political change, triggered a new approach of the agrarian economy escorted by an innovative apperception of the out-of-town landscape. It was in correlation with this cultural framework that the garden art asked for its formative inspiration in the architectural building design, creating the prototype of the “stanza garden,” a vegetal room-like structure without a roof; “stanza” being the Italian term for the room, the chamber<sup>66</sup>. Analogous comments may be presented in association with the 17<sup>th</sup> Dutch apperception of the landscape or the formation of the 18<sup>th</sup> formation of the British landscape architecture.

A metaphor may thus create new links between otherwise distinct conceptual domains,<sup>67</sup> between formal approaches of different expressive activities. For example, between landscape painting and landscape architectural compositional approaches, or, as in the case of Zaha Hadid Architects, among landscape formations, building design, urban design or even interior architecture and object design. Nevertheless, an even more important metaphor, in the case of Zaha Hadid Architects, correlates all those design approaches with topological mathematics. I refer to a central contemporary epistemological and cultural tendency, “epistemic” in Michel Foucault’s terms (Foucault, 1966, 1986 & 1994)<sup>68</sup>, which characterizes scientific and expressive design domains as well. In the case of Bernard Cache’s theoretical approach (Cache, 1983 & 1995) it correlates landscape perception and landscape design, with object and furniture design and, furthermore, with topological mathematics and their computational design application. An even more revealing metaphoric connection may refer to the theoretical intersection of the topological mathematical conception with the historic-philosophical concern of the Baroque 17<sup>th</sup> century, as epitomized by Gottfried Wilhelm Leibniz’s early topological anxiety. We may expand this theoretical approach, as presented by Gilles Deleuze in his book, *Fold. Leibniz and Baroque – Le Pli. Leibniz et le Baroque* in its

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<sup>66</sup> It also refers, figuratively, to a self-contained part of a poem, including connected thoughts.

<sup>67</sup> Whereas, another expressive correlative formation, “metonymy” relies on pre-existent links within such domains.

<sup>68</sup> “Epistemic”, in reference to the term “épistémè”, used by Foucault to express not scientific approaches solely but, moreover, the general cultural conditions, which contribute to the formation of social expression and cognition or knowledge at a given historic period.

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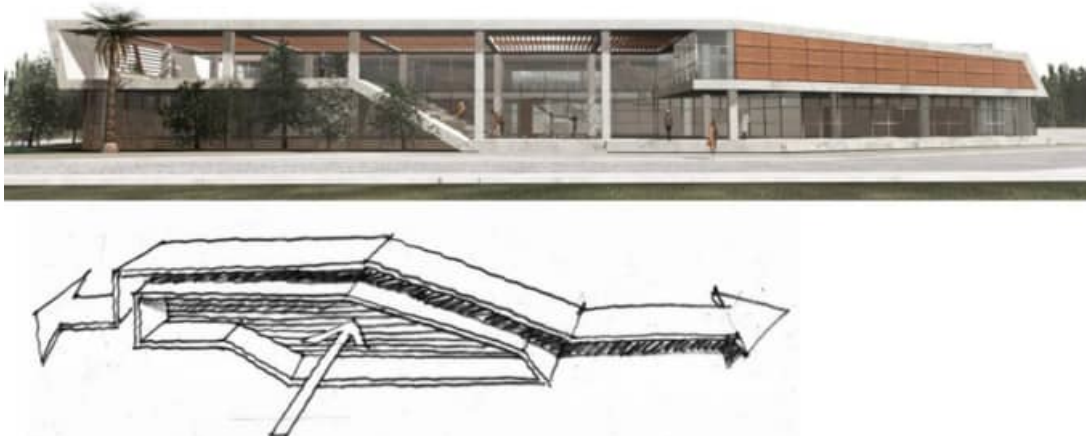
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initial French title (Deleuze, 1988, 1993 & 2004). We may additionally refer to the deliberate deformations of the earth bas-relief of the baroque gardens in order to produce the “trompe d’œil” results of the illusionary perspective known as “anamorphosis” (Moraitis, 2017 & Moraitis, 2024: p. 89). Let us comment that the previous book constitutes a well-known reference for contemporary architects and landscape architects.

### Three Projects of personal design involvement, correlating building structures with landscape formations

In reference to the concept of the folding forms that may create a structural continuity between earth surface and building envelope, we shall dare to present three analogous proposals, three projects in which we have participated in the past. They concern *a building imitating landscape formation* [Image 12], *the concept of the continuity of the earth surface on the building structure* [Image 13 and Image 14], and *an analogous landscape folding formation applied to a building approach as a continuity to the surrounding urban scape* [Image 15].

The first project refers to the architectural proposal for the town hall for the municipality of Vocha, in Corinthia, Greece.<sup>69</sup> The town hall, proposed to be constructed at the boundary of the built area of the town of Vocha, directs its principal façade towards an extended agricultural territory, planted with orange trees. Out of this landscape of arboreal delights, the earth’s surface arises; it folds up in a horizontal direction to form the building shell. At the upper part of Image 12, a 3D aspect of the building is depicted, captured towards its principal façade. At the bottom part of the image, the idea of the schematized folding form, creating the building shell, is explained.



**Img 12:** A town hall of the municipality of Vocha, in Corinthia Greece – a proposal of a folding form, insisting on the concept of the continuity of the earth surface on a folded building structure, a building alleging that was conceived in continuity to the surrounding landscape.

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<sup>69</sup> Designed by the members of the architectural team “Arsis Architects” (A. Chelidoni, K. Moraitis, P. Nikolaidis), in 2001-2002.



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The second project is presented in Image 13 and Image 14. It was proposed in the context of an international architectural competition,<sup>70</sup> concerning the design of a building complex for the reception and information facilities provided for the visitors, at the territory of the Giants' Causeway in Ireland. We have to remind you that the Giant's Causeway,<sup>71</sup> located in County Antrim on the north coast of Northern Ireland, is an area of forty thousand interlocking basalt columns, produced by an ancient volcanic fissure eruption. In association with this primordial volcanic earth bas-relief, the architects' design team decided that a building formation, would have to prove its respect to the identity of the exceptional Irish landscape. Thus, the reception and information complex for the visitors, was envisaged as a compound structure of two separate building wings, came forth from the surrounding terrain, their roofs described as planted surfaces.



**Img 13:** Visitors' building for Giants' Causeway in Ireland; insisting on the concept of the continuity of the earth surface on the building structure. The roofs of the two separate building wings of the visitors' facilities complex were designed as planted surfaces, as parts of the surrounding landscape, as a continuity of the green surrounding terrain.

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<sup>70</sup> Designed by architects S. Mavrommati, A. Moraiti, K. Moraitis, M. Voreakou, in 2005. The competition was organized under the auspices of U.I.A. (International Union of Architects)

<sup>71</sup> In Irish, Clochán an Aifir.

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The third exemplary project is presented in Image 15. It refers to a building complex, proposed for the Intercity Bus Station at the territory of Eleonas in Athens, Greece.<sup>72</sup>



**Img. 14:** The masterplan of the Giants' Causeway territory, where the visitors' facilities building for Giants' Causeway would be located. The two-wing building complex is indicated by a yellow arrow; it is veiled under its planted terraces and attempts to be assimilated in the surrounding green scape, presented as part of the landscape, as part of its bas-relief continuity.

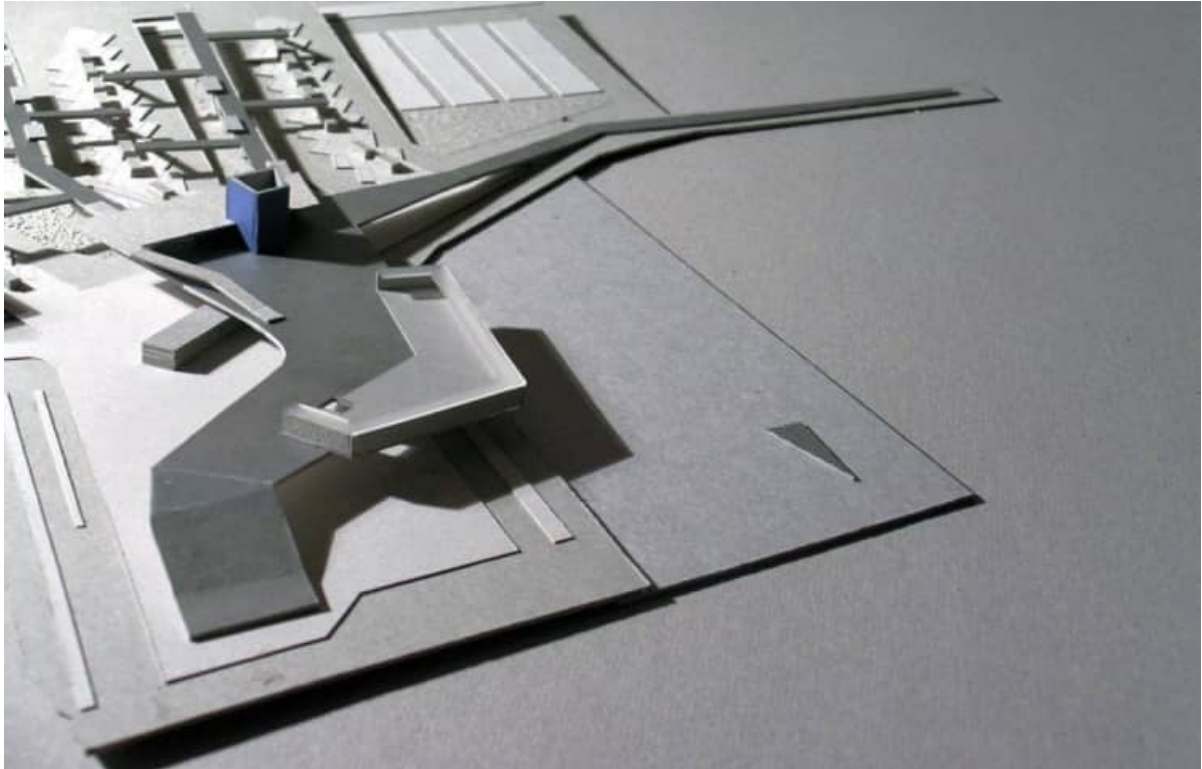
<sup>72</sup> The version of the building complex presented is the result of a preparatory architectural study, produced in the context of a research program, organized by the School of Architecture of the National Technical University of Athens (N.T.U.A.) and the Hellenic Metro S.A. in 2003. The proposal was designed by the architects G. Tsolakis and K. Moraitis



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**Img 15:** A landscape folding formation, analogous to the two previously presented exemplary projects, was applied to the proposal for a building complex, proposed for the Intercity Bus Station at the territory of Eleonas, in Athens. The complex is presented as the result of the detachment of two surface layers, coming out of the surrounding urban scape, in a way that would facilitate the continuous approach and circulation, on different levels, of vehicles and passengers.

**Conclusive remarks: the contemporary reference to natural landscape as an extended expressive and “epistemic” metaphor transcending different cultural domains**

According to the French mathematician, expert in topology (Thom, 1972 & 1975) and founder of the “Catastrophe Theory,” René Frédéric Thom, natural landscape may offer a satisfactory formal paradigm of reference for the description of the topological formations. *The landscape surface, the earth bas-relief under transformation, are they necessary as references to the continuous change of forms, to the “animate” forms* (Lynn, 1999)? Finally: *Is the form of landscape useful, as a visualized reference, in all research approaches interested in trans-formational and morphogenetic procedures?*

It is in this context that reference to natural landscape constitutes an extended expressive and “epistemic” metaphor transcending different cultural domains. Its correlation to building structures designed as “landscape formations” presents an analogous expressive example, important for our design interest, an expressive up-to-date example that, nevertheless, may be regarded as a current extension of our initial proposal concerning the common abstract

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schemes underlying building and landscape design. Common abstract schemes, which enable the expressive metaphors among building design, insist on the concepts of the topological transformation and the folding forms.

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### THE LIMINAL SPACE OF THE GREEN CITY

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#### Abstract

The modern cities, while occupying only 2-3% of the land surface, host an astonishing 55% of the world population. As IUCN states, modern cities account for a vast majority of consumption and waste production, main factors leading to the catastrophe of the environment. The lion's share of production is used to provide the big cities with even more resources, and as that need keeps growing, is leading to deforestation and expropriation of the natural environment, something that seems like the story of the death of Pan.

While inhabited, those spaces make the residents feel alone and imprisoned. A voluntary prison that seems to have no escape. Recognizing the problem, a solution that often comes up is the one of the green cities, a sustainable inhabitable place. Coming from a capitalistic perspective, whose main objective is pure profit and exploitation, this topic seems to touch the spectrum of fiction and can be considered greenwashing. The modern city keeps growing denser, while leaving no space for the inhabitants. The growth of population in those areas also leaves rural areas deserted and decadent.

In theory, a green city might prove to be a valid option, but it is of outmost importance to seek alternative ways of inhabiting spaces, focusing on less density and more means of primary production, distributed as evenly as possible. The importance of the natural environment and the connection of the people with it can prove crucial for the protection of the planet and the growing problem of alienation that the modern human keeps facing. This solution can prove helpful, not only for the environment, but also for the better habitation of people in those areas.

**Key words:** Green cities, greenwashing, environmental catastrophe, Urban revision

#### Introduction

The summer of 2024 was the hottest summer recorded in the northern hemisphere, marking severe climate anomalies globally. While these phenomena are becoming a new reality, creating new challenges of inhabitation in human settlements worldwide, the social, economic and political structures seem to disregard the constant change, while focusing on marketing capital, using climate change, or catastrophic natural phenomena, to promote new ways of technocratic control. This disregard of human living conditions and the exploitation of resources keep pushing the limit of the need for a constant growing cityscape around the world. There is an importance of recognizing the evident problems that lead to this kind of phenomena and proposing new solutions. While solutions keep focusing on market gain or

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mildly modifying the cities as a façade to seem more environmentally and resident friendly, the problems that come with urbanization and modern cityscapes will keep recycling.

### **The parasitic nature of modern cityscapes**

The modern cities host more than 4.4 billion people worldwide, making them home to 55% of the human population. This rate reveals its dire nature when, in the current state, modern urban environments are responsible for 75% of natural resource consumption, 80% of energy consumption, 70% of greenhouse gas emissions and 50% of waste production, while only covering 2-3% of the global land surface. This percentage is rapidly increasing, with studies showing that by 2050, the total number of residents in urban environments will rise to 6.7 billion, leaving non-urban, rural and natural land masses deserted.

A problem that can be detected here is that the modern city has become a place of constant demand of resources, while the only production it is capable of offering is waste. A wasting condition occurs, constantly draining everything around it, like a parasitic entity, that has a never-ending demand for supply into a vast host, leaving earth depleted. The reality is the severe threat of climate breakdown and ecological collapse. The uncontrollable expansion of means of energy production, combined with vast acres of land expropriated, is depleting the natural resources by destroying the natural environment to perpetuate capital to the main technocratic powers.

Combining these data, one can easily realize that the perpetuation of urbanization has created a demand for resources that greatly overcomes the total production, leading to constant drain of resources. This observation can also be traced by example, if the tracing is focused on specific fields regarding the usage of urbanized, or rapid developing areas. Along with the resource depletion, urbanization also leads to cultural and social consequences, such as the commercialization of the public space.

An aspect that plays a significant role, for example, is the ever-growing field of tourism and hedonism. While living in an era that can be characterized as the peak of urbanization, the demand for capital gain keeps pushing further into the commercialization of every aspect of life inside cityscapes. The public spaces are shrinking, in favor of commercial development demand. This phenomenon, alongside other multiple factors, also affects the market value of housing, making it almost impossible to keep the average citizen up with the ever-growing development of urban areas. This is most evident in extreme cases, such as Mumbai, India, where 60% of the population is living in slum areas. Mumbai is a city where the income divide is most visible and can signify the importance of action against modern development.

This topic is difficult to summarize fully on paper, but even this fraction of stats and evident matters tracing can provide anyone with enough information that proves that action is necessary. While the connection of the natural environment and the protection of it is an expanding area, when it is combined with cityscapes and human settlements, reveals an evident fact. In the grand scheme of the planet, time, space and resources occupied by humans are almost insignificant. Humans have occupied the planet for only 0.008% of its 3.7-billion-year history, while the planet is in a constant state of metamorphosis. What makes this matter so important is that it affects the living environment in this period. Ecology is much more than “saving the planet”, but it can be characterized by making the best living conditions for the existence of human lives. The factor of ecology, the need for open-air cities and resource

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diversification and better distribution is vital in creating better living conditions for all humans in the present.

### **The “Green City” concept**

The urgent need to address these matters has led to a consecutive search for solutions and catalysts. One commonly discussed concept is modifying the existing cityscapes and creating new urban areas with certain characteristics. This concept refers to Sustainable cities. Green cities (or sustainable cities) are typically characterized by their focus on certain features that divide them from a typical urban area, usually associated with environmental protection and restoration driven goals.

The UN Environment Programme focuses on maintaining the economic growth of the cities while creating sustainable and livable solutions, focusing mainly on cities in Asia and the Pacific. The prospect of resource efficient and healthy cityscapes seems appealing and a step in the right direction. The sustainable cities, in theory, seem to have some key characteristics.

- The presence of green spaces within the urban environment
- The use of renewable energy sources, such as wind turbines, solar panels, and biogas.
- Sustainable architecture is also a significant aspect, exemplified by green roofs and the use of eco-friendly materials.
- The integration of green ‘islands’ through the urban fabric, utilizing resilient plants or xeriscaping, is another innovative approach.
- Lastly, the emphasis on creating more open spaces contributes to the overall sustainability of the city

Those are some of the main factors that deem the city, Green. If the above factors are seen as a register, some key points can be observed. While these characteristics define sustainable cities, there are important shortcomings to consider:

- While the main focus is on city density, with proposals such as open green areas, this approach does not address the housing crisis or improve conditions in slum areas.
- Although there are proposals for resilient plants or xeriscaping, they overlook the importance of natural biodiversity, which is essential for a healthy ecosystem.
- While renewable energy sources like wind and solar power are beneficial, they are often located in rural areas, which can result in the destruction of natural habitats. This can result in the destruction of large natural areas and the disturbance of local ecosystems.
- Sustainable architectural practices may prove effective, but they will not provide lasting benefits without regulations that protect natural landscapes and control excessive tourism.



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- While open spaces in cities are generally positive, they could lead to the expansion of dense urban areas to meet housing demands, potentially causing significant harm to the surrounding environment.

The alternative we need may require a more radical approach, rather than simply modifying existing cityscapes, to benefit both people and the environment. By reviewing the above register, we can set some new goals. Energy sources should have the least environmental impact possible, capitalizing on the unique strengths of each location. The way we build should focus on the needs of the commons, not the interests of corporations and lastly open spaces should be carefully considered, with the understanding that the natural surroundings of an urban area are still part of the environment.

### **Human derealization and liminal spaces**

The rapid urbanization of cities worldwide has led to overpopulated areas, isolating individuals in a constant state of derealization. That case makes for a state of the individual that could be characterized as liminality. Liminality is a concept that refers to a state of being ‘in between’ or on the threshold of two different states, stages, or places. Derived from the Latin word *limen*, meaning “threshold”, liminality describes a transitional phase where normal rules and structures may not apply, and ambiguity or uncertainty prevails. Liminal spaces are empty or abandoned places that often feel eerie, forlorn, and surreal. These spaces are commonly associated with transition, reflecting the concept of liminality.

The rapidly growing urban environment is used as a place of hosting a constantly moving working force with the sole purpose of an expanding Gross Domestic Product. The individual is in a constant state of productivity to ensure sufficient resources to keep surviving in the urban environment or to expand one’s wealth. The everyday schedule of every resident is to keep functioning accordingly, to keep the city’s way of life. Every misstep of this process creates a vicious cycle led by technological hedonism and market gain, leaving no place for socializing, inspiration or self-care. This unrelenting push for productivity, coupled with the overwhelming anonymity of urban life, isolates every aspect of the individual’s life. Over time, this contributes to a feeling of fragmentation, where individuals feel detached from their surroundings, their communities, and even themselves.

This decline in human experience is connected to the constant modification of the city that keeps evolving to meet the demands of the capital. The urban areas are undergoing a state of development that focuses on commercialization and use the cities as factories or products, rather than human settlements. The concept of the city as a product reflects on the way of life of every resident and defines their everyday lives. In this manner, residents feel that this way of life is the best and only option they have, leading to a deeper state of liminality.

While this phenomenon keeps expanding across the globe, the resource requirements are growing rapidly by the day. This leads to even more exploitation of the natural environment to keep up with these demands. Deforestation is a common practice to enlarge fields in order to increase the food and goods production, but also to place energy sources like wind turbines. Those modifications of the natural environment have a huge impact on biodiversity, natural formations and the individual characteristics of a place, gentrifying it and making it another alienated site.

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As cities continue to expand, the liminal experience becomes more pervasive. Urbanization that emphasizes on productivity and economic growth fosters a sense of isolation where individuals are caught between the need for survival and the absence of social existence, perpetuating emotional and psychological fragmentation.

### **Urban and non-urban revision thoughts**

The strategies proposed are informed by observations in the register, with the aim of sparking a discussion on the future of designing spaces for habitation. The first issue that appears common in both the statistics identifying the problems of modern habitation and the requirement for a sustainable city is the focus on density. While this is indeed a major concern, it must be addressed with caution to avoid undesirable outcomes. The main focus while creating an open-air city is reducing the built-up area and usage of the city center. This will set an example for the rest of the urban fabric. This proposal is a difficult and radical solution that may disorganize the cities for a certain time but will have a great long-lasting outcome. The changes in density should be made gradually and precisely, offering the people new common spaces to occupy and socialize. The infrastructure should be in favor of the residents and occupants of the city, providing them with proper affordable housing, means of transportation, that will also reduce the carbon footprint of the city and easy access to schools, public areas and workplaces. The reorganization of urban fabric should also focus on distributing land usage in a way that supports open spaces, provides communal areas, and facilitates production within the city, with usages like urban gardens. Finally, the city should move away from being a central hub and become more self-sufficient. Instead of depleting resources, it should prioritize better access to rural areas for more balanced resource distribution.

Another effective way to reduce the high density of cities while diversifying land use and production is deurbanization. A key factor for its success is strengthening rural areas and making them more appealing for habitation. A key focus should be the improvement of rural environments, making them more accessible and appealing for human habitation. An important aspect of this is addressing the needs of rural areas, such as access to water and affordable energy. A great number of the residents of those areas are living as farmers. Water and energy are vital for agricultural development and should be provided to strengthen those occupations. Agriculture can revitalize areas heavily injured by industry, making them a productive part of the environment. But this should not be the only concern when thinking about deurbanization. Rural areas should have diversified uses. Rather than distinguishing between city jobs and rural jobs, employment should be spread across all areas to encourage people to live throughout the region. Encouraging people to expand in a larger area, while diversifying the occupations for different trades can provide an equal habitational fabric that maximizes production while focusing on habitation and the individual's wellbeing. The final step is ensuring proper housing, public access to essential services like hospitals and schools, and establishing means of production that can support the community. The state should be able to provide common goods and services across the country and not only focus on the capital.

A key factor in this transition is alternative production. Currently, most land is controlled by corporations for private gain, rather than focusing on production for the

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commons. The means of production should prioritize the wellbeing of the residents of an area, rather than expanding in favor of capital. By decommercializing areas dedicated to mass production or depleted by the pollution caused by industries, the creation of spaces with the best living conditions can prove an effective way to face the problem of slums. Another important factor is distance. Local production reduces the need for transportation and eliminates the numerous stages involved in a product's journey. By diversifying the usage and production of an area can be a key factor in ensuring a more even distribution of the human population, with less environmental impact and fewer resource-draining centers. Local reserves can be vital for sustainability and the independence of areas, allowing for more even distribution of resources like water.

This type of production can be facilitated by semi-autonomous societies throughout the area. Local administrative societies tend to be more resourceful and have greater respect for the environment. Local administration can be crucial for the proper development of both urban and natural ecosystems. The people living in an area are more knowledgeable about certain strengths and weaknesses of those areas, that can help with the map problem. The main issue with maps and administration is that, in many cases, maps fail to account for elevation and generalize the use of large, diverse areas. By administering locally rather than on a large scale, it should be easier to manage most of the land area, instead of focusing on specific regions. Tending to the map problem can maximize certain strengths of an area that leads to more resourceful management. Resource distribution should also be a key priority, particularly in areas with limited access to natural resources or where farming and gardening are challenging. Additionally, local administration encourages people to care more about the places they live in, rather than those they don't. They once again connect with their natural surroundings, creating the best living conditions.

Finally, inhabiting spaces with a closer connection to nature can be beneficial for both the well-being of residents and the environment, helping to prevent the encroachment and destruction of natural land. Better communication and a closer connection with the natural environment should help prevent people from feeling alienated. The reintroduction of both people and cities to the natural environment should improve physical and mental health, reducing feelings of liminality. Common control of production should be crucial in stopping excessive production and the environmental destruction it causes. Finally, this could offer a new way to reevaluate habitation and the role of the city, helping people feel more connected and purposeful.

### **Possible outcomes and the future of cities**

A new approach to the city, or the urban environment in general, must be carefully considered. It should consider modern sustainability practices while also critiquing them. The theory posits that only a radical shift in how we inhabit our spaces can yield the desired results, and the steps to achieve this form the foundation of this theory. While this is indeed a radical approach, it is something that can be conquered gradually and with the least environmental and social impact. This type of urban healing idea and alternative ways of habitation can be loosely trace back to Doxiadis and the Ekistics. But rather than heading for the idea of the Ecumenopolis, this theory proposes that the best way to heal the problems of the modern cityscape is diversification of uses and autonomous collectives that respect the environment,

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the residents and the culture of each region respectfully. The state of liminality is a modern theory that is the product of the time and should be addressed as such. By facing this problem, the closed city becomes evident.

In conclusion, the urban environment of the future must undergo a radical transformation to address the pressing challenges of climate change, resource depletion, and social inequality. Current solutions, such as the "Green City" concept, offer some promise but fall short by failing to address the root causes of urban issues, such as resource consumption, waste production, and the commercialization of public space. A more sustainable approach requires not just minor modifications to existing cityscapes but a fundamental shift in how we design, inhabit, and produce in our urban environments.

To move toward a better future of human settlements, we must prioritize a more decentralized model that promotes deurbanization, strengthens rural areas, and emphasizes local production and resource distribution. Cities should evolve from being resource-draining hubs to self-sufficient, eco-friendly communities that coexist harmoniously with the natural environment.

The desired outcome is a more refined and diversified urban environment that focuses on coexisting with the natural world, using its resources respectfully, and proposing a new way of designing cities in harmony with the environment. While there may be counterpoints to this essay, its aim is to spark a conversation about the future of cities during the climate crisis, with an emphasis on the well-being of every resident. This essay aims to emphasize the need for coexistence between urban and natural environments. It advocates for cities that are not parasitic, draining resources and producing pollution, but instead can coexist with and protect the natural world, while providing a better quality of life for all their residents.

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# LANDSCAPE AND URBAN SUSTAINABILITY. CULTURAL ROUTES FOR CULTURAL TRAVELLERS: A POSITIVE APPROACH - CASE STUDY

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## Abstract

The value of protecting natural spaces is highlighted by the environmental, social, economic and cultural principles of sustainability, which are recognized as contributing factors to the goal of development. Furthermore, the role of 'cultural routes' is very important, to strengthen the enabling environment by encouraging policies and methods that support sustainable tourism as a significant vehicle for managing cultural and natural heritage. It is well known that Greece, although a small piece of landmass with numerous islands scattered around, has always communicated with the rest of the world, the Mediterranean and beyond, through sea routes. Consequently, several of the most important cities that were established as ports were built next to the sea, from antiquity until today. The fact that Greece, at the edge of the Balkan peninsula, is surrounded by sea, reflects the importance of the water element as a means of communication and a pole of sustainable development for the coastal cities that constitute natural areas of great importance.

It is argued that the promotion of the identity of a “place” towards sustainable development undoubtedly has multiple benefits for the local society, in terms of improving the living environment and supporting cultural, social and economic development. Moreover, the progression of sustainable development goals in tourism, in a human-centered way, creates cultural and political connections between the local to global, the past to the present, transforming the modern traveller through experiences and co-presence into a ‘cultural traveller’.

This paper explores a contemporary approach to the promotion of “cultural landscapes” through the creation of Cultural Routes, at a “supra-local” level. The research focuses on a holistic view of methodological processes in terms of education and awareness for sustainable consumption and the improvement of the quality of life of citizens.

**Key words:** Cultural landscape, routes, political sustainability, interactive platform

## Introduction

In 1987, the concept of Cultural Routes was launched and established at European level by the Council of Europe with the aim to strengthen the common European identity through the contribution of a shared cultural legacy (EU 2016). Greece's contribution to the establishment

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of the partial agreement is highlighted by its role as one of the main pillars of cultural interconnection in Europe, as it has always been a crossroads of civilizations. Moreover, although it is a small country, it has the peculiarity that parts of its territory are mostly submerged in the sea. Thus, the landmass consists mainly of a main strip of land and a multitude of islands between the Aegean, the Ionian and the Cretan Sea, endowed with magnificent natural beauty with a wide variety of landscape variations. By extension, Greece has been a place intertwined with history and culture since ancient times, so every part of it includes archaeological sites as fragments of evidence of historical memory. Therefore, these two advantages (historical background and natural geographical location) can be exploited for cultural and tourist activities. Cultural Routes are emerging today as an important management and useful tool for the promotion of cultural resources and the advanced promotion of cultural tourism of a city, or of a cultural landscape. Through a marked path, the visitor has the opportunity to experience the history and culture of a place and to get to know its special physiognomy (Moraitis, 2015). But at present, the progression of sustainable development goals in tourism, at present are predominantly ‘local area’ focused, whilst ‘cultural landscapes’ are usually treated in a fragmented manner (e.g. archaeological sites from urban landscapes). Subsequently, a field of discussions and reflections on the management of this kind of cultural landscape has developed into an important field of research. This paper attempts to introduce a better understanding between the links of heritage and tourism. It also suggests that it is important for monuments and archeological sites not to be presented in isolation from their social context, but rather to be examined in relation to man and his environment.

### **A positive approach. Case Study: Research Area and general framework**

As a positive approach, it has been chosen a case study of a special innovative Cultural Route Project, created by the Ministry of Culture of Athens (Directorate of Prehistoric and Classical Antiquities) which is part of a broader action entitled "Cultural routes in emblematic archaeological sites and monuments", and included in the financial programs of the Recovery and Resilience Fund. The said action concerns the planning of a total of five (5) emblematic cultural routes, with themes that cover all periods of Greek history and extend geographically almost throughout the Greek territory.

The examined route implemented by the Directorate of Prehistoric and Classical Antiquities, whose implementation is still in progress, has the title: **"Cultural Route: The Road to the West. From Homer to Cervantes"**. The program unfolded in May 2022 and is coming to an end. (The supervisors have been appointed as: *Anastasia Gadoulou, Georgia Ivou and Napoleon Xifaras (archaeologists)* and the Scientific collaboration Team of: *Ieremias S. & Chiotis G. (archaeologists), Katraouzou D.-architect, Kotsainas M.-civil engineer*).

The main narrative of this Cultural Route deals with the 'dual movement of colonists': Greeks and Romans. An additional important element that differentiates this specific cultural route project from the usual ones is the different modes of transportation by the traveller-visitor, a fact that differentiates not only the character of the two individual routes (by sailing boat or by van land) but also the way of visitors' view and understanding. Specifically, the project consists of the next two sub-routes:



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The first one ‘from Greece to the West’ takes place as a ‘*sea route*’ (by a sailing boat). It refers to the historical background, where the Corinthians and the Achaeans, (from the 8th and the end of the 7th century BC) moved west, establishing colonies in Southern Italy and Sicily, following divine instructions from the Oracle of Delphi. The colonies that they founded were particularly important because they remained powerful cities for many centuries whilst in turn, they founded other new cities, thus creating *Magna Grecia*.

The second one ‘from the West to Greece’ is a ‘*land route*’ (by car, on foot etc.). It refers to the fact that Romans from the 1st century BC and after (167 BC) seem to have moved to the S.W. Peloponnese and specifically in Olympia for the games but also for the promotion of their emperors, while continuing to the Northwest they founded colonies, that is, cities with Roman citizens and corresponding rights, such as Patras and even Nicopolis, where Augustus consolidated his victory (after the conquest of Actium in 30 BC).

The physical object of this project concerns the creation of a ‘double cultural route’, which will connect various archaeological sites in the Peloponnese, central Greece, including the western Greece regions of the Ionian Islands and Epirus (Ephorates of Antiquities of Corinth, Achaia, Ilia, Phocis, Aitolokarnania, Preveza, Corfu and Ithaca). These sites, based on archaeological data and ancient sources, constitute starting points or stations in the movement of populations that transported goods and ideologies, within the general context of the economic, commercial and colonial process of early historical times, as well as of classical and late antiquity. Moreover, the distinctiveness of this tour is that it is based on the plot of an entire narrative, while it is formed with a network of physical and mental routes, articulating various types of ‘landscapes’. Thus, in addition to archaeological sites, such as cemeteries, sanctuaries, ancient cities and ports, it will include a wide range of information concerning architectural cultural heritage and natural environment ancient and modern. Furthermore, as well as elements of the intangible cultural heritage of the areas through which it passes will be addressed along the cultural activities of modern life such as: tours and visits to local festivities of music or food celebrations of local customs revival, and other artistic cultural events such as performances, exhibitions, sailing boat sports or navy competitions (e.g. Regatta etc.).

The following activities were scheduled to be carried out within the general framework of this project:

- to record and collate scientific documentation of selected locations, that will constitute main and secondary stops on the cultural routes, collection of cartographic data and audiovisual material, gathering information on monuments or archaeological sites located in close distance from the selected monuments on the route. This material will be fed to an *interactive digital platform*;
- to identify potential improvement works in order to beautify and enhance the surrounding area of the monuments/stations;
- to design, supply and organise the installation of information signs;
- to create the production of information material (guides/brochures) in various languages and in Braille, and to organise public information activities (e.g. seminar, periodic exhibition).

It should be noted that within the framework of the broader action of the Cultural Routes, for the implementation of the physical object of the above project, as well as for the indication

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of possible locations and monuments, a range of improvement and promotion works are going to be carried out such as: cleaning, beautification, upgrade and/or expansion of existing paths, introducing interventions at both, ancient and modern paths for improved access and security. Moreover, conservation, restoration and promotion projects are proposed to be implemented by the competent regional services and central Directorates of the Ministry of Culture, as appropriate, in selected archaeological sites and monuments related to the above thematic routes.

Methodologically, an interdisciplinary collaboration has been followed for its accomplishment consisting of scientific documentation, natural and digital technologies correlated with material and intangible heritage data, myths and facts, symbolic and imaginative interpretations that intercross between the past, the present and the future.

### **Design of a cultural route. *The Architectural Project***

The aim of the work was also to demonstrate the contribution of these cultural places and landscapes to improving the quality of life, as well as the frequency and reasons for citizens finding them worth visiting (Aravantinos, 1997). On the other hand, the recent crisis caused by the pandemic of covid-19 has prompted an unprecedented acceleration of the digital transformation of the cultural sector in most countries (UNESCO 2020). According to this, the Hellenic Ministry of Culture also issued a special invitation for the creation and distribution of digital cultural material, original or converted from existing material, aiming at the possibility of remote access in the context of finding alternative ways of cultural production and innovative means of cultural expression (YPPOA 1995-2022). Additionally, the main goal is to create a dynamic relationship between individuals who may not share the same physical space but have an interest in the same topic. Thus, the creation of an interactive digital platform in our project aims to consist of a social and communicative ‘**common place=κοινό τόπο**’ using technology with the continuous flow of information and continuous feedback, investing in participation, safety and sustainability (Micheli, 2020).

All the members, of the Project’ working group, participated in the on-site inspections at archaeological stations along the route, where the areas that required immediate rescue interventions were recorded, drafting corresponding technical reports with intervention proposals and the relevant specifications. For the implementation of the project, we contributed to the creation of the interactive map of the route and digitized archival material, while in the context of planning its promotional actions, we collaborated with co-responsible bodies and representatives of local communities. Moreover, to create an exciting cultural route, the initiation on our project includes three stages that connect man with life and with other people over time: 1) Receiving information through digital browsing of the site, 2) in-situ browsing in real time with all the possible difficulties and physical fatigue but with the opportunity of experiential participation in actions and events (e.g. in sacred places to local festivals) and 3) providing feedback from knowledge and experience associatively as well as communicating and searching for participation in subsequent actions.

Specifically, due to the context of the ‘architectural work’ regarding the architectural design, the following were specifically implemented: According to a systematic bibliographic study of the findings of the Route Stations and based on the narrative of the Project, the ‘logo’

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and the ‘informative metal signs’ of the Project were synthetically studied and digitally designed, while patterns were proposed for the creation of objects (souvenirs). As the goal is to encourage European citizens to rediscover their heritage, the ‘Architectural Synthesis’ of this project is characterized by: *Inspiration, Innovation, Exploration, Temptation for Socialization and Co-Presence*. In this way the experience should stretch throughout the entire time range, which means *before, during and after* the route. Overall, the architectural intervention concerned all stages from the idea conception to the design proposal in digital form of a complete series of architectural and construction drawings.

The design of the new information signs of the route, consists of a complete series of digital architectural and construction (detailed) plans of the basic, in totem type signs for indoor and outdoor use and two more alternative types for special cases. Specifically, their aesthetic aspect was studied and their graphic structure as well as their perspective and realistic form were designed in a color model, so as to fit into the wider landscape, proposing their placement positions at the thirty-three (33) stations in each case. Moreover, access configurations (for visitors and people with disabilities), signage, decorum and the promotion of monuments and archaeological sites were also proposed. Additionally, the design and beautification of the new main entrance area for the Heraion of Perachora at Corinthia, was studied. The architectural proposal concerns the construction of a ‘new central entrance’, of a new door with a new fence with an aesthetic upgrade of the surrounding area and the addition of a new visitor outdoor lounge with a canopy for visitors. The architectural design project includes the conception of the initial idea to digital design in a full series of architectural and construction plans as well as photorealistic presentations. For the implementation needs of the Project, market research was conducted into the type of products and construction materials. Due to the morphological aspect of every new construction of our route project concerning architectural or landscape ‘beautification’ design, the general rule focuses on the creation of a unified style, easily visible, with contemporary and innovative style. Functionally, it is necessary to have good quality of materials for resilience in outdoor exposure and to be easily informative and ergonomic for all categories of visitors.

### **Architectural Approach: The design of the route’s logo**

However, in order to encourage the development of a new type of tourism with an ethic focused on dialogue among cultures, the architectural investigation of designing the ‘Logo’ and the ‘Information Signs’ is to express the ‘meaning’ of the route according to its symbolic notion of the total narrative and the creation of a ‘new language’ with ‘new messages’.

Finally, the design of the project's logo was inspired by one of the dominant geometric motifs of ‘the spiral, founded in early historical times in ceramic art, in relation to the time period of the Geometric Age, in which our Cultural Route’ project refers to, but also to its symbolic dimension (Gadolou 2008). Considering that the Project of our Cultural Route “The Road to the West. From Homer to Cervantes” deals with the double movement of colonists: Greeks and Romans, the motif of the ‘double spiral’ that folds as a logo represents, precisely this double movement. Therefore, at first reading, the double folding form of the spiral of the logo in a symbolic and minimalistic way renders this two-way flow relationship of the movement of colonists ‘from Greece to the West and vice versa’ as well as the transfer of

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their Cultural heritage. The term “colonization” in its conventional sense is used for the founding of cities because of the organized activity of a ‘mother city’ (metropolis/mother city) under the leadership of an official founder (oikistes/oikistes). Thus, the double movement of the spiral interprets this very relationship: from the mother city to the new city-offspring, expressing a centrifugal-extroverted force and a continuous introverted folding in reverse from the new city-offspring to the mother city. With a freer interpretation, the motto of the logo could also symbolize the ‘*Nostos for the return*’ or by extension the swirling wave of the sea for this journey. Odysseus, as a mythical figure of a traveller, hero and in a sense the ‘first colonizer’, inspired the myth (especially for Nostos) with his journey to return to Ithaca (Malkin, 1998).

Equally important, however, is that fiction inspires ventures, and so the Greeks, having a perception of reality and myth, succeeded and sailed, explored, created relationships of friendship and hospitality (xenia), raided, traded and colonized the coasts beyond Ithaca in the Ionian, Adriatic and Tyrrhenian seas, while simultaneously projecting the myth into new territories, thus articulating new landscapes, genealogies and ethnicities. As historical documents, the three-legged cauldrons (*tripods*) were also votive offerings of settlers to the West to propitiate the gods for a favorable outcome of their journey. Similar ones existed in sanctuaries such as Delphi, Olympia, the sanctuary in the cave of Loizos in Ithaca and elsewhere, an event directly related to the narrative of the work ‘from Homer to Cervantes’ (Gadolou, 2013).

In a second, more expanded reading, the double movement ‘Towards and From the West’, as rendered by the ‘folded spiral with a dot’, can also be likened to a wheel (of a chariot) that runs endlessly and arduously (on rough roads, throwing up gravel), traveling through the depths of time and history, marking the constantly recurring movement of people and goods around the world, but also the ‘global phenomenon’ of population migration, which with the corresponding mixing and exchange of different views and ways of life each time ultimately contributes to the ‘osmosis’ of ideas, people, types of art and cultures, thus contributing to the ‘overall,’ social, political and cultural ‘becoming’, enriching and developing it.

### **Architectural Approach: The Design of the Information Signs**

The project includes the design and placement of information signs at the stations along the route (e.g. archaeological sites and museums) that will inform the public about the narrative of the route to each station. The project's information signs were designed in a 'totem' type, while the logo and the vertically written title of the project (which are cut out) mark and emphasize them on both sides. Their construction consists mainly of two metal sheets: a larger one (dimensions 0.49m x 1.75m) at the back and a smaller one (by 10 cm) in front, which has a wavy shape to resemble the way a postcard unfolds, to facilitate the reading by a standing or a sitting person. They are designed to be used in both cases: for outdoor spaces, on a concrete base and for indoor use in Museums, as self-supporting (see Figure 1).

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Due to the special nature of the Project, the design of the information signs has to satisfy various special cases such as: the different way and level of viewing (either from the sea or from land) so that they are easily recognizable even from afar, thus highlighting each station and its position as part of an overall Cultural Route. They can also be used as landmarks of significant intermediate stations, even in the case where the traveller does not need to go to them (e.g. their use to signify the position of important caves in the view of a traveller from the sea, sailing by boat, as they would have appeared in the eyes of a seafarer of the past) (Lynch, 1960). Specifically, the design of the information boards, according to their form and function, satisfies the following basic principles:

Morphologically, they are easily visible from sea & land (in a totem type) and are not similar nor competitive, with the existing ones found in museum and archaeological site signs -with a unified style, so as to mark on the one hand each station of the Cultural Route, as a ‘reference point’ and on the other hand its importance as a ‘part’ of a ‘wider overall tour’. They incorporate an innovative design (corrugated sheet metal that seems to unfold like a postcard) challenging the traveler-explorer to read it by additionally projecting the title and logo on both sides, while for their integration into the landscape, they are in rust-colored (‘Corten’ type).

Functionally, they are made of high-quality materials whilst manufactured to slowly wear and tear over time in outdoor exposure (e.g. severe weather). They are easy informative for all visitors (even at low level - for children and wheelchair users) and offer additional services for visually or hearing-impaired people (with Qr Code and audio listening method). Finally, they are ergonomic for all, due to their shape, proportions and the combination of vertical (covered with fine glass) and inclined reading surfaces, so that they can be read from close up and from distance.



*Figure 1: The project's information sign and logo, designed by Katraouzou Dimitra - PhD architect.*

### **Architectural approach: The design of the New Entrance and Sitting Area with Pavilion. Works to beautify and enhance the surrounding area of the Route.**

The important area of Heraion Perachora in Loutraki at Corinthia was chosen as the starting (departure) point of the maritime cultural route by sailing boat. The archaeological site takes its name to the great sanctuary of the goddess Hera Akraia that is located at the lowest point of the area, at sea level next to the old harbor (Payne, 1940).

The wider area uniquely combines the magnificent natural landscape of land and sea. The visitor who chooses to visit it by car arrives at the parking area, where the end of the road is. From that place to the top, where the archaeological site can be visited, the visitor has to walk down, along a pedestrian ramp, and pass through the existing ‘rough’ entrance. Thus, due to



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the importance of sacred landscape and in the context of the possibility of beautification works, the design project for a new entrance was carried out. The basic architectural synthesis proposes the creation of a new central entrance with a new fence and the extension of a new sitting area next to it, with a pavilion.

Furthermore, in terms of beautifying and enhancing this important stop, the main goal of the landscape architectural synthesis, is to create an unbreakable contact in consecutive stages between the visitor and the archaeological site, even when the visitor is not inside it. Thus, according to the new architectural synthesis (see Figure 2), when the visitor arrives at the height of the platform, the form of the new entrance and the image of the new fence signifies ‘*the boundary*’ between the countryside and the archaeological site and the ‘*transition*’ practically and symbolically. Both the visual escapes from the walk and towards the archaeological site, as well as the urban planning of the new sitting area (with a clear reference to the ancient roads) intensify the visitor's communication with the archaeological site as well as with other people. Visitors are informed about the route by the project's information board (of new design), which is placed centrally in the open space, while small metal cubes arranged in a spiral direction create a fluid continuity and extend the sitting area.

Moreover, the compositional proposal was not limited just to a superficial beautification of the entrance but was deepened to reflect the interconnection of the sacred space with our cultural route, by searching for a new language about the common historical time period of the narrative with the relevant archaeological findings. Given the fact that the vessels are 'spoken symbols' telling the story of the people who used them (Gadolou 2013), this strong numerical repetition of lines and spiral forms underlines the conceptual correlation between the identity of society and its symbolic representations. Specifically, the design of the facade of the new entrance enclosure came out from the decoding of specific motifs and symbols of Achaean pots of the Geometric era, not by copying them, but by decomposition and redesigning in a new '*plexus*' (πλέξη), using also proportions regarding the '*golden ratio*'. Morphologically, the whole synthesis of the new entrance fence and its surrounding landscape distribution was treated as a sculpture.

Furthermore, its construction of rusty metal strips (analogous to those of the newly



*Figure 2. The archaeological site of Heraion at Perachora-Corinthia. The design of the New Main Entrance by Katraouzou Dimitra -PhD architect.*



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designed information signs) harmoniously integrates the structure into the landscape even in the event of possible future damage from material fatigue, even in the case of lack of maintenance. The visitor, through a shaped pedestrian walkway-ramp, is directed to the archaeological site at a much lower level that ends up by the sea. After visiting the sacred site, the only way out is following the same ramp back to the (previous) area of the new main entrance.

The nearby addition of a newly designed shelter offers rest by also protecting in adverse weather conditions (like wind, rain or hot summer sunshine). Its characteristic cubic form creates a frame from where the visitor's gaze (like a photographic lens), focuses with contemplation on the unique landscape of the wider natural and mainly cultural environment.

Finally, the design of the facade of the new entrance as a ‘*striped barcode*’ of the architectural form works associatively to the visitor by transmitting the rhythmic pulse of the sacred space, even when he has left, while the knowledge acquired may continue to be fed back through the interactive platform. Upon leaving, the visitor should have experienced the place's code, felt the rhythm of history as well as the identity of the sacred cultural landscape.

## Conclusions

Memory has always been a contributing factor in the analytical and synthetic design process. From a local point of view, the open public spaces from ancient times until today are places of gathering and communication for citizens, an interface 'network' of exchange and expression of ideas, a 'political scene'. From a global point of view, according to Greek history, since ancient times, communication networks have been formed, both economically by the movement of goods through trade and culturally and socially by the exchange of ideas and social contact by the movement of people-travellers.

Nowadays, digital technologies and social networks have opened ‘new routes’ not only for information, searching and browsing, but also for communication by a multiple cultural interface.

This paper refers to the positive way in which the gifts of nature and history can be exploited to the maximum extent possible to constitute a natural, economic, historical and mainly tourist resource, that will familiarize citizens with both local and global cultural heritage, as well as strengthening the relationship between them. In particular, the modern cultural traveller has the opportunity to acquire valuable knowledge that is integrated into a broader game of browsing and gaining experiences of various cultural activities, combining creative exploration with education and entertainment, from antiquity to the present day.

The aim of the architectural research is also to demonstrate the contribution of these cultural sites and landscapes to improving the quality of life of citizens. By highlighting and redesigning them it is anticipated to make their integration into modern life more familiar and attractive so that citizens find them worth visiting.

Conclusively, the “identity” of Cultural Routes focuses on highlighting the physiognomy of the “diversity” of the urban and digital cultural landscape with the sense of “political viability” thus enabling the traveller to reproduce some kind of “collective end” - the model of “co-presence”.

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Similarly, the initiated “world traveller”, following in the “footsteps” of the mythical traveller Odysseus, will discover that what is ultimately worthwhile is “the journey”.

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- Figure 1. Photo (2025). Design of the project’s logo and information sign /for indoor use (by Katraouzou Dimitra)
- Figure 2. Plan of the elevation of the New Entrance in the context of the landscape (by Katraouzou Dimitra)

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# SUPPORTING ARCHITECTURAL EDUCATION THROUGH PARTICIPATORY LANDSCAPE MAPPING USING CROWDSOURCING AND GIS

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## Abstract

A web application for participatory urban landscape mapping was introduced in the educational process of the Schools of Civil Engineering and Architecture of NTUA. Using the application students were encouraged to document their perceptions of the landscapes in which they live. Student participations also included introductory lectures, independent-voluntary landscape evaluation by students, and feedback sessions together with educators. Participants created a dynamic and evolving landscape map merging spatial and qualitative data and participated in interviews and answered questionnaires to evaluate their participation.

The results investigated the application's impact in three distinct areas. Educationally, evaluating how its modernization of teacher-student interaction enhanced architectural education and helped students embrace architectural and landscape related education. Socially, by evaluating the effect of integrating interactive digital tools that allow democratic social participation in education and whether it managed to engage students in meaningful discussions and critical thinking about urban landscape quality. Scientifically, by yielding valuable data for analyzing architectural styles, urban typologies, and public perceptions thereof, supporting further research in the interfaces of the technology of crowdsourcing, Geographic Information Systems (GIS), mobile development, and studies in the area of culture and humanities. In the later stages of the research, preliminary insights and observations were also made on matters of expanding participant inclusion to citizens and to other European countries and its inferences for future research,

By bridging academia and society, the present research improved student's perception regarding architectural education, catalyzed scientific discussion on urban landscape quality, encouraged collective responsibility for improving public spaces and led to the observation of trends regarding the perception of architecture and landscape by the public. The presentation further summarizes the project's achievements, methodology, and implications for architectural education and research, in the context of urban landscape sustainability and its determinant natural and socio- cultural factors.

**Key words:** Landscape, Architecture, Education, Participatory, Democratic, Crowdsourcing, Mapping

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### TRIKALA CITY CENTER

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#### Abstract

It is commonly accepted that in the contemporary city the ground and landscape in general is conceived as a thermostat. Just as the thermostat adjusts the temperature within a system by controlling the flow of heat in order to preserve the system's temperature, so the green or nature is seen as hedge against the negative environmental and aesthetical effects of the economic and cultural activities taking place within the contemporary city. The urban discontent is usually paused by enclaves of green natural pleasures.

Against that attitude and this thermostatic function, we present our project (under construction) for the transformation of the two central squares of the city of Trikala and the area in-between as a strategy of composing the public space and the urban landscape as a continuous flow not as an enclaved oasis.

That is to say, the paradox of a de-territorialized territory. The ambition of the project is to intervene and re-shape the landscape of the city center of Trikala not by finding an ideal analogy between natural/artificial. If anything, the plan tries to acknowledge the contradiction between natural and artificial as one single formal component, immanent to the city, that is, the landscape itself.

**Key words:** public space, contemporary city, landscape, Trikala

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# **AN IMPORTANT URBAN RESEARCH PROPOSAL: ADULT EDUCATION FOR SUSTAINABILITY IN THE CONTEMPORARY URBAN LANDSCAPE: THE MEANING OF LIFELONG ACTION THROUGH SUSTAINABLE URBAN COMMUNITIES**

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## **Abstract**

The proposed research aims to explore the ways in which Adult Education for Sustainability will be integrated into the contemporary Urban Landscape. The key question is, how an effective Formal Adult Educator Training, as well as a Non-Formal Adult Education, should be structured through organized educational programs, actions, communication policy and educational strategy to trigger a transformative way of thinking and acting, resulting in the creation of Sustainable Urban Communities and their Lifelong Action, in the urban landscape.

More specifically, in the field of Adult Education for Sustainability, the study is linked to the need to recognise the importance of the environmental and social limits within which human activity in cities needs to be confined. Regarding the second field of knowledge, the research will be focused on changing the current individual beliefs, habits and actions of citizens as units, towards a collective transformation of Lifelong Action, through organizing themselves into Sustainable Urban Communities.

The research will be conducted in the urban network of Athens as it alternates between characteristic nodes of the Attic Metro, in order to explore the needs of specific target populations and to pursue the desired outcomes.

**Key words:** Formal & Non-Formal Adult Education for Sustainability, Lifelong Action, Sustainable Urban Adult Education Communities.

## **Introduction**

Today, there's an enormous need for citizens to recognise the importance of the environmental and social limits within which human activity in cities must be contained. Science has already demonstrated the need to limit the temperature increase from human activity to 1.5o Celsius by 2030 in order to survive on Earth. To achieve it, the UN's agenda of 17 Sustainable Development Goals must be implemented in every corner of the world. But it is not easy to rationalize the truth to change the deep and unconscious consumption habits that drive human actions in today's globalized conditions. Nor is it easy to implement prohibitive measures, laws and policies that would restrict individual freedom through democratic processes when citizens themselves are not ready for such radical changes in their way of life (Orr, 2004).

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The general problematic of this proposal is the study, research and evaluation of adult education in both formal and non-formal contexts. Its character is interdisciplinary. It will move in the cognitive domain of two disciplines of adult education a) on sustainability and b) its lifelong action through the organization of sustainable urban communities. Particularly, in the field of adult education for sustainability, the study is linked to the need to recognize the importance of the environmental and social limits within which human activity in cities must be confined. In relation to the second area of knowledge, research will be concerned with changing the current individual beliefs, habits and actions of citizens as units towards a collective transformation of lifelong action through their organization into Sustainable Urban Communities.

### **Adult Education for Sustainability**

Izabel Rimanoczy (2021) proposes as a necessary precondition for this change the transformation of values, perceptions and beliefs towards a sustainable way of thinking and therefore acting for modern society, which will be achieved not only by taking into account the magnitude of the destruction the planet is experiencing, but by achieving 'a broad understanding of the revelations of the ecosystem, through social awareness and an intimate focus on personal values and the higher self, expressed through action for the common good. Such change is intimate and is reflected in several approaches that need to be developed at both individual and collective levels: ecological worldview, systems thinking, and emotional and spiritual intelligence.

The ecological worldview is a unifying perspective on reality that guides individuals in analyzing information and making decisions, taking into account aspects of environmental and social interconnectedness (Weber, 2010). This way of thinking might result in negative emotions such as fear, anxiety, despair, but also positive ones such as hope, enthusiasm, confidence, compassion. The ecological worldview is empowering and promotes awareness of the individual's role, as it activates the capacity to respond and the ability to choose behavior that has a positive impact (Barnes, 2013).

Cultivating relationships between people and places involves the notion that people are one and related to nature. Although today's citizens are not born into communities where such an understanding is a lived practice, there is a strong need for it. Without seeing it as a conscious process, redefining the relationship between humans and nature could mean seeing a connection to nature as embedded in it, and nature as embedded in humans. Rather than being emancipated and separated from nature, humans can reconnect with the city's natural environment (Horn & Hausdoerffer, 2017). As a way of connecting with it and reflecting on its wisdom, human actions could be relocated on guided tours in green open spaces, engaging with different senses, connecting with non-human beings and seeking inspiration from nature. Such exercises would provide an opportunity to stop, read and reflect on alternative ways of knowing that brings wisdom to their daily lives (Benyus, 1997). Human-nature values could get engaged with the idea and metaphor of connection with nature, through creative experimentation in which citizens could connect, get inspired and express their emotions on a personal level but also to get to know each other while connecting to the theme of human-nature relations.



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The systems approach, on the other hand, helps to examine the interactions between different systems, their mutual influences and feedback loops, while feeding into the short- and long-term thinking that is equally necessary for sustainable decision-making (Capra & Luisi, 2014). As an alternative to polarization, the system's perspective focuses on non-binary thinking, leading to inclusive decisions that respect people and ecosystems, the present and the future. Moreover, systems processes encourage consideration of natural cycles, something societies today neglect, because they rely on linear thinking, with linear growth targets (e.g. GDP) that do not respond to the planet's finite resources and focus on control rather than adaptive resilience (Rowarth, 2018).

To cultivate this mindset, embodiment is a state in which new meanings, relationships, and understandings of self are developed through the connection of body, mind, heart, and imagination (Sipos et al, 2008). Embodied practices are practices that engage cognitive and embodied knowledge and nurture the body and mind in a simultaneous and synergistic way and in addition, create spaces of connection and expression beyond words. Participating in skill-building activities that are designed and curated around the idea that the body and mind are not separate entities, but an integrated and interconnected whole, can offer opportunities for deep connection with self, others and nature (Richmond & Snowber, 2019). For example, daily lessons could be encouraged, starting with an embodied knowledge session in a park, through movement exercises based on play or dance, or with workouts such as walking, stopping and running, and finally becoming aware of the space around oneself. Another embodied approach could be sensory walks, such as guided tours, which provide an opportunity to explore the specific area through the lens of a sense (e.g. auditory, visual, taste and smell). Playful learning also involves getting into a playful state of mind. Through play, people open up a way of breaking through cognitive biases and using other ways of knowing, acting and being.

The development of emotional intelligence is also challenging individuals to rethink the pace and speed of their behaviors, which tend to adapt to today's expectation of quick reactions, while decisions are made without adequate consideration of environmental and social impacts (Argyris & Schon, 1974; Goleman, 1995). Contemporary cultural values such as independence and autonomy, competition, comfort and wealth, while reinforcing individual identity, are an obstacle to sustainability. Finally, in order to develop a more sustainable mindset, individuals need to free themselves from limiting beliefs that prevent them from developing their full innovative and creative potential, which is of paramount importance in developing sustainable solutions (Nemeth & Oliver, 2017).

Getting to know the world in other ways, such as through imagination, creativity, intuition, sensations and emotions, is now a priority beyond the use of uninhibited scientific knowledge. Arts and science approaches are potential interdisciplinary methods for engaging and working with different habits of knowing in an open, collaborative and creative way. Art has the capacity to create learning spaces that help expand people's imagination for a regenerative, just and peaceful present and future. In these learning spaces, citizens can imagine and develop interventions and transform everyday situations. Such approaches provide a tangible experience and conceptual understanding of interdisciplinarity and how to explore broadening horizons for addressing environmental challenges. It could include a theoretical lecture on interdisciplinarity, as well as different interdisciplinary approaches to

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imagining and co-creating just sustainable, healthy futures that promote a sense of belonging. (Kokkos, 2021).

In fostering emotional intelligence in societal change, stories can play an important role as they function like magnifying glasses that help us to make sense of and learn from a complex past and present (Grummell & Finnegan, 2022). A crucial aspect is their use of metaphors. Metaphors create meaning, images, emotions, values, and judgements about what is true and possible. Stories can become the windows into other worlds and lives, revealing hidden perspectives and illustrating the challenges others are currently facing while creating empathy and connection. They can illuminate future possibilities and thus support the creation of meaning, agency, and direction. As a way to reflect on understanding wisdom, storytelling sessions lead the group to get to know each other while connecting to the theme.

Finally, the spiritual intelligence approach aims at reunification with nature, a concept that is not acquired intellectually, but through actual experience. However, these are simple experiences, available to anyone at any time, without purpose, that bring a new perspective to peoples' thinking, influencing their choices and the way they relate to the natural resources on which they tend to depend (Zohar, 2012). Empathy, a term used to describe contemplative practices of all kinds, invites individuals to focus on the inner dimensions, the silent self, tuning out the noise and distractions and connecting with their intuitive and ancestral wisdom. As individuals, human beings move from automatic and reactive behaviors to more conscious, purposeful and directed ones, they give new meaning to their self-realization and bring out the best of what they have for the sustainability of the planet (Scharmer, 2009).

Exploring and connecting to one's inner capacities and most important values is a powerful and effective way of building empowerment and leadership. Creating spaces where citizens can explore the values that underpin their actions and where they can deepen their sense of meaning, can be highly empowering and can strengthen their commitment to regenerative urban futures. Across different cultures and geographical contexts people value the relationships that ensure cooperation and protection of the natural world and that it is a matter of making these values salient and bringing them into practice. Discovering and cultivating the values that inform and motivate people can help establish ethical, responsible, and caring relationships within and beyond their neighborhood. Working in small groups on personal moments of deep insight and intuition that changed their course of action in the past, or sharing experiences when they felt that their purpose was aligned with their actions could help identify useful tools and practices to invite wisdom into daily decisions.

### **Urban Sustainable Communities and the Circle of Lifelong Action for Sustainability**

The Urban Sustainable Community could be developed as a space for expression and action, through collective change and individual approaches, to achieve a sustainable way of thinking and acting locally. Recent research has shown that there is widespread public support for bolder action to protect the planet, despite prevailing perceptions that citizens are less likely to act, or that the burden of action falls disproportionately on the less well-off, discouraging their participation. Changing the narrative to one of widespread public support, and telling stories of communities that have taken action, is more likely to inspire citizens to take concrete action to reduce inequalities and build social trust, thereby promoting widespread public

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support for urgent and bolder action for the planet that supports the well-being of all (Chamberlin, 2009).

Building lasting alliances through the creation of local sustainable urban communities requires patient work to build common understanding, trust and partnerships. New ways of thinking and acting often require explaining the same thing over and over again. On the tactical side, it requires a deeper understanding of who the key people are, who can influence political processes and who can often be barriers to progress. It is important that adult educators engage using a variety of approaches and tools, as mentioned above. Working with local actors and civil servants to support lifelong learning requires the integration of systems thinking into public administration and policy making so that they are better equipped to address interrelated societal challenges. Policies should not be something that governments impose on citizens and that only politicians talk about. There should be more support and education for every citizen to participate actively in policy making (Vandenabeele, Schreiber-Barsch, Finnegan 2024). Therefore, it is the education of citizens in a culture of lifelong action that will gradually lead them to active participation and active citizenship.

The research will attempt to apply the idea of a cycle that promotes the regeneration of lifelong action in the urban environment. This cycle aims to be renewed and revitalized by the citizens themselves, who, by changing roles throughout the process, actively participate in the transformation, both individually and of the city. In the first step of the cycle, the neighbors of a place commit themselves to how they will create the community forest, a reference point in which they will cultivate their individual and collective consciousness. Its creation is intended to encourage further experimentation in the neighborhood to implement sustainable solutions. The second step involves cultivating connections with the natural environment at an individual level, bringing the local population together through reflection and finding meaning in the daily life of the community. In the third step, non-formal lifelong learning, which promotes critical reflection and dialogue, is used to transform established beliefs and strengthen collective sustainable thinking. The fourth step for the neighborhood is a commitment to collective action by transferring the knowledge gained to the next neighborhood, ensuring continuity of lifelong action for sustainability across the city.

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### Working case - Objectives

Individual research objectives will be set:

- In the first phase, to study and review the current international literature and research on Adult Education for Sustainability in the Urban Landscape as it has been reflected in contemporary societies.
- To study the current situation in Greece regarding the existence of organized actions, activities, educational programs concerning Adult Education for Sustainability in the Urban Landscape and to present the typology of these programs and activities.
- To draw conclusions about the needs and expectations of adults to ensure a sustainable future in the Greek urban landscape.
- To identify the obstacles that constitute a barrier to the adult learning process, both towards an individual sustainable transformation and towards a collective lifelong action transformation, and to propose ways to remove these obstacles.
- The study and presentation of contemporary educational theories of adult education (with particular emphasis on transformative learning, critical reflection) and their potential for creative application in adult education for sustainability in the Greek urban landscape.
- In relation to the previous objective, to propose appropriate pedagogical techniques and tools to facilitate learning.
- The study of case studies and good practices in the organization, implementation and application of formal and non-formal education programs for Adult Education for Sustainability and Lifelong Action in urban landscapes worldwide.

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- The potential contribution and use of digital technologies, modern and asynchronous tele-education in the effort to broaden the way citizens organize themselves in sustainable urban communities.
- The presentation of the necessary and specialized knowledge and skills that Adult Educators for Sustainability and Lifelong Action need to possess in order to be able to fulfil their task.

In particular, the role of training adult educators in the creation of sustainable urban communities and their lifelong action in the urban landscape will be explored:

- In formal training and certification of adult educators for urban sustainability and lifelong action.
- In non-formal education, focusing on the organization and implementation of face-to-face and online training programs on the creation of sustainable urban communities and their lifelong action, through research-action.
- In informal learning, through actions within the urban fabric that contribute to collective Lifelong Action for the city.

### Research methodology

The research aims to change the current individual beliefs, habits and actions of citizens to search for internal contradictions and gaps in a system of thought (or discourse) and push these contradictions to the point where something different emerges, so that they can begin to see where possibilities for change might lie and where they might take action (Kearins & Springett, 2003). To construct qualitative research 'with people' rather than 'for people' requires theoretical and methodological creativity. The focus cannot therefore be on data collection, but on stimulating and encouraging collective and critical knowledge production with participants. Collaborative action research requires different ways of approaching it, through criteria of validity, reliability, ethics and quality, based on the researcher's ability to truly respond to what is learned through dialogue. Aiming to explore the ways in which Adult Education for Sustainability is integrated into the contemporary urban landscape, the research will be conducted in the urban network of Athens as it alternates between characteristic nodes of the Attic Metro, in order to explore the needs of specific target populations and to pursue the desired outcomes.

### Research Tools

#### 1<sup>st</sup> Stage: Creating Community Forests at Metro Stations

Areas of trees, called "community forests", will be created at indicative metro stations. Inside, passengers will be able to walk around the space, creating sensory connections with the natural environment that is missing in their area. Using QR codes located along the route, passengers will be able to enter links on their smartphones, either through story examples or through exploratory questionnaires, to indicate their willingness to regenerate and green their neighborhood, as well as the place where they would like to be active.



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### 2<sup>nd</sup> Stage: Empowering Urban Communities for Sustainable Regeneration

From the 1st stage, samples of the population will be taken in different locations to form the first groups of adult learners. They are the ones who, in the second phase, will actively participate in a non-formal training course on the role of sustainability in the daily life of the city and the results that can be achieved through collective action.

The main objective is to increase the positive and active participation of citizens in creating a sustainable future in their local community, based on the shared values they will co-create (Suzuki, 2007).

The training will be followed by second action-research of the groups in their respective neighborhoods. The trainees will be asked to carry out a sustainability action through awareness-raising and action by local collectives, first at the level of the apartment building and then at the level of the neighborhood. From the groups formed, conclusions will be drawn, adapted to local needs, and problem-solving efforts will be carried out, with the aim of transforming the habits that lead to unsustainable practices in the daily lives of citizens.

### 3<sup>rd</sup> Stage: Creating Community Forests - Fostering Sustainable Urban Engagement

In a third stage, the "sustainable urban communities" that will emerge through collective processes will claim the creation of their Community Forest, a reference point in the neighborhood for the further development of a sustainable culture that will have a multiplier effect on the wider area. The Community Forest will be studied as a research tool within which to carry out processes of connecting the different populations that make up the urban landscape and interacting with local actors, forming the basis for direct participation in the management of public space. The main objective is to enhance the positive and active participation of citizens in the creation of a sustainable future in their local community, based on the shared values they will co-construct.

The non-formal educational material will help the citizens of the communities to address social cohesion AND environmental challenges; to carry out projects and implement their inclusive democratic participation; to support teachers in new key competences so that a new curriculum can be created from all the research and intercultural knowledge can be co-constructed. At the end of the three phases of research, pedagogical material will be collected to formulate formal training of sustainability educators to become key relays in the non-formal training of local cooperating teachers in the field of social sciences/citizenship.

### **Desirable outcomes**

The success of the whole project would be considered as its continuing character through a cyclical renewal of adult education for sustainability and especially of Citizens' Lifelong Action in the urban landscape. The research will attempt to theorize this desirable circularity through **the circle of lifelong action for sustainability**.

In conclusion, there is urgent need for formal training of adult educators for sustainability to be built up. They will be the leaders for a Non-Formal Education of the citizens through organized educational programs and actions, building a communication policy and educational strategy that will trigger a transformative way of thinking and acting and finally, resulting in the creation of Sustainable Urban Communities and their Lifelong Action, in the



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urban landscape. In order to carry out the research, key stakeholders must be contacted, and resources have to be raised, in order to implement the project in the most efficient way. The expected results may be able to provide the impetus to overcome the current difficulties in adopting sustainable practices in the city.

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# **AN IMPORTANT URBAN RESEARCH PROPOSAL: ADULT EDUCATION FOR SUSTAINABILITY IN THE CONTEMPORARY URBAN LANDSCAPE: THE MEANING OF LIFELONG ACTION THROUGH SUSTAINABLE URBAN COMMUNITIES**

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## **Abstract**

The proposed research aims to explore the ways in which Adult Education for Sustainability will be integrated into the contemporary Urban Landscape. The key question is, how an effective Formal Adult Educator Training, as well as a Non-Formal Adult Education, should be structured through organized educational programs, actions, communication policy and educational strategy to trigger a transformative way of thinking and acting, resulting in the creation of Sustainable Urban Communities and their Lifelong Action, in the urban landscape.

More specifically, in the field of Adult Education for Sustainability, the study is linked to the need to recognise the importance of the environmental and social limits within which human activity in cities needs to be confined. Regarding the second field of knowledge, the research will be focused on changing the current individual beliefs, habits and actions of citizens as units, towards a collective transformation of Lifelong Action, through organizing themselves into Sustainable Urban Communities.

The research will be conducted in the urban network of Athens as it alternates between characteristic nodes of the Attic Metro, in order to explore the needs of specific target populations and to pursue the desired outcomes.

**Key words:** Formal & Non-Formal Adult Education for Sustainability, Lifelong Action, Sustainable Urban, Adult Education Communities.

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### **URBAN PLANNING IN A PROCESS RE- CONSIDERATION AND RE-EXAMINATION.A CASE STUDY THE MUNICIPALITY OF LARISSA, THESSALY, GREECE.**

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#### **Abstract**

Urban planning is a technical and political process concerned with the use of land and design of the urban environment, including air, water, and the infrastructure passing into and out of urban areas such as transportation and distribution networks. In theory, urban planning is a process of elaborating solutions that aim both to improve or re-qualify an existing urban area, as well as to create a new urbanization in a given region. As a discipline and as a method of action, urban planning deals with the processes of production, structuring and appropriation of urban space. In this sense, its main objective is to point out what measures should be taken to improve the quality of life of the inhabitants, including matters such as transport, security, access opportunities and even interaction with the natural environment.

However, nowadays, urban planning has to deal, interact and include issues and elaborate solutions derived from other categories of planning, such as those of civil protection, climate change, accessibility and investment plans, etc.. This is a great challenge of urban planning as well as the citizens of every city involved in. Larissa realized the above “great challenge” in September 2023 when the phenomenon Daniel took place. Nowadays, the city is in the process of reconsidering its urban planning taking into consideration the different issues raised by both climate change as well as sustainability, which includes cultural, economic, environmental, political and social parameters. In this context, the paper deals with the case of Larissa in relation to the above considerations and presents areas of co-existence, complementarity and conflict among different categories of planning.

**Key words:**Climate change, Municipality of Larissa, Sustainability, Urban planning

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### **RE- PLANNING AND RE- DESIGNING THE LARISSA’ S LANDSCAPE INCORPORATING PARAMETERS OF NATURAL AND SOCIO- CULTURAL SUSTAINABILITY**

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#### **Abstract**

Urban sustainability is “an adaptive process of facilitating and maintaining a virtual cycle between ecosystem services and human well-being through concerted ecological, economic, and social actions in response to changes within and beyond the urban landscape”. Urban structures are complex systems, bringing communities and the environment in a living, continuously evolving setting. They are social, cultural and economic centres, embedded in the regions surrounding them. Despite these commonalities, each city and town in Europe is unique. They have unique features developed through history, shaped by their geography, inhabitants and socio-political systems. Consequently, the challenges faced by cities vary significantly. Some cities face ageing or shrinking populations, whereas others are growing.

Most urban structures have been inhabited over centuries and their streets, neighbourhoods and buildings reflect this heritage. The existing infrastructure partly determines how fast we can replace the building stock or retrofit the existing buildings or create new transport options. Achieving sustainability in these cases requires careful considerations. The goal towards urban sustainability and its impact on landscape needs to cater to each city’s unique set of characteristics as well as challenges, as well as issues of circularity, resilience and inclusivity. In addition, parameters of a low-carbon, green and healthy city should be also incorporated.

In this context, the paper discusses the goal of developing a sustainable urban landscape for the city of Larissa, the 5<sup>th</sup> largest Greek city elaborating ideas and highlighting factors of natural and socio- cultural content that will contribute to the above goal. As a final result a conceptual framework will be created which will help the city re-plan and re-design.

**Key words:** Landscape, Municipality of Larissa, Sustainability, Urban planning

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### **Special session: COST ACTION 22124 ECO4ALL**

## **ECO4ALL FOR CONSUMER PROTECTION THROUGH CIRCULAR ECONOMY STRATEGIES – THE CONTRIBUTION TO SUSTAINABLE DEVELOPMENT**

Carrying out sustainable development goals by 2030, especially focusing on sustainable consumption, represents a collective priority in today’s society, but significant regional differences within the EU and globally. In this context, the transition to the circular economy (CE) brings a significant paradigm shift in modern sustainability strategies, especially in the area of consumer protection and the development of sustainable practices. ECO4ALL action responds to these challenges by encouraging regional and international cooperation to improve sustainable consumption and consumer protection, thereby contributing to the achievement of sustainable development goals and creating a circular economy that serves the interests of all participants in society. ECO4ALL particularly emphasizes producer responsibility in the product design and marketing stages, thereby encouraging consumer protection through the strategies of reducing, reusing, and repairing products.

The special session will focus on circular economy (CE) strategies that can improve consumer protection, reduce environmental risks, promote resource efficiency, and alleviate inefficient use. One of the key aspects of this session will be a discussion on how the proactive role of consumers can contribute to the full circularity of the process, through inclusive participation in every step of sustainable development, and advocating for stronger regulatory frameworks that encourage circular practices. ECO4ALL thereby complements existing EU policies, which are focused on the ecological and productive aspects of the circular economy, expanding the focus on social and consumer dimensions.

The key topics of the present Session are the following:

- The Role of Circular Economy in Achieving the 2030 Sustainable Development Goals
- Circular Economy Strategies for Sustainable Resource Management
- Consumer Protection through Product Lifecycle Extension through Reducing, Reusing, and Repairing
- Circular Economy as a Tool for Sustainable Consumption
- Enhancing Cross-border Cooperation for Circular Economy Success
- Policy Frameworks for Regional Development and Their Impact on Circular Economy Adoption
- The Socio-Economic Impacts of Circular Economy Practices on Consumer Rights
- Overcoming Barriers to Circular Economy Implementation in Different Regions
- Cross-sector Collaboration for Promoting Circular Economy in Consumer Markets
- Education and Awareness for Sustainable Consumption

### **Acknowledgments**

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### **CIRCULAR ECONOMY AS A STRATEGIC IMPERATIVE FOR FOSTERING SUSTAINABILITY AND CONSUMER ENGAGEMENT**

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#### **Abstract**

In contemporary society, the idea of a circular economy plays a crucial role in achieving sustainable development goals. It promotes efficient resource use, enabling reuse and recycling instead of single-use. It is based on economic systems and business models that replace the linear model with alternative approaches such as reducing, reusing, and repairing. As consumer needs become more complex and technologies advance, it is necessary to focus on circular strategies that enable responsible resource management and strengthen consumer awareness. This paper aims to identify barriers to implementing circular strategies by analyzing consumer education and the relationship between systems, needs, and opportunities, focusing on the local specificities of the countries involved in the COST Eco4All action. The research includes data from 30 countries collected through surveys. The results will be processed through statistical analyses to identify differences in barriers and opportunities between these countries, providing insights for creating more effective circular strategies at regional and national levels. The paper highlights the importance of consumers as catalysts for circular transformation, whose protection and engagement have a fundamental impact on the success of this concept.

**Keywords:** Circular economy, Customer, Strategies, Barriers, Sustainable development

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### Introduction

In today's world, the circular economy (CE) is recognized as a fundamental concept. Increasing concerns over rising resource consumption have prompted both governments and companies to adopt circular models. These models not only help alleviate resource scarcity but also serve as a source of innovation and economic development (Alves et al., 2022). This concept has gained global significance as it addresses the issues of diminishing resources and the environmental challenges posed by the current linear economic model. It also encourages active consumer protection and education (WHO, 2018).

Therefore, to promote sustainability and effective resource management, the circular economy has emerged as an innovative approach that links industries, governments, and consumers (Brydges, 2021). It provides solutions for more efficient material use and recycling within industries while promoting policies encouraging sustainable economic growth at the government level (Alves et al., 2022). Additionally, it empowers consumers to adopt more responsible habits, engage in product reuse, and support circular business models (Jain et al., 2018; Geiger, 2018).

This concept encompasses various aspects, including adapting business models, redesigning products, and promoting responsible resource use. Of particular importance is the involvement of consumers in this process by raising awareness of the importance of circular models, educating them about sustainable practices such as recycling and reuse, and providing information about consumer rights in the context of the circular economy (Stumpf et al., 2021).

The circular economy provides numerous benefits but presents some challenges for consumers. This model operates on principles of "make-use-return" or "take-make-use" with the goal of reducing waste production. As a result, it has distinct implications for consumers (Schaik, & Klundert, 2001; Elisha, 2020). In this context, consumer protection involves ensuring that products are safe, durable, and designed for repair or reuse. To successfully implement this concept, companies need to undergo structural changes while also fostering informed consumers who comprehend the principles of circular business. This approach ultimately contributes to sustainable development as a whole (Lewandowski, 2016).

The concept of a circular economy has been extensively studied, particularly regarding general sustainable development and waste reduction strategies. However, significant research gaps exist in understanding the specific aspects of its implementation at the international level, especially when considering countries' local specificities. Most existing research focuses on macroeconomic policies, technological innovations, and industrial models, while there is relatively little emphasis on the interaction between consumer education and their specific needs. Further analysis is needed to understand how education and environmental awareness can overcome barriers to implementing a circular economy and adapt circular strategies to various socio-economic and cultural contexts. In this sense, this paper seeks to fill existing gaps through the analysis of three key research questions:

**RQ1:** How does work experience influence the perception of personnel, organizational, and financial barriers in managing a circular value chain?

**RQ2:** How does work experience influence the perception of institutional and infrastructural barriers to implementing the circular economy?

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**RQ3:** How does the country of origin influence the perception of institutional barriers, such as the absence or low level of financial incentives and the effectiveness of recycling laws?

Hence, this research aims to examine how strategic planning and management can contribute to a more efficient application of circular economy principles, emphasizing overcoming key barriers, such as personnel, organizational and financial obstacles, and institutional, infrastructural, and legal challenges. The research will also analyze how these barriers affect the strengthening of environmental awareness and active engagement of consumers, as well as the challenges associated with implementing circular strategies that must be adapted to local socio-economic and cultural specificities in the countries involved in the COST action Eco4All.

### Literature review

The circular economy is an alternative to the traditional linear economy, which relies on the "take-use-throw" model by promoting a pattern of reducing, reusing, and repairing (Özkan et al., 2020). In a circular economy, resources are kept in use for as long as possible to maximize their value. Once products and materials have served their purpose, they are returned and reused instead of being discarded (Morgan & Mitchell, 2015). According to Erkman (2001), when a product reaches the end of its life cycle, its materials tend to be retained within the economic system wherever feasible. In this way, materials can be reused, thereby continuously creating additional value.

The circular economy, as a sustainable approach, aims to reduce the negative effects of the linear economy by building long-term resilience in business and economic circumstances while providing significant environmental and social benefits (Alves et al., 2022). This model is gaining importance in developing countries and developed economies, supporting various sectors such as industry, tourism, and services. The focus is on reducing waste at all stages of the production process, from design to disposal, which not only improves sustainability but also contributes to closing the supply chain loop (Hartley et al., 2020).

According to Bocken et al. (2016), strategies play a key role in implementing circular approaches, enabling organizations to extend the life of products, reduce waste, and use resources efficiently. Well-designed strategies promote economic and environmental benefits and raise awareness of circular practices through the engagement of consumers and other relevant stakeholders. Hence, strategic management in the circular economy is a key factor for achieving sustainability and encouraging consumers' active participation.

Innovative models, driven by digital technologies, rely on close cooperation with customers, mass personalization, and sharing and collaborative economy principles. They accelerate the transition to a circular economy and encourage resource optimization, making the European economy less dependent on primary raw materials (European Commission, 2020).

The European Commission (2020) proposes changes to the law on consumer protection in the EU to encourage greater consumer participation in the circular economy. These changes aim to provide consumers at the point of sale with reliable and relevant information about products, including their lifespan, as well as the availability of repair services, spare parts, and

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repair manuals. Also, companies and consumers can jointly analyze the end of product life, focusing on recycling, repairing, and reusing options (Islam et al., 2021).

Consumer behaviour plays a significant role in the success of companies that apply circular principles in their business (Parajuly et al., 2020). According to Islam et al. (2021), consumer behaviour research can help companies find appropriate methods to improve aspects of the circular economy that will serve consumers through their consumption and raise awareness about disposal, recycling, and repair. Active participation of end consumers is a key factor in the transition to a circular economy, as it influences the demand for products that support this model. This includes durable, high-quality, and repairable products, as well as those that can be reused, recycled, remanufactured, repaired, or resold, and products that can be shared (Shevchenko et al., 2023).

### Methodology

This paper presents the results of a survey conducted within the COST Action CA22124 - ECO4ALL framework, in which representatives from 30 countries participated. A total of 165 respondents were surveyed, which provides a significant basis for analysis. The survey aimed to collect data on the role of consumers in circular practices, with a particular focus on activities such as waste reduction, reuse, and product repair. Conducted through a structured online questionnaire, the survey highlighted the importance of empowering consumers by informing them about their rights, obligations, and opportunities in the context of a circular economy. In addition, their impact on creating business policies and strategies was analyzed. The data obtained serve as a basis for quantitative analysis and formulating recommendations for improving public policies at the national and European levels.

Before proceeding to a detailed demographic analysis of the respondents, the measuring instrument's reliability was checked. The calculated value of Cronbach's  $\alpha$  coefficient for the entire data set was 0.978, indicating an extremely high level of reliability of the instrument. These results confirm that the measuring instrument is adequate for assessing the selected parameters and provides justification for continuing the research with a more detailed analysis of the data. This provided a stable basis for interpreting demographics and other relevant aspects, further contributing to the conclusions' relevance and significance.

### Data Analysis and Results

After data collection and initial analysis were completed, incomplete responses were eliminated from the sample, resulting in a final set of 165 valid questionnaires. Table 1 shows the demographic characteristics of the respondents.

**Table 1: Demographics profile of respondents**

| Measure       | Item    | %    |
|---------------|---------|------|
| <b>Gender</b> | Male    | 34.5 |
|               | Female  | 65.5 |
| <b>Age</b>    | 18 - 30 | 25.5 |
|               | 31 - 40 | 24.8 |
|               | 41 - 50 | 30.3 |

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|                                    |                             |      |
|------------------------------------|-----------------------------|------|
|                                    | 51 - 60                     | 14.5 |
|                                    | 61 - 65                     | 0.6  |
|                                    | 65+                         | 4.2  |
| <b>The level of education</b>      | High school diploma or less | 6.1  |
|                                    | Higher school               | 7.9  |
|                                    | Basic academic studies      | 9.1  |
|                                    | Master studies              | 16.4 |
|                                    | Doctoral studies            | 60.6 |
| <b>Years of working experience</b> | none                        | 3.6  |
|                                    | up to a year                | 6.7  |
|                                    | from 1 to 5 years           | 17.6 |
|                                    | from 6 to 10 years          | 8.5  |
|                                    | from 11 to 20 years         | 30.3 |
|                                    | from 21 to 30 years         | 18.8 |
|                                    | from 31 to 40 years         | 11.5 |
|                                    | 40+ years                   | 3.0  |
| <b>Country</b>                     | Albania                     | 7.3  |
|                                    | Algeria                     | 0.6  |
|                                    | Bosna and Herzegovina       | 4.8  |
|                                    | Bulgaria                    | 1.2  |
|                                    | Croatia                     | 1.2  |
|                                    | Cyprus                      | 1.2  |
|                                    | Czech Republic              | 9.7  |
|                                    | Denmark                     | 0.6  |
|                                    | Estonia                     | 0.6  |
|                                    | Georgia                     | 0.6  |
|                                    | Greece                      | 1.2  |
|                                    | Hungary                     | 3.6  |
|                                    | Indonesia                   | 0.6  |
|                                    | Ireland                     | 0.6  |
|                                    | Israel                      | 6.1  |
|                                    | Italy                       | 0.6  |
|                                    | Latvia                      | 0.6  |
|                                    | Montenegro                  | 0.6  |
|                                    | Munich                      | 0.6  |
|                                    | North Macedonia             | 1.8  |
|                                    | Portugal                    | 3.6  |
|                                    | Republic of Moldova         | 16.4 |
|                                    | Romania                     | 0.6  |
|                                    | Serbia                      | 12.7 |
|                                    | Slovakia                    | 0.6  |
|                                    | Spain                       | 1.8  |
|                                    | Sweden                      | 0.6  |
|                                    | Taiwan R.O.C.               | 0.6  |

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|  |                |      |
|--|----------------|------|
|  | Turkey         | 17.0 |
|  | United Kingdom | 1.8  |

Table 1 shows the demographic profile of the respondents, including gender, age, education level, work experience, and countries of origin. Most respondents are women (65.5%), while men comprise 34.5%. The age groups are diverse, with the most represented respondents aged 41 to 50 (30.3%), followed by those between 18 and 30 (25.5%) and 31 to 40 (24.8%). The age group from 51 to 60 is less represented (14.5%), while respondents over 60 are rare (4.8%).

In terms of education, the majority of respondents have a doctorate (60.6%), while a smaller percentage have a master's degree (16.4%), basic academic studies (9.1%), college (7.9%) or high school or lower education (6.1%). Work experience varies, with the largest number of respondents reporting between 11 and 20 years of experience (30.3%), while groups with less than five years (21.2%) and over 30 years (14.5%) are less represented.

Respondents come from 30 different countries involved in the COST action. The most represented participants are from Turkey (17.0%), the Republic of Moldova (16.4%), Serbia (12.7%) and the Czech Republic (9.7%). A smaller percentage comes from other countries, such as Albania, Bosnia and Herzegovina, Bulgaria, Croatia, Cyprus, Greece, Hungary, Italy, Portugal and Spain, with less than 8% shares. This diversity, which includes participants from a broader pan-European context, provides a solid basis for analysis within the framework of international cooperation and research within the ECO4ALL action.

Further data analysis examined the relationship between demographic characteristics, such as work experience and country of origin, and barriers that limit circularly responsible consumer behavior. This approach allowed for a deeper understanding of the interrelationships between these variables, providing a basis for formulating conclusions and identifying factors that influence consumer behavior in the circular economy context.

### Discussion of the results

This research analyzes the relationship between demographic characteristics, such as work experience and country of origin, and key barriers that hinder effective circular value chain management. These barriers include personnel, organizational, and financial obstacles, as well as institutional, infrastructural, and legal challenges that can hinder the implementation of circular practices.

The relationship between customers' work experience and perceptions of personnel, organizational, and financial barriers was examined: high initial investment (Barr\_hii) and short-term interests of stakeholders (Barr\_stis). The research question RQ1 was confirmed based on the obtained results. The results show significant differences in responses depending on the length of work experience. For the high initial investment barrier, participants with work experience of 1 to 5 years and 11 to 20 years more often perceive this barrier as extreme. For the short-term interests' barrier, participants with work experience of 11 to 20 years express the most concern. Statistically significant results ( $p = 0.024$  for Barr\_hii and  $p = 0.000$  for Barr\_stis) indicate that work experience influences the perception of these barriers, which are classified as personnel, organizational, and financial barriers, with those with more work experience more often recognizing these challenges as significant obstacles.



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Within institutional and infrastructural barriers, statistically significant differences in responses related to consumers' work experience were observed for four key items. The first item, Absence or low level of financial incentives (IIB\_fi), showed a significant difference in responses, with consumers with more work experience more often perceiving this barrier as significant ( $p = 0.001$ ). The second item, Antitrust laws that prevent cooperation in the circular economy (IIB\_al), also showed a statistically significant difference ( $p = 0.038$ ), with consumers with 11 to 20 years of work experience expressing agreement with this barrier more often. The third item, Problems with responsibility, obligations and ownership of the circular economy implementation process (IIB\_roo), also showed a significant difference ( $p = 0.015$ ), with the highest percentage of responses as a significant barrier being given by consumers with work experience between 11 and 20 years. Finally, Limited reverse logistics capacities (IIB\_lc) showed the highest statistical significance ( $p = 0.000$ ), indicating that consumers with more work experience often see this barrier as an important challenge in implementing the circular economy. These differences show that work experience plays a significant role in the perception of various institutional and infrastructural barriers in the process of transition to a circular economy. Based on these findings, the research question RQ2 is confirmed. The results demonstrate that work experience significantly influences the perception of institutional and infrastructural barriers, as evidenced by statistically significant differences in responses for key items such as financial incentives, antitrust laws, responsibilities in the circular economy process, and reverse logistics capacities.

When it comes to analyzing the relationship between countries of origin and barriers within institutional and infrastructural barriers, two items showed a statistically significant difference: Absence or low level of financial incentives (IIB\_fi) and Recycling laws are ineffective in achieving (IIB\_r) high-quality recycling. According to the results of the Chi-Square test, IIB\_fi showed a statistically significant difference (Pearson Chi-Square = 154.141,  $df = 116$ ,  $p = 0.010$ ), with countries such as Serbia, Albania and Turkey marking this item as an "Extreme barrier" more, while other countries, such as Hungary and Portugal, had a lower number of such responses. Similarly, for IIB\_r (Pearson Chi-Square = 151.711,  $df = 116$ ,  $p = 0.015$ ), countries such as Turkey and the Republic of Moldova also perceived recycling laws as a significant barrier. In contrast, other countries, such as Slovakia and Portugal, were less concerned about these laws' effectiveness. These differences point to the different attitudes and challenges that countries face about recycling financing initiatives and legislation. Based on these claims and statistically significant differences, the research question RQ3 is confirmed, indicating that countries of origin significantly influence the perception of institutional and infrastructural barriers.

## Conclusion

The transition from a linear to a circular economy model is a continuous process that changes traditional production and consumption paradigms. This research examines how strategic planning and management can contribute to a more successful implementation of the circular economy principles by overcoming key barriers, including human resources, organizational, financial, institutional, infrastructural, and legal challenges. In addition, the analysis focuses on the impact of these barriers on increasing environmental awareness and active consumer involvement, with a particular emphasis on adapting circular strategies to the specificities of

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the countries covered by this research, which are involved in the COST action ECO4All. Given the importance of consumers in this transition, their behavior is recognized as a key factor in achieving sustainable change.

This research contributes significantly to understanding how work experience and country of origin influence the perception of key barriers to implementing a circular economy. The results highlight that work experience shapes consumer attitudes towards barriers such as high initial investments and short-term stakeholder interests, while institutional and infrastructural barriers, such as lack of financial incentives and limited reverse logistics capacities, further complicate the transition process. In addition, significant differences between countries indicate the need for a localized approach that considers specific socio-economic and cultural characteristics.

This paper's theoretical contribution lies in filling the gaps in the literature on consumer interaction with circular economy principles. The research expands the existing understanding of barriers with a focus on their perception from the consumer's perspective, which contributes to the development of more effective strategies for education and awareness raising. Analyzing work experience and origin as key determinants enables more precise modeling of obstacles and solutions in the circular economy.

The practical implications are manifold. For companies and policymakers, the findings suggest adapting strategies and communication campaigns to overcome the barriers perceived as key by different consumer groups. Educating consumers about the principles of the circular economy and providing financial incentives can significantly improve their involvement and acceptance of this model. Also, the identification of differences between countries provides a basis for developing localized policies that respond to the specific challenges of each country, thereby contributing to the global goal of sustainable development.

## Acknowledgments

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### NORDIC CROSS-BORDER COOPERATION FOR CIRCULAR ECONOMY SUCCESS

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#### **Abstract**

The Nordic countries, namely Norway, Sweden, Denmark, Finland and Iceland, are at the forefront of cross-border cooperation to promote the circular economy. Their joint approach uses shared values, regional networks and policy alignment to achieve sustainable development goals and promote circular practices. This paper has examined the following key aspects of this cooperation, namely: policy coordination and frameworks; knowledge exchange and research collaboration; industry and business integration; infrastructure and waste management; consumer engagement and education; and global leadership. On the one hand, the main achievements of this cooperation have been identified, including high recycling rates and waste reduction in all five countries, as well as their leading role in the development of circular business models and technologies. On the other hand, it found challenges for Nordic cooperation, including harmonizing regulations across national borders and scaling up innovation to meet the growing demand for green products. This study concludes that Nordic cross-border cooperation is an example of regional integration in the circular economy. By combining policy harmonization, innovation, and shared resources, these countries are accelerating the transition to a sustainable future by jointly addressing challenges. Their success highlights the power of regional partnerships in addressing global environmental challenges.

**Keywords:** circular economy, Nordic countries

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## SUSTAINABILITY AND COMPETITION POLICY - VIA CONSUMER PROTECTION

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### Abstract

Approaching the 2030 deadline for achieving sustainable development goals progressively intensifies the need to evaluate the relationship between sustainability objectives, competition policy, and consumer protection. Thus, the examination on the possibilities of alignment and cooperation between these three pillars towards a more sustainable, competitive, and consumer-friendly economy comes to the fore.

An analysis of the foundational principles underlying sustainability, competition, and consumer protection, reveals inherent tensions but also synergies, as an efficient economy driven by competition can either complement or conflict with broader sustainability goals and consumer protection objectives. The focus of EU institutions on environmental and competitive elements of the circular economy, with barely a mention of the social and consumer-related aspects being an expressive negative example of this interaction.

Achieving sustainability goals relies significantly on the understanding of the role of competition policy in promoting sustainability. However, a narrow focus on this aspect, without due consideration of the consumer's role, risks violating their rights, undermining as such the very core of our political systems – the protection of human rights and freedoms.

Therefore, this research analyses the current state of competition policy in Europe, assessing its compatibility with sustainability and consumer protection objectives. It explores opportunities to integrate the regulations addressing practices like abuse of dominant position, anti-competitive agreements, mergers, or state aid, and aiming for a greener and more sustainable economy - into a framework that incorporates consumer perspectives. Moreover, an analysis of potential conflicting cases of such a regulation and consumers' rights would benefit to underscore the aspects in need of further attention from the regulators in order to prevent or resolve conflicts effectively.

In conclusion, this paper contributes to the ongoing discourse on sustainability, competition, and consumer protection by providing insights into the challenges, opportunities, and policy options for achieving a harmonious balance between these imperatives in the European context.

**Key Words:** Sustainable development, consumer protection

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### THE ROLE OF CIRCULAR ECONOMY IN SUSTAINABLE DEVELOPMENTS GOALS IN ALBANIA

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#### Abstract

This article aims to explore the role of the circular economy towards the accomplishment of Albania's Sustainable Development Goals by emphasizing the developments of sustainable practices in areas such as waste management, resource efficiency, and environmental conservation. Aiming to align the country's practices with EU standards, Albania has integrated the circular economy practices into several national policy frameworks and recently approved or reviewed environmental laws. Through collaboration with several international organizations, and the implementation of international projects, Albania has developed a Circular Economy Roadmap, focused on green procurement, producer responsibility and public engagement.

Even though there are significant developments especially in the alignment with EU standards, limited recycling infrastructure, low waste separation rates, low public awareness, and inadequate regulatory implementation are considered significant obstacles in the process of transition from linear to circular economy. Enhancing the regulatory framework, promoting the public awareness, investing in the improvement of infrastructure, financing SME-s and improved collaboration among the public and private sector, would support an easier transition to circular economy and contribute to the job creation, environmental protection, and sustainable growth in Albania.

**Keywords:** Circular economy, sustainable development goals, Albania, EU integration.

#### Introduction

The Sustainable Development Goals are made of seventeen objectives aimed at achieving sustainable development, with a strong emphasis on solving several social, economic, and environmental concerns. The SDGs are published in 2015 by the UN General Assembly. Aimed to be accomplished by 2030, SDGs follow the Millennium Development Goals and shifts the global development direction toward sustainability. For developing nations like Albania, the Sustainable Development Goals are particularly significant because their achievement will indicate progress in fulfilling the prerequisites for EU membership. Albania has adopted the National Strategy for Development and European Integration 2015-2020 and integrated the Sustainable Development Goals since being granted EU candidate status in June 2014.

Several Sustainable Development Goals, especially goals associated with production and consumption, economic expansion, and environmental sustainability, are closely related to the



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circular economy principles. Recognizing the role of the circular economy practices in achieving several Sustainable Development goals especially those that are related to production and consumption, resource management, waste management, competitiveness and innovation, environment protection, clean energy, economic growth and so forth, has leveraged the interest of the researchers and the policymakers toward circular economy implementation practices (Arruda et al., 2021; Moraga et al., 2019; Padilla-Rivera et al., 2020).

The circular economy has significant economic, environmental, and social impact. Ekins et al. (2019), Lewandowski (2016), and Rizos et al., (2017) show that switching from a linear to a circular economy seeks to decline environmental damage caused by non-reusable waste and so lessen reliance on non-renewable natural resources. A basic model of the circular economy is the pattern of utilizing the output of one product as the input for another, so generating a closed-loop system. McCarthy et al. (2018) also argue that optimizing the use of natural resources can help achieve environmental objectives, lower reliance on imports by using domestic secondary resources, and promote economic growth and job creation by circular economy practices.

The distinction between a linear economy and a circular economy is substantial. In a linear economy, resources are extracted, processed into products, consumed, and ultimately removed as waste. On the other hand, the circular economy operates within a closed-loop framework, where waste is minimized, and resources are continuously cycled back into the system. After products are used, they undergo processes such as recycling, recovery, repair, retention, and return, ensuring their ongoing utility and reducing environmental impact.

Ellen MacArthur Foundation (2015) describes the concept of circular economy by using butterfly diagram. The diagram illustrates the circulation of materials through two circles. The first cycle includes the activities and processes such as sharing, maintaining or prolonging, reusing, remanufacturing and recycling of the finite sources and is called the technical cycle. The second cycle includes all the activities and processes that ensure the regeneration of nature and natural renewable resources, and the sustainability of their utilization is called the biological cycle.

The implementation of circular economy is in the early development stages in Albania. However, a report of OECD (2024) highlights three critical focus areas where circular economy reforms could significantly benefit Albania. These include: (1) utilizing economic tools to promote sustainable production and consumption practices, (2) fostering the development of circular business models, especially among small and medium-sized enterprises (SMEs), and (3) tackling challenges within the plastics value chain, having a particular focus on combating marine pollution. Sustainable production and consumption can be achieved by increasing the recycling rate, extending the life of production and increasing the waste management. Business models play a crucial role in the implementation of circular economy.

The aim of this paper is to investigate the role of circular economy in the Sustainable Development Goals in Albania emphasizing the main obstacles and opportunities in the process of transition towards more sustainable practices in waste management, resource efficiency, and environmental conservation. Since receiving its candidacy for the European Union integration, Albania has undertaken several reforms focusing on the sustainable growth

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and development, with a special focus on green reforms, waste management, and increasing the infrastructure supporting the circular economy.

Albania is in the earliest steps of implementation of circular economy. Based on the statistics of the Albanian Institute of Statistics (2022), the recycling rate of municipal solid waste in Albania is only 17%, which is significantly lower compared to the EU average of 49% (Eurostat, 2022). Based on the report of Lloyd's Register Foundation (2024) entitled World Risk Poll 2024 Report, 78% of the household in Albania has responded not to practice any waste separation at the source, which is a very high percentage compared to the 63% which is the average for the low-income countries, emphasizing the low public awareness and the need for increased public participation and improved waste management infrastructure.

### Literature Review

Several research papers have examined the connection between the circular economy implementation indicators and the compliance with SDGs and have achieved significant results. Rodriguez-Anton et al., (2019) investigate the correlation between nine indicators of circular economy and SDGs, in 156 countries with data as of 2017. The chosen indicators are organized in four groups, such as production and consumption indicator, waste management indicator, secondary raw materials indicator and competitiveness and innovation indicator. The authors investigate the correlation between the chosen indicators and SDG 6, 8, 9, 11, 12, 13, 14, and 15. The findings of the study suggests that there is found a relationship of all CE indicators with SDG 8, 9, 11, 12 and there is found a relationship of at least one of CE indicators with SDG 13 and SDG 14.

Fatimah et al., (2020) give a valuable contribution by developing and designing the smart systems and business processes for the waste management in Indonesia. They use internet of things to integrate the application of the circular economy processes. The authors conclude that the system they have designed to implement the circular economy will have a significant influence on the Sustainable Development Goals such as SDG 3, 6, 8, 12 and 13. Their system is designed to have vital economic, social and environmental impact. Another study by Dantas, et al., (2021) aims to investigate the impact of both circular economy and Industry 4.0 on the Sustainable Development Goals. By conducting a systematic literature review, the authors find that the incorporation of Circular Economy and Industry 4.0 has a pivotal impact on the SDGs as it ensures the incorporation of innovative technology, circular production practices and business models. The impact is particularly significant in SDG 7, 8, 9, 11, 12, and 13.

Ronzon and Sanjuan (2020) examine the relationship between EU bioeconomy strategy and sustainable Development Goals in 28 EU countries for the period from 1990 until 2018 by using a bivariate correlation and mapping the 2018 EU bioeconomy strategy with SDGs. The results of their study suggests a positive relationship among bioeconomic strategy and SDG 7, 11, and 15. However, there is a negative correlation between agrobiodiversity strategies and SDG 2, SDG 8, SDG 9, and SDG13. Schroeder, Anggraeni, & Weber (2018) use a narrative literature review to analyse the relation between circular economy and sustainable development goals. The findings suggest that the practices of circular economy have a positive direct strong contribution to SDG 6, 7, 8, 12, 15. Furthermore, Circular

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Economy may give a significant contribution on potential synergy among several SDGs such as SDG 8, 1, 2, 14, and 15.

Also, Ferraz & Pyka (2023) conduct a bibliometric analysis 649 research papers for the period 2007-2022, and systematic literature review of 81 articles to investigate the impact of circular economy and bioeconomy on sustainable development goals. The authors conclude that the circular economy primary impacts SDG12, continuing SDG7, 6. Furthermore, bioeconomy impacts SDG 7, 9, and 12.

Table 1. Literature Review Summary

| Study                         | Focus Area                                                           | Methodology                                               | Key Indicators/Systems                                                                                       | Relevant SDGs                                      | Key Findings                                                                                                                 |
|-------------------------------|----------------------------------------------------------------------|-----------------------------------------------------------|--------------------------------------------------------------------------------------------------------------|----------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------|
| Rodriguez-Anton et al. (2019) | Correlation between CE indicators and SDGs                           | Correlation analysis using data from 156 countries (2017) | Production & consumption, waste management, secondary raw materials, competitiveness & innovation indicators | SDG 6, 8, 9, 11, 12, 13, 14, 15                    | Strong correlation of all CE indicators with SDG 8, 9, 11, 12; at least one CE indicator linked to SDG 13 and 14.            |
| Fatimah et al. (2020)         | Smart systems & business processes for waste management in Indonesia | Development of IoT-based systems                          | Internet of Things (IoT) for CE process integration                                                          | SDG 3, 6, 8, 12, 13                                | CE system design has significant economic, social, and environmental impacts, enhancing SDG implementation.                  |
| Dantas et al. (2021)          | Joint impact of CE and Industry 4.0 on SDGs                          | Systematic literature review                              | Integration of innovative tech, circular production practices, and business models                           | SDG 7, 8, 9, 11, 12, 13                            | CE and Industry 4.0 combination plays a pivotal role in driving SDGs through technology and business model innovation.       |
| Ronzon & Sanjuan (2020)       | Relationship between EU bioeconomy strategy and SDGs                 | Bivariate correlation and strategy mapping (1990–2018)    | EU bioeconomy strategy and agrobiodiversity strategies                                                       | Positive: SDG 7, 11, 15; Negative: SDG 2, 8, 9, 13 | Positive correlation with SDG 7, 11, 15; negative correlation found between agrobiodiversity strategies and SDG 2, 8, 9, 13. |
| Schroeder et al. (2018)       | Narrative literature review                                          | CE practices and SDG synergy                              | Strong contribution to SDG 6, SDG 7, SDG 8, SDG 12, SDG 15;                                                  | Schroeder et al. (2018)                            | Narrative literature review                                                                                                  |

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|                            |                                                                                                                  |                                              |                                                                                                                |                            |                                                                                                               |
|----------------------------|------------------------------------------------------------------------------------------------------------------|----------------------------------------------|----------------------------------------------------------------------------------------------------------------|----------------------------|---------------------------------------------------------------------------------------------------------------|
|                            |                                                                                                                  | analysis                                     | Potential synergy with<br>SDG 8, SDG 1, SDG 2,<br>SDG 14, SDG 15                                               |                            |                                                                                                               |
| Ferraz &<br>Pyka<br>(2023) | Bibliometric<br>analysis (649<br>papers, 2007-<br>2022) &<br>systematic<br>literature<br>review (81<br>articles) | Impact of CE<br>and<br>bioeconomy on<br>SDGs | CE primary impact on<br>SDG 12; also impacts<br>SDG 7, SDG 6;<br>Bioeconomy impacts<br>SDG 7, SDG 9, SDG<br>12 | Ferraz &<br>Pyka<br>(2023) | Bibliometric<br>analysis (649<br>papers, 2007-<br>2022) &<br>systematic<br>literature review<br>(81 articles) |

## Methodology

As Albania is still in its early phases of implemented circular economy, this study employs a desk research approach to analyse the role of the circular economy in achieving Albania's Sustainable Development Goals. The research methodology of this study consists of using available data, articles, reports to have a descriptive analysis of the topic of study. The key concepts of conducting the research are circular economy and sustainable development goals in the context of Albania. To look for those concepts are used scientific research search engines such as Science Direct, Google Scholar, Semantic Sholar, RePEc and SSRN. For reports and data mostly are used the websites of OECD, United Nations, The World Bank, Eurostat, European Commission, the Albanian Institute of Statistics, and so forth. One of the most important limitations of this methods stands in the fact that the analyse may not go into deep details.

## Findings and Discussions

Albania's shift to a circular economy is in its nascent stages, characterized by both emerging opportunities and persistent challenges. The integration of circular economy practices into Albania's policy framework has been primarily driven by the National Waste Management Strategy (2018-2033) and various environmental protection laws designed to align with EU standards. The implementation of several national strategies and the improvement of the regulatory framework emphasize Albania's commitment to aligning with sustainable development goals, particularly within the context of its EU integration aspirations.

In the framework of application of the circular economy, Albania has development the Circular Economy Roadmap, which relies on three main pillars: green public procurement, extended producer responsibility, and public awareness campaigns. The Circular Economy Roadmap serves as a guideline to the Albanian government by providing several policy recommendations and monitoring frameworks to facilitate and track the transition to circular economy. Albania's transition to circular economy is also supported by the European Union institutions and the UNDP which have continuously offered technical assistance and funded several projects, contributing to the facilitation of the capacity-building and the adoption of best practices from other European countries.

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The implementation of the circular economy in Albania is supported by business models in several areas, such as waste management, agriculture, textiles, tourism, and renewable energy, which are crucial to achieving sustainable development Goals (Hysaj, 2024). Sustainable Goal 12, related to Responsible Consumption and Production, is the focus of the main pillars of circular economy, such as sustainable resource use, waste generation reduction, and recycling practices (Schroeder, Anggraeni, & Weber, 2018). Moreover, Sustainable Development Goal 8, related to Decent Work and Economic Growth, and Sustainable Development Goal 9, related to industry, innovation, and infrastructure, is supported by the promotion of recycling, waste management, and eco-innovation sectors (McCarthy et al., 2018; Ferraz & Pyka, 2023). Sustainable Development Goal 6, Climate Action, is promoted by the policies and laws aiming to lower the greenhouse gas emissions through waste management and energy efficiency. Moreover, the promotion of renewable energy supports the achievement of Sustainable Development Goal 7, Affordable and Clean energy (Ferraz & Pyka, 2023; Schroeder et al., 2018).

Regardless of the significant developments that enable the application of circular economy practices, this process faces considerable barriers. These barriers are related to the limited and inadequate recycling infrastructure, low levels of waste separation at the source from the households, and gaps in regulatory enforcement. Even though several EU projects are supporting the country's advancement toward this direction, the limited financial incentives and low awareness among businesses and consumers makes the transition difficult and slow. Moreover, small and medium-sized enterprises, which represent over 99% of Albania's businesses, often lack the technical expertise and resources needed to adopt circular business models (OECD, 2019).

Regardless of the barriers and challenges faced there are numerous local initiatives aiming to ease the application of circular economy. Municipalities of Tirana and Durrës have launched several projects aiming to improve the waste management systems, to encourage recycling, and to promote the usage of clean energy, furthermore, directly contributing to SDG 11, associated with Sustainable Cities and Communities, SDG 12 associated with Responsible Consumption and Production, and SDG 7, associated with Affordable and Clean Energy. Furthermore, the encouragement of public-private partnerships, educational initiatives, integration of the circular economy concept into university curricula, and collaboration with academia are widely used practices used to promote community involvement in sustainable practices and increase awareness especially among young generations.

## Conclusions

This study analyses the contribution of circular economy in the fulfilment of Albania's Sustainable Development Goals (SDGs), focusing on the goals associated with responsible consumption and production, economic growth, sustainable cities and communities and environmental sustainability. Albania has made significant efforts to incorporate circular economy principles within its national policies, aligning with EU environmental standards and fostering international cooperation.



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On the other hand, the transition to a fully functional circular economy in Albania is still a work in progress. The primary obstacles include infrastructural deficiencies, weak regulatory enforcement, limited financial incentives, and insufficient public awareness. To overcome these challenges, it is crucial to strengthen institutional capacities, enhance stakeholder engagement, and promote innovative business models that support circular practices.

Key policy recommendations derived from this study include:

- **Enhancing Regulatory Frameworks:** Strengthening the enforcement of existing environmental regulations and introducing new policies that incentivize circular economy practices.
- **Promoting Public Awareness:** Implementing nationwide educational campaigns to encourage a culture of sustainability among citizens and businesses. Integrating the circular economy concepts into university curriculum.
- **Supporting SMEs:** Providing technical assistance, financial incentives, and capacity-building programs to help SMEs adopt circular business models as the SMEs make 99% of businesses in Albania and they have limited financial sources.
- **Encouraging Public-Private Partnerships:** Leveraging partnerships between government entities, businesses, and civil society to induce innovation and investment in circular economy initiatives.
- **Improving Infrastructure:** Investing in modern waste management and recycling facilities to support efficient resource recovery and reduce environmental impact.

Moreover, financing the infrastructure to facilitate clean energy

In conclusion, although Albania faces considerable challenges in its circular economy transition, the opportunities for sustainable growth, environmental protection, and economic resilience are significant. By addressing the existing the internal barriers and benefiting from its international strategic partnerships, Albania has the opportunity to move forward with a more sustainable growth and development.

## Acknowledgments

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# ADVANCING CLIMATE NEUTRALITY THROUGH CIRCULAR ECONOMY SANDBOXES: A FRAMEWORK FOR INNOVATION AND REGULATION

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## Abstract

Decoupling economic growth from resource use and transitioning to circular systems of production and consumption are essential to achieving climate neutrality by 2050.

The current economy favours excessive consumption and endangers natural resources. The activities of extraction, processing and disposal of materials generate various negative environmental impacts, including the increase of greenhouse gas emissions, which jeopardise the achievement of essential environmental protection goals. It is imperative to promote stricter resource efficiency policies and to advance the circular economy throughout the value chain, replacing traditional business models with circular ones.

The failure to accelerate innovation in the circular economy is more evident than ever. Innovators face the challenge of framing their innovative solutions within the relevant laws, policies, standards, norms and specifications set by regulators during the development and implementation phases.

The Circular Economy Sandbox is essential for promoting innovative experimentation by providing a flexible regulatory framework that facilitates the temporary testing of innovative products, technologies, services and business models. This mechanism allows for temporary exemptions from certain restrictive legal regulations, such as those related to spatial planning, construction, environmental protection or tax procedures, while ensuring fiscal compliance. The implementation of sandboxes thus contributes to accelerating the transition to sustainable solutions and to creating an environment conducive to innovation.

**Keywords:** circular economy, economic growth, climate neutrality

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### **EMPOWERING CONSUMERS FOR CIRCULAR FOOD SYSTEMS: INSIGHTS FROM HUNGARIAN RESEARCH ON SUSTAINABILITY AND CONSUMPTION PATTERNS**

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#### **Abstract**

The circular economy (CE) concept has emerged as a pivotal framework for fostering sustainable consumption, particularly within the food sector. In Hungary, recent studies have examined CE principles in relation to organic food purchasing behavior, consumer awareness, and segmentation, highlighting young, educated urban consumers as key drivers of circular innovation (e.g., Fogarassy et al., 2020; Berecz & Fogarassy, 2022). However, challenges persist, such as developing robust indicators for nutrient circularity and addressing gaps in bio-economy integration (e.g., Fassio & Chirilli, 2023). Research on CE in food systems often focuses on waste reduction, sustainable packaging, and supply chain optimization (e.g., Zhang et al., 2022), yet more attention is needed on empowering consumers as active participants in circular practices.

Recent findings highlight the nuanced dynamics of sustainable food consumption in Hungary, including the role of cultural capital in shaping consumer engagement. For example, Kristóf and Megyesi (2024) reveal how sustainability manifests in both "hip" and practical forms, underscoring the duality of consumer behavior in this domain. Furthermore, the integration of nature-based solutions (NBS) in urban planning, as explored by Megyesi et al. (2024), provides valuable insights into stakeholder perceptions that can inform CE strategies, especially in fostering inclusive and participatory approaches.

This presentation explores the Hungarian context through survey and interview data derived from a recently concluded H2020 project and an ongoing research initiative. These studies examine how shifts in sustainability awareness and consumption patterns can support CE transitions. We emphasize the role of consumers as proactive agents, advocating for inclusive engagement in sustainable development processes. By highlighting the social dimensions of CE, this research aligns with ECO4ALL's focus on integrating consumer participation and regulatory frameworks to advance resource efficiency and full circularity.

**Key words:** consumers' attitude; direct food purchasing; short food supply chains; local food system

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## SUSTAINABILITY, CIRCULAR ECONOMY AND CREATIVE COMPUTING

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### Abstract

Currently, there is an increasing concern about sustainability and robustness of complex infrastructures upon which many of our day-to-day activities depend. In the European Union, the term circular economy is a well-established element of the European Green Deal, describing a transformation towards greater sustainability and waste reduction. Many of us work in fields related to creative computing and have spent time researching the right to repair and other sustainable practices related to creative computing. Open Educational Materials will be presented that provide an opportunity for educators and learners to explore these ideas based on practical examples and accessible activities. This material is available for non-commercial re-use under the Creative Commons License. It comprises of a slide deck and supporting materials, both available for free on the website <https://costgrade.eu>. The slide deck may be used during lessons in secondary school in both formal and informal settings. Educators may also edit and re-use the material in their own teaching tools. The supporting materials file includes descriptions of each slide, and suggestions for further reading. This material was created by Grassroots of digital Europe (GRADE), a network of scientists, researchers, activists, and artists from the EU and beyond, created within the COST framework for European Cooperation in Science and Technology. GRADE Working Group WG2, Institutionalising digital grassroots, is responsible for the creation and distribution of these materials.

**Key words:** Sustainability, circular economy, creative computing, Open Educational Materials

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# LEGAL ANALYSIS OF CONSUMER RIGHTS TO PRODUCT REPAIR UNDER THE EU DIRECTIVE ON REDUCING, REUSING AND REPAIRING

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## Abstract

This paper provides a comprehensive legal analysis of the time limits governing consumers' rights to claim and request product repairs. It focuses on the new EU Directive promoting product lifecycle extension through reducing, reusing, and repairing. The Directive mandates that manufacturers and sellers enable product repairs up to ten years from the date of manufacture, marking a significant advance towards sustainable consumption and enhanced consumer protection, but only for certain kinds of goods.

Scientific contribution lies in the author's critical examination of the intersection between the newly introduced obligations under the Directive and existing consumer rights under warranties and guarantees. By analysing potential overlaps and conflicts, the paper sheds light on the legal implications and challenges of harmonising these rights within current legal frameworks in selected member states.

The critical legal questions to be addressed will include alignment with existing laws and determining how the directive's mandate for repair for up to ten years aligns with existing national laws on warranties and guarantees. Additionally, stakeholders' responsibilities will be examined in relation to the analysis of the legal obligations of manufacturers and sellers under the Directive, as well as their interactions with consumers' rights to claim defects. In conclusion, the implementation challenges will be addressed to ensure the effective implementation of the Directive into national legislation.

By addressing these questions, the paper aims to provide actionable recommendations to facilitate the effective implementation of the Directive. The findings contribute to the broader discourse on consumer law reform, environmental sustainability, and the integration of circular economy principles into legal systems.

**Keywords:** Consumer rights, R2R Directive, guarantee, sustainability, legal analysis.

## 1. Introduction

The intensifying global awareness of environmental degradation and the imperative for sustainability have spurred unprecedented legislative action worldwide. The European Union is at the forefront of enacting comprehensive policies to mitigate the adverse consequences of unsustainable production and consumption patterns ([Luzak, 2020](#)).

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The European Union has been progressively advancing a comprehensive framework to foster a circular economy, with a significant emphasis on enhancing product durability, reparability, and reusability ([Boniface et al., 2024](#)). This commitment is reflected in various policy initiatives and legislative measures designed to encourage sustainable production and consumption patterns across member states ([Camilleri, 2020](#)). The ambitious goals of the circular economy include minimizing waste, reducing material demand, and promoting the efficient use of resources throughout the product lifecycle ([Mikula et al., 2020](#)). Among the key instruments driving this transition is the EU Directive on Reducing, Reusing, and Repairing (Directive (EU) 2024/1799 of the European Parliament and of the Council of 13 June 2024 on common rules promoting the repair of goods and amending Regulation (EU) 2017/2394 and Directives (EU) 2019/771 and (EU) 2020/1828; further in text: Directive on Reducing, Reusing and Repairing or Right to Repair Directive (R2R Directive) which seeks to empower consumers with enhanced rights related to product repair, thereby promoting a culture of repair over replacement and contributing to a more sustainable and resource-efficient economy ([Hernández et al., 2020](#)). This directive is strategically designed to tackle premature obsolescence and encourage manufacturers to create more durable, repairable, and easily disassembled products. By establishing a legal framework that supports and protects consumer rights to repair, the EU aims to incentivize manufacturers to prioritize product longevity and facilitate access to repair services and spare parts ([Hernández et al., 2020](#)). The directive's provisions aim to create a level playing field, ensuring that consumers are not unduly pressured into purchasing new products when their existing ones can be repaired, thereby extending product lifecycles and reducing environmental impact.

The R2R Directive represents a pivotal step towards a more sustainable and circular economy within the European Union, addressing critical aspects of product design, consumer rights, and waste reduction ([Pangburn & Stavroulaki, 2022](#)). It aims to establish a robust legal framework that empowers consumers to opt for repair over replacement, thereby extending the lifespan of products and reducing environmental impact.

This paper examines the EU legal framework on promoting repair as a pivotal step towards sustainable consumption and waste reduction within the European Union. A central problem it addresses is the prevailing "throwaway culture," which is incentivized by manufacturers designing products for obsolescence rather than durability and reparability. This problem will be tackled through a detailed legal analysis based on the European consumer protection legal framework.

This research explores the scope of consumer rights, the obligations imposed on manufacturers and sellers, and the mechanisms for enforcement, including the role of Member States with varying consumer protection standards. The Directive's legal, economic and environmental impacts will be analysed, considering its potential effects on businesses, consumers, and the environment. Furthermore, by examining the Directive's interaction with existing EU legislation, such as the Eco-design Directive, this article aims to provide a comprehensive understanding of its potential and challenges in promoting a more sustainable and circular economy ([Boniface et al., 2024](#)).



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### 2. Objectives of the EU Directive on Reducing, Reusing and Repairing

The Directive on Reducing, Reusing, and Repairing addresses the unsustainable consumption patterns that have become a hallmark of modern economies. The core objective is to create a harmonised set of rules across member states that promote the repairability of goods, ensuring that consumers have access to the necessary information, spare parts, and repair services. Furthermore, it aims to incentivise manufacturers to design more durable, easily repairable products that are less prone to premature obsolescence, fostering a culture of sustainability and resource efficiency.

By establishing a legal framework that supports and protects consumer rights to repair, the EU aims to incentivise manufacturers to prioritise product longevity and facilitate access to repair services and spare parts ([Hernández et al., 2020](#)). This approach aims to promote sustainable consumption and minimise waste.

The directive acknowledges the significant role that consumer behaviour plays in the transition to a circular economy, recognising that informed purchasing decisions and a willingness to repair products can drive demand for more sustainable goods and services. Ultimately, the EU Directive on Reducing, Reusing, and Repairing represents a multifaceted approach to promoting sustainable consumption and production patterns, aiming to create a more resilient and environmentally responsible economy that aligns with the principles of a circular economy. This Directive strengthens provisions related to the repair of goods, contributing to the proper functioning of the European Union's internal market and providing a high level of consumer and environmental protection ([Directive, 2024](#)). The directive's provisions aim to create a level playing field, ensuring that consumers are not unduly pressured into purchasing new products when their existing ones can be repaired. Thus, the directive extends product lifecycles and reduces environmental impact.

The genesis of the EU Directive on Reducing, Reusing, and Repairing lies in the European Union's broader commitment to transitioning towards a circular economy, a model that emphasises resource efficiency, waste reduction, and sustainable consumption ([Weale et al., 2002](#)). Recognising the limitations of the traditional linear "take-make-dispose" economic model, the EU has prioritised the development of policies and regulations that promote the reuse, repair, and recycling of products and materials ([Chiaraluce et al., 2021](#)). The Directive emerged as a direct response to growing concerns about premature obsolescence, the environmental impact of discarded products, and the need to empower consumers with greater control over the lifespan of their goods. It also aligns with the design for disassembly, remanufacturing, and recycling ([Hernández et al., 2020](#)). Academic research has highlighted the critical role of consumer behaviour in driving the transition to a circular economy, noting that consumers can either support or hinder this transition through their purchasing decisions ([Jones & Comfort, 2021](#)).

The primary objective of the Directive is to establish a comprehensive legal framework that promotes the repairability and longevity of products, thereby reducing waste and conserving resources. This involves a multi-pronged approach that includes enhancing consumer rights, incentivising manufacturers to design more durable and repairable products, and facilitating access to repair services and spare parts. By empowering consumers to choose repair over replacement, the Directive aims to extend the lifespan of products, reduce the

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demand for new goods, and minimise the environmental footprint associated with manufacturing and disposal. The absence of incentives to design products and buildings for disassembly and reuse at the end of their life is a significant challenge ([Adams et al., 2017](#)).

The Directive aims to address several key challenges that hinder the widespread adoption of repair practices ([Mak & Lujinovic, 2019](#)). One such challenge is the limited access to repair information and spare parts, which often makes it difficult or impossible for consumers to repair their products. Another challenge is the perceived high cost of repair compared to the cost of replacing a product, which can discourage consumers from choosing repair even when it is technically feasible ([Sevcenko et al., 2019](#)). The directive is designed to encourage a circular consumption pattern ([Rahla et al., 2021](#)). It aims to promote the development of a robust repair sector, creating new economic opportunities and supporting the growth of local repair businesses.

### 3. Core Provisions and Consumer Rights under the R2R Directive

The EU Directive on Reducing, Reusing, and Repairing introduces a range of provisions aimed at enhancing consumer rights and promoting the reparability of products. One of the most significant aspects of the Directive is the establishment of a "right to repair," which grants consumers the legal entitlement to have their products repaired by manufacturers or authorised repairers.

This right extends to a wide range of goods, including electronics, household appliances, and other consumer products, ensuring that consumers are not unduly pressured into purchasing new items when their existing ones can be repaired. The Directive requires manufacturers to provide access to repair information, diagnostic tools, and spare parts to both consumers and independent repairers, thereby facilitating the exercise of the right to repair ([Jin et al., 2022](#)).

This right extends beyond the warranty period, ensuring that consumers can access repair services throughout the reasonable lifespan of a product. The Directive requires manufacturers to provide consumers with clear and comprehensive information about the reparability of their products, including details on the availability of spare parts, repair manuals, and diagnostic tools. This information must be easily accessible and user-friendly, enabling consumers to make informed decisions about whether to repair or replace their products. Furthermore, the Directive requires manufacturers to design products that facilitate repair, using standardised components and avoiding the use of proprietary tools or techniques that could restrict access to repair.

The right to repair is a significant development that allows individuals to reclaim and tinker with old technologies ([Hatta, 2020](#)). To further incentivise repair, the Directive encourages member states to implement measures that reduce the cost of repair services, such as tax breaks, subsidies, or the establishment of repair vouchers. These measures aim to repair a more economically attractive option for consumers, encouraging them to choose repair over replacement. Additionally, the Directive encourages the development of repair networks and community repair initiatives, enabling consumers to access affordable and convenient repair services.

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The Directive also addresses the issue of planned obsolescence, the practice of designing products with a limited lifespan to encourage repeat purchases. While explicitly prohibiting planned obsolescence is challenging due to difficulties in proving intent, the Directive takes steps to combat this practice by requiring manufacturers to ensure that spare parts are available for a reasonable period after a product is discontinued. This provision aims to prevent manufacturers from deliberately shortening the lifespan of products by limiting access to spare parts. The Directive introduces several key consumer rights related to product repair and maintenance.

First, consumers can request repair services from manufacturers or authorised repairers, regardless of whether the product is still under warranty. Second, consumers have the right to receive clear and transparent information about the cost of repair services before agreeing to proceed with the repair. The provisions of the directive are designed to keep repair costs minimal, making it a viable option for consumers. Third, consumers are entitled to a warranty extension for repaired products, ensuring that the repair is carried out to a satisfactory standard and that any subsequent defects are covered. Fourth, consumers can seek redress if a repair is not carried out correctly or if the product fails again after the repair.

These consumer rights are designed to empower consumers and provide them with the confidence to choose repair over replacement, contributing to a more sustainable and circular economy. The lack of consumer awareness regarding product care has also been identified as a reason why consumers either do or do not take care of their products ([Ackermann, 2018](#)).

### **4. Analysis of the Legal Framework and Scope of the Directive**

The EU Directive on Reducing, Reusing, and Repairing is a complex legal instrument with a broad scope that encompasses various aspects of product design, manufacturing, and consumer rights. To fully understand its implications, it is essential to analyse the legal framework underpinning the Directive and clarify its scope of application.

The EU Directive places significant obligations on manufacturers to ensure the repairability and longevity of their products. Before the introduction of this Directive, consumer repair rights within the EU were mainly governed by Directive (EU) 2019/771 on the sale of goods. This directive provides for a minimum two-year legal guarantee period during which consumers can seek remedies, including repair, for defective goods. Nonetheless, implementation of these rights has varied across Member States, often resulting in disparate levels of consumer protection.

The Directive mandates that manufacturers design products with repairability in mind, using standardised components, avoiding proprietary tools, and providing clear disassembly instructions. The product should be designed to facilitate a seamless repair process. Furthermore, manufacturers must make spare parts, repair manuals, and diagnostic tools available to consumers and independent repairers for a reasonable period after discontinuing a product. Legal guarantees under Directive 2019/771 are supplemented by commercial guarantees voluntarily offered by sellers or manufacturers. These guarantees differ in duration, scope, and conditions and often do not align with the more extended repair obligation now mandated under the new Directive.

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The new Directive extends beyond the scope of Directive 2019/771 by ensuring repairability throughout the product's lifespan, not just during the initial guarantee period. This is a significant shift towards promoting sustainable consumption patterns. The Directive also introduces the concept of "extended producer responsibility", requiring manufacturers to take greater responsibility for the end-of-life management of their products. (Weale et al., 2002) This includes incentivizing repair and reuse as well as ensuring the proper collection and recycling of products that cannot be repaired. The Directive aims to shift the focus from a linear "take-make-dispose" model to a circular economy model, where products are designed to last longer, be easily repaired, and ultimately recycled (Chen, 2019). Furthermore, the new Directive aims to overcome barriers to repair, such as limited access to spare parts and repair information, by requiring manufacturers to provide this information to consumers and independent repairers.

### 5. Interaction with the existing Consumer Rights

This Directive does not exist in a vacuum; it interacts with a well-established body of consumer rights legislation at both the EU and Member State levels. Understanding this interaction is crucial for effective implementation and to avoid unintended consequences.

As mentioned above, the Directive complements the existing EU directives, such as the Eco-design Directive and the Consumer Rights Directive. While the Eco-design Directive focuses on setting minimum standards for product durability and energy efficiency, this new Directive tackles the barriers to repair, ensuring that consumers can exercise their right to extend the lifespan of their products. It also reinforces aspects of the Consumer Rights Directive by clarifying the remedies available when goods are faulty and emphasising the importance of providing clear and accessible information to consumers (European Commission, 2023). Consumer protection law ensures the defence of the collective interests of consumers in the internal market (Chaudhary, 2005). Member States are free to adopt measures that offer a higher level of consumer protection, as long as this is compatible with Union law (Weale et al., 2002).

The interplay between EU directives and national laws is equally important. Member States often have their specific regulations regarding consumer protection, product liability, and waste management. These national laws may impose additional or more stringent requirements than those outlined in EU directives. When implementing the new Directive, Member States must ensure that their national laws are aligned with the Directive's objectives while preserving any existing national provisions that offer a higher level of consumer protection.

Regarding the relationship with national consumer protection laws, Member States have varying levels of consumer protection agencies and legal frameworks. Some, like Germany, France, and the Netherlands, boast strong consumer protection traditions, well-established consumer organisations, and proactive enforcement agencies (Cuijpers, 2009; Giliker, 2016).

Others, particularly in Southern and Eastern Europe, may have weaker systems due to limited resources or a less developed tradition of consumer activism. The Directive should be implemented to respect these existing national frameworks while ensuring a minimum level of consumer protection across the EU (Chaudhary, 2005).

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The Directive introduces the concept of "extended producer responsibility," which requires manufacturers to assume greater responsibility for the end-of-life management of their products. However, the specific details of these schemes are left to the discretion of each Member State, which may lead to inconsistencies in the application of the Directive and potentially undermine its effectiveness ([Kanamugire & Chimuka, 2014](#)). Clear guidelines from the Commission are needed to ensure a level playing field and prevent regulatory arbitrage.

Careful attention must be paid to potential conflicts with existing EU legislation, such as the Eco-design Directive. While both directives aim to promote sustainable products, their specific requirements may overlap or contradict each other. For example, stricter energy efficiency standards under the Eco-design Directive might inadvertently make products more difficult to repair. Policymakers need to ensure that the two directives are implemented in a coherent and mutually supportive manner ([Giliker, 2016](#)).

### 6. Legal Challenges and Implementation Issues

Prior to the introduction of the EU Directive, consumer repair rights within the EU were largely governed by Directive 2019/771 on the sale of goods. This directive provides a minimum two-year legal guarantee period during which consumers can seek remedies, including repair, for defective goods.

However, implementing these rights has varied across Member States, often resulting in disparate consumer protection. The new Directive strengthens consumer rights related to repair by working in conjunction with existing consumer protection laws, such as the Sale of Goods Directive (2019/771). While the Sale of Goods Directive provides a minimum two-year legal guarantee period during which consumers can seek remedies, including repair or replacement, for defective goods, the new Directive extends beyond this period by promoting reparability throughout the product's lifespan.

The new EU Directive interacts with existing consumer rights frameworks, particularly those established by Directive 2019/771, by expanding the scope and duration of repair rights. It supplements the existing two-year guarantee period by ensuring that manufacturers make spare parts and repair information available for a longer period, even after the guarantee has expired.

The implementation of the EU Directive faces several legal challenges and potential implementation issues. One key challenge is ensuring effective enforcement of the Directive's provisions across all Member States ([Errington & Childe, 2013](#)). Variations in national legal systems and enforcement mechanisms could lead to inconsistencies in applying the Directive, potentially undermining its effectiveness. Furthermore, the Directive's success depends on active consumer awareness and engagement. Many consumers may be unaware of their new repair rights or face practical barriers to accessing repair services. Overcoming these challenges requires a multi-faceted approach, including robust enforcement mechanisms, consumer education campaigns, and support for independent repair networks.

Another challenge lies in balancing the interests of consumers, manufacturers, and repair service providers. The Directive aims to incentivize manufacturers to design more repairable products, which may require significant investments in product design and manufacturing



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processes. Some manufacturers may resist these changes, arguing that they could stifle innovation or increase production costs. The Directive requires Member States to establish effective monitoring and enforcing compliance systems, including imposing penalties for non-compliance. However, each Member State is left to determine the specific details of these enforcement mechanisms.

To ensure consistent and effective enforcement across the EU, the Commission should develop guidelines for Member States on best practices for monitoring compliance. Moreover, standardisation of repair procedures is crucial. Standardised diagnostic tools and repair manuals would facilitate the repair process, enabling independent repairers to compete effectively with authorised service centres.

The complexity of modern products, particularly electronic devices, poses a significant challenge to repairability. Many products are designed with proprietary components or software that can only be accessed by authorised repairers ([Lefebvre et al., 2018](#)). This creates a barrier to independent repair and limits consumer choice.

The EU Directive should encourage manufacturers to adopt open standards and provide independent repairers with access to necessary repair information and tools. This could lead to a fragmented enforcement landscape where the level of protection afforded to consumers varies depending on their location within the EU. Another legal challenge relates to interpreting and applying key concepts within the Directive, such as "reasonable cost" for repairs and "reasonable period" for the availability of spare parts. These concepts are inherently subjective and open to interpretation, which could lead to disputes between consumers, manufacturers, and repairers. To address this issue, the Commission should issue clear guidelines on the interpretation of these concepts, providing concrete examples and benchmarks to ensure consistent application across Member States.

The Directive introduces the concept of "extended producer responsibility", and this requires manufacturers to take greater responsibility for the end-of-life management of their products ([Hörnle et al., 2018](#)). However, the specific details of these schemes are left to the discretion of each Member State, which could lead to inconsistencies in the application of the Directive and potentially undermine its effectiveness.

The potential for conflicts with other EU legislation, such as the Eco-design Directive (2009/125/EC), requires careful attention because this directive establishes minimum energy efficiency standards for a wide range of products ([Stevels & Smit, 2019](#)). The Eco-design Directive aims to reduce the environmental impact of products throughout their life cycle, including setting requirements for product design, energy consumption, and durability ([Heyen et al., 2017](#)). It complements the new Directive by ensuring that products are designed to be more durable and energy-efficient from the outset.

## 6. Economic and Environmental Impacts

Assess the economic and environmental implications of the Directive, taking into account its potential impacts on businesses, consumers, and the environment. The Directive's economic impact is multifaceted, affecting businesses, consumers, and the repair sector in various ways. For businesses, the Directive introduces new obligations and costs related to the availability of spare parts, repair information, and product design for repairability ([Grigore & Kifor,](#)



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[2021](#)). Manufacturers may need to invest in redesigning their products to make them easier to repair and establish systems for providing spare parts and repair information to consumers and independent repairers. These costs could be significant, particularly for smaller businesses that lack the resources to adapt quickly.

However, the Directive also presents opportunities for businesses. The increased demand for repairs could stimulate the growth of the repair sector, creating new job opportunities and business prospects for independent repairers and specialised service providers. Moreover, businesses that adopt the principles of repairability and sustainability can gain a competitive advantage, attracting environmentally conscious consumers who are willing to pay more for products designed to last.

On the consumer side, the Directive is expected to result in long-term cost savings. By making products more durable and repairable, consumers can avoid the need to replace them as frequently, reducing their overall expenditure on goods. The availability of spare parts and repair information will also empower consumers to repair their products themselves or seek out independent repair services, potentially saving money on costly manufacturer repairs. However, the initial cost of more durable and repairable products may be higher, which could be a barrier for some consumers.

The principles of the circular economy are crucial for achieving the Directive's goals because of their potential to promote efficient resource utilisation and minimise the environmental burdens associated with conventional linear production and consumption models ([Ruiz et al., 2019](#)). By emphasising product durability, repairability, and reuse, the Directive aligns with the circular economy's core tenets, encouraging a shift away from the "take-make-dispose" approach. The paradigm of regeneration is obvious in maintenance and retirement processes, where products are repaired, reused and disassembled ([Diez et al., 2016](#)).

## 7. Conclusion

The EU Directive on reducing, reusing and repairing represents a significant step forward in promoting sustainable consumption and waste reduction within the European Union. By granting consumers enforceable rights to product repair, the Directive addresses critical market shortcomings, incentivising manufacturers to design more durable and repairable products while empowering consumers to extend the lifespan of their goods.

The detailed legal analysis reveals the Directive's multifaceted nature, encompassing key aspects such as the scope of consumer rights, obligations imposed on manufacturers and sellers, and enforcement mechanisms. The Directive introduces a new legal framework that prioritises repair over replacement, challenging the prevailing culture of disposability that has contributed to environmental degradation and resource depletion ([Michelini et al., 2017](#)).

Moreover, the Directive's emphasis on access to spare parts, repair information, and independent repair networks is crucial for fostering a competitive and consumer-friendly repair market. This can lead to more significant innovation in the repair sector and more affordable repair options for consumers.

Looking ahead, the successful implementation of the Directive will require ongoing collaboration among policymakers, businesses, consumers, and other stakeholders.

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# ENHANCING CIRCULAR ECONOMY THROUGH NATURE-BASED SOLUTIONS IN HIGHER EDUCATION

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## Abstract

Circular economy entails core sustainability concepts, such as reducing waste, preserving the environment and recycling goods in order to promote sustainable development. Nature-based Solutions (NBS) have been identified as tools for protecting biodiversity and natural resources, thus supporting healthier ecosystems and leading to sustainable development. NBS includes the concept of circular economy, as by protecting and sustainably managing natural resources, natural cycles are enhanced and promoted. Both concepts lie in the heart of the European Commission's efforts to strengthen environmental protection and economic development at the European and global level. Higher Education Institutions (HEIs) as primary agencies of education and training, which are to deliver and promote Sustainable Development Goals (SDGs), are called to integrate those concepts not only into their everyday campus practices but in their courses and academic curricula as well.

This paper aims to explore the level of integration of those concepts in the Greek HEIs by examining and analyzing policies, strategies and initiatives at the campus level as well as by exploring relevant university curricula. It highlights the importance of interdisciplinary cooperation and innovative learning methods in order to leverage the integration of circular economy by implementing NBS in HEIs.

**Key words:** Circular Economy, Nature-based Solutions, Higher Education Institutions, sustainable development

## Introduction

Our societies need to take urgent action to address current environmental concerns, with climate change and biodiversity loss being the most pressing ones. International community's efforts have led to the adoption of the Sustainable Development Goals (SDGs), as tools to achieve the overarching goal of sustainable development (UNGA, 2015).

SDGs include inter alia the target of “Quality Education” (SDG 4) “that will allow many other Sustainable Development Goals (SDGs) to be achieved” (UNGA, 2015). Quality education is crucial for achieving sustainable development (Laurie R. et al., 2016) and current research focuses especially on the role of higher education institutes in promoting sustainable development and transforming their curricula towards sustainability and eco-citizenship (Lozano R. et al., 2013, Filho W. et al. 2019, Serafini et al. 2022). This transformation requires several reforms and integration of new concepts in academic teaching, such as the



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concepts of circular economy, nature-based solutions (NBS) and eco-citizenship, as well as new pedagogical approaches (Lozano R. et al. 2017, Martín-Garin A., 2021).

This article explores the integration of the concept of circular economy into higher education institutions (HEIs) programs, especially through other environmental concepts and particularly nature-based solutions (NBS). It aims at highlighting NBS and circular economy education programs in Greece and discussing the integration of these concepts in higher education institutions' curricula and campus policies. It emphasizes the need for state and institutional support for promoting innovative teaching programmes as well as the significance of interdisciplinary cooperation towards a greener and more inclusive higher education.

The paper is structured as follows: after the introductory part, the second part clarifies the research question and explains the methodology. Presentation of the research findings follows regarding the integration of NBS and circular economy in Greek universities' curricula and courses. Finally, conclusions and recommendations for future research are presented.

### **Research Question and Methodology of Research**

The concepts of Nature-Based Solutions (NBS) and circular economy have gained a lot of leverage in the last few years because of their significant potential to address environmental (as well as social) challenges and their dynamic in fostering global efforts towards biodiversity conservation and restoration and adapting to climate change.

According to the European Commission's definition, NBS are 'solutions that are inspired and supported by nature, which are cost-effective, simultaneously provide environmental, social and economic benefits and help build resilience; such solutions bring more, and additional diverse, nature and natural features and processes into cities, landscapes and seascapes, through locally adapted, resource-efficient and systemic interventions' (European Commission: European Research Executive Agency 2024). In literature, NBS have been identified as means of natural solutions which may address both environmental protection and social challenges (Viti M., 2022). Nature-based Solutions (NBS) are critical tools for restoring biodiversity and protecting natural resources, thus fostering healthier ecosystems and a green transition.

The United Nations Environmental Assembly (UNEP 2019) has attempted a definition of circular economy, or maybe “a shared understanding of some of its basic principles” (United Nations Economist Network, 2022). The United Nations Environmental Assembly has defined circular economy as “one of the current sustainable economic models, in which products and materials are designed in such a way that they can be reused, remanufactured, recycled or recovered (4-R) and thus maintained in the economy for as long as possible, along with the resources of which they are made, and the generation of waste, especially hazardous waste, is avoided or minimized, and greenhouse gas emissions are prevented or reduced” (UNEP 2019).

Circular economy entails sustainability concepts such as reducing waste, preserving the environment and recycling goods, as well as “sustainable management of natural resources, the closing of material loops, the preservation of natural capital, and circular consumption and production behaviours in the economy in order to promote sustainable development” (United

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Nations Economist Network, 2022). Nature-based Solutions (NBS) include the concept of circular economy, as by protecting and sustainably managing natural resources, natural cycles are enhanced and promoted.

Both concepts lie in the heart of the European Commission’s efforts to strengthen environmental protection and economic development at the European and global level. The economic benefits of nature-based solutions (NBS) and a nature-based economic approach can act in a complementary way to achieving circular economy (European Commission Knowledge Centre for Biodiversity, 2023).

Following these new targets and goals at the global as well as the EU level, and as Higher Education Institutions (HEIs) are considered primary agencies of education and training, they are expected to deliver and promote Sustainable Development Goals (SDGs) and SDG 4 in particular (Chankseliani, M., McCowan, T. 2021, McCowan T., 2023). Thus, higher education institutions are called to integrate circular economy, nature-based solutions and other sustainability concepts not only into their everyday campus practices (Nunes, B. T. et al., 2018) but in their courses and academic curricula as well (Stefanakis, A. I. et al., 2021). Integrating nature-based solutions and circular economy (Renfors, S.-M., 2024) into higher education institutions is a critical parameter towards sustainable transition (Salas, D. A. et al., 2021, Vergani F., 2024).

Therefore, the research question of this article is formulated in order to explore the current projects, programmes and initiatives which foster integration of NBS and circular economy in Greek universities and the possible barriers, challenges and obstacles which could impede educators in higher education institutions to integrate nature-based solutions and circular economy concepts in their courses and university curricula.

In order to explore the level of integration of NBS in Greek universities, the author of this article has elaborated previous desk research and field work in the framework of the Erasmus Plus Project "Integrating Nature-Based Solutions into Higher Education towards exploiting the transformative potential of Social Economy for a green and inclusive future" (acronym: “SEgoesGreen”), funded by the European Union (2022-1-PL01-KA220-HED-000087149) along with the rest of the partners of the project, aiming at identifying different best practices on nature-based solutions in different EU countries. The goal of the project was to support university faculties to integrate sustainability teaching within their courses and curricula with a specific focus on exploiting the educational potential of Nature-Based Solutions. SEgoesGreen aimed at a) offering flexible training tools and resources to HEIs educators, b) exploring the state of the art in NBS education, c) identifying any barriers against the integration of NBS in HEIs, d) promoting students’ interest in green education and eco-citizenship.

The research conducted in the framework of the project has explored the integration of NBS in universities and academic institutions in five European countries, namely Poland, Croatia, Greece, Cyprus and Portugal (Murzyn, D., et al. 2024). Desk research aimed at identifying the best practices in integrating NBS in the abovementioned countries and a combination of research methods has been used, such as best practices analysis, interviews with stakeholders and constructed discussions in small groups of professionals, educators, and other stakeholders. The author has built upon the research on nature-based solutions by

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adding the parameter of circular economy and focusing explicitly on the Greek higher education institutions.

### Research Findings

The first part of the research in the framework of the SEgoesGreen project identified a set of best practices in Greece by using specific parameters such as “the country and city of implementation, the field of study, the educational institution, the level of study, course(s), NBS category, topic of the best practice, its specific objectives, the results or impact achieved, stakeholders involved, pedagogical approaches utilised and any significant considerations pertinent to the best practice” ((Murzyn, D., et al. 2024).

Building upon the research conducted on Nature-based Solutions within the SEgoesGreen project, this article explored the level of integration of the concept of circular economy in Greek higher education institutions’ courses and curricula and focused particularly on the synergy creation between nature-based solutions and circular economy.

The first findings of this research on the integration of circular economy in Greek higher education institutions demonstrate that circular economy is gradually being integrated into Greek universities. However, the level of implementation varies across institutions, programmes and levels of tertiary education (master programmes, undergraduate programmes etc.). The integration of circular economy principles in Greek universities may be identified in courses and curriculum development, in research projects and initiatives, as well as in other sustainability projects, and collaborations with external stakeholders.

The most important methods and tools for integrating circular economy in Greek higher education institutions are first of all, through curriculum and academic programmes. During desk research it was found that Greek universities have started including the concept of circular economy, and the principles related to it, into their academic courses and programmes. Thus, one may find a number of specialized courses, modules, and entire degree programs, which focus on sustainability, environmental management, circular economy and sustainable consumption. For instance, the University of West Attica<sup>73</sup> and the Aristotle University of Thessaloniki<sup>74</sup> are currently offering courses related to sustainability and circular economy as part of their environmental sciences, engineering or business programs. Similarly, the Technical University of Crete (TUC), offers a master’s program for students on the topics of Circular Economy and Bioeconomy<sup>75</sup> and generally it is a university very much involved in sustainability research, trying to integrate the concept of circular economy into courses that examine sustainability and resource management.

Apart from the specialized programmed and courses, the Greek higher education institutions foster circular economy through research and collaborations with other universities and research centers abroad. They participate in and/or lead research projects that

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<sup>73</sup> MSc “Circular Economy and Sustainability Strategies”, <https://msc-circular.uniwa.gr/>

<sup>74</sup> Elective course on “Waste treatment and circular economy (sustainability management and circular economy), <https://qa.auth.gr/en/class/1/600216145>

<sup>75</sup> <https://www.tuc.gr/en/university/in-the-spotlight/item/tuc-participates-in-masters-program-on-circular-economy-and-bioeconomy>

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focus on circular economy (i.e. funded projects<sup>76</sup> or international partnerships and collaborations<sup>77</sup>). Greek universities have also been very active in initiating or supporting respective research initiatives on relevant topics. Areas of focus include waste management, renewable resources, sustainable production processes, and others. The Athens University of Economics and Business<sup>78</sup> and NTUA<sup>79</sup> (National Technical University of Athens), actively participate in European and international research initiatives related to the circular economy, addressing issues like recycling, eco-design, and green technology. Greek HEIs also cooperate with research centers: for instance the Centre for Renewable Energy Sources<sup>80</sup> (CRES) in Greece focuses on developing sustainable energy solutions, which is closely tied to circular economy principles.

In addition, the Greek HEIs have developed and/or are developing collaboration schemes with the private sector and relevant government agencies. Almost all Greek universities are working closely with local businesses, municipalities, and governmental organizations to pilot circular economy practices. By developing such collaboration schemes, higher education institutions in Greece can offer their students real-world application of circular economy principles in various sectors of the economy, such as waste management, agriculture, and manufacturing. An example of this process is the collaboration of the Harokopio University of Athens with the Hellenic Recycling Agency<sup>81</sup> in the integrated LIFE project LIFE-IP CEI-Greece which aims to contribute towards the implementation of the National Waste Management Plan, the National Waste Prevention Plan and the National Strategy for Circular Economy. Other university departments work with local waste management organizations and municipal authorities in pilot projects that explore sustainable waste processing and resource management.

Another aspect of the Greek HEIs' engagement in circular economy and Nature-based Solutions are the initiatives developed for promoting sustainability and “greening” the universities' campuses. For instance the University of Patras<sup>82</sup> has established the Sustainable-Green University Committee which promoted a combination of nature-based solutions and circular economy practices, such as adopting circular economy solutions by promoting resource reuse practices, redesigning of the campus map to include new green zones planting and transplanting of trees, green routes for pedestrians and cyclists, procurement of electric and conventional bicycles, creation of a parking base and photovoltaic charging system, etc., with the aim to provide quality living, sports and recreation to all members of the community and others. The higher education institutions in Greece are trying to develop and adopt circular economy principles in their everyday operations, through initiatives such as:

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<sup>76</sup> For example: BIOREGIO Interreg at <https://fodsakm.gr/en/projects/other-programs/bioregio/>

<sup>77</sup> COST Action CA21103 Implementation of Circular Economy in the Built Environment at <https://circularb.eu/>, CA22124 – EU Circular Economy Network for All: Consumer Protection through reducing, reusing, repairing (ECO4ALL) at <https://eco4all.org/>

<sup>78</sup> For example: <https://www.dept.aueb.gr/en/ReSEES/content/circular-economy-balkan-countries>

<sup>79</sup> For example: <https://unescochair.simor.ntua.gr/>,

<sup>80</sup> Centre for Renewable Energy Sources at [http://www.cres.gr/kape/index\\_eng.htm](http://www.cres.gr/kape/index_eng.htm)

<sup>81</sup> <https://circulargreece.gr/partners/>

<sup>82</sup> <https://www.upatras.gr/en/university/sustainability/>

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- Waste minimization: The Greek universities have recycling programs in place for paper, plastic, and electronic waste. Some of them also encourage cycling within campus grounds.
- Energy efficiency: Universities are investing in green energy and energy-saving systems, which align with the goals of circular economy and sustainability by reducing consumption and minimizing their environmental footprint.
- Green infrastructure: Campuses also embrace circular economy practices through nature-based solutions by integrating sustainable infrastructure, such as green roofs, rainwater harvesting systems, and energy-efficient buildings.

Last but not least, the Greek HEIs are promoting and taking measures to enhance student and community engagement. The main vehicle towards student and local communities' engagement is the uptaking of initiatives which raise awareness both within the academic community and beyond it. These efforts include organizing conferences, workshops, and seminars on sustainability, nature-based solutions and circular economy, such as hackathons and innovation challenges related to circular solutions, student-led sustainability projects, i.e. organizing zero-waste events or supporting the use of shared mobility (bike-sharing programs) on campuses.

## Conclusions and Future Research

This article provided a study on the emerging field of promoting circular economy through nature-based solutions (NBS) in higher education institutions focusing on the Greek universities. It offered insights into the ways in which Higher Education Institutions develop and support effective ways for integrating circular economy and NBS in their settings. The data and information collected have been synthesized in a study that elaborated on how circular economy concepts and practices may be further strengthened through the adoption of NBS solutions in Greek universities.

The study conducted was based on desk research and data collection from Greek higher education institutions and can be further developed to include surveys and interviews with the academic community (researchers, educators, students, management) and other stakeholders which may foster the integration of circular economy through applying nature-based solutions in the Greek universities' curricula and in the campuses, as well.

There are certainly several barriers and obstacles that limit the adoption of nature-based solutions and circular economy learning in higher education. The most important challenges are the lack of appropriate state funding, the lack of knowledge and experience within the academic community, especially within educators who are not familiar with these concepts and sometimes the lack of time needed to familiarize and gain knowledge on these topics.

These challenges could be addressed by developing interdisciplinary and multidisciplinary collaboration schemes/partnerships within the academic community and by involving other external stakeholders (including government agencies, the civil society and the private sector) in the whole process. It is crucial for the achievement of sustainable development to promote integration of circular economy principles across all disciplines and university policies and nature-based solutions offer a vehicle for facilitating this integration.



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A few recommendations towards this goal could be first of all, to develop a curriculum that will be particularly designed to offer students hands-on project approach and research experience using nature-based solutions. Second, it is crucial to engage students by helping them to develop better awareness about environmental challenges, circular economy and the potential contribution of nature-based solutions. Furthermore, both educators and students need to be trained and build specific skills in order to take action towards sustainable transition and transformation of the Greek higher education institutions, by endorsing circular economy and NBS concepts. Eco-citizenship approaches in Greek academic institutions may only be promoted by fostering behavioural transformation of students, researchers, educators, professors, employees and the academic community in general. Engaging experts and academics from different fields/disciplines shall offer a new dimension of the NBS/circular economy synergy.

In conclusion there is great potential for Greek universities to serve as key players in promoting circular economy strategies, given their research capabilities, innovation culture, and position in the broader European sustainability landscape. By integrating circular economy practices, such as reusing materials or designing products for longer life cycles, with nature-based solutions, new systems are created that have the potential to regenerate both human-made and natural environments. Universities can offer their students an advanced approach in sustainability transition by exploring real world problems and promoting the Sustainable Development Goals. The outcome of this process will be building resilience and sustainability and enhancing a harmonious relationship between human activities and nature.

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# REPORTING ON ESG UNDER THE NEW CSRD DIRECTIVE – ARE WE READY FOR A CHANGE IN THE PARADIGM OF CORPORATE GOVERNANCE AND BUSINESS?

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## Abstract

ESG reporting usually encompasses the disclosure of environmental, social and governance aspects of undertakings' business. In January 2023, the new CSRD Directive (Directive on Corporate Sustainability Reporting) entered into force, which essentially tightens non-financial reporting. The CSRD field of application has been expanded to a much larger number of undertakings and, according to estimates, it will cover approximately 55,000 companies operating in the EU internal market. Such a wide application will have great repercussions not only for EU undertaking, but also undertakings from the third countries that operate on the EU market. Following the above, this paper analyzes and examines the most significant novelties that come with the new CSRD directive and whether Croatian commercial companies (especially small and medium-sized ones) are ready for the novelties brought by the new CSRD directive. It is about changing the paradigm of corporate management and business in the EU single market, and consequently also in the Republic of Croatia. The conclusion provides an assessment of the situation and guidelines for better implementation of the new CSRD directive into the Croatian legal framework and into the corporate governance and operations of domestic companies.

**Keywords:** ESG, CSRD, non-financial reporting; circular economy; sustainable reporting.

## 1. INTRODUCTION

Nowadays, business sustainability is no longer focused only on financial but also on non-financial sustainability (Tuula, 2019; Tulla, 2020; Tuula, 2021; see also: Jovanović and

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Jovanović, 2023). In this regard, reporting on ESG, which includes: environmental (E), social (S) and governance (G) elements, is increasingly important. (Fornasari & Traversi, 2024; Brondoni & Plata, 2022; Yeaw and Seow, 2024; Raghavan, 2022).

At the international level, there are numerous examples of ESG soft laws instruments, policies and examples of good practice (see for instance so-called SDG, sustainable goals UN; Raghavan, 2022; Galant et al, 2024; Pizzi et al; 2020). In this regard, the EU is considered an international leader in ESG regulation (in this context see: Brennan, 2024; Almeyda and Darmansya, 2021; Raimo et al., 2021). Thus, as part of the EU legislative activity, the CSRD Directive came into force in January 2023, bringing significant changes to ESG reporting (Fornasari & Traversi, 202). Among other things, the innovations relate to the expansion of the field of application to small and medium-sized enterprises (SMEs), more precise reporting and standardization of ESG reports, the introduction of the concept of double materiality, etc. All of the above will have a major impact on the Croatian market, because the Republic of Croatia had to incorporate the aforementioned CSRD Directive into its legislation (Zubović, 2024).

Therefore, the following issues are posed as key research questions in this paper: are Croatian companies ready for these changes? The paper first analyzes the background and reasons for adopting the new CSRD. Then, the innovations brought by the CSRD are analyzed. The central part of the paper examines how the aforementioned changes will affect the Croatian market and whether entrepreneurs to whom the CSRD Directive applies will be able to adapt to the changes. The concluding part of the paper provides an assessment of the situation and guidelines for de lege ferenda action.

## 2. HISTORICAL DEVELOPMENT AND ORIGIN OF THE CSRD DIRECTIVE

In the 1970s, lobbying by states and international organizations for environmental protection began, with the EU positioning itself as one of the leading international leaders in promoting environmental protection, even though it was not and is not currently a significant global polluter (Sgaravatti et al, 2024). At the international level, the UN Framework Convention on Climate Change was first concluded in 1992. Then, five years later, in 1997, the Kyoto Protocol was concluded. These agreements formed the basis for the international community to conclude the Paris Agreement in 2016. This was the first legally binding agreement on this topic, which prescribed clear parameters for monitoring the signatory states with clear goals and guidelines, such as limiting the increase in global temperature, etc. (Savaresi, 2016).

All of these efforts also had an impact on EU legislation, so the Paris Agreement was the basis for the adoption of the European Green Deal. It is a document that has similar goals as the Paris Agreement with the aim of preserving nature for future generations (Staudt et al, 2023). All of the above resulted in strong legislative activity of the EU, and in the following period a large number of documents were adopted regarding the standardization of environmental protection and the expansion of the focus and concept of business from financial to non-financial business. In this context, the content of corporate reporting began to be discussed more significantly because the focus of such reporting was no longer only on profit and financial sheets (Fornasari & Traversi, 2024, p. 117; Brondoni & Plata, 2022, p. 1-2).

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Generally speaking, at the international level we find various forms of corporate non-financial reporting: voluntary, mandatory and hybrid. Nowadays, the voluntary model is mostly used, i.e. a model in which reporting is not legally binding, but it is an autonomous decision of the company whether or not to report. Despite such regulation, most companies report on their operations in order to avoid reputational damage and negative effects and effects on their operations due to bad publicity. For many years, a hybrid model was in force in the EU, which as a rule obligates large companies to report on non-financial aspects of business, but large undertakings can be released from such an obligation if they explain the reasons why they do not want to report on it (Lee et al, 2023).

Directive 2014/59/EU, i.e. the Non-Financial Reporting Directive (hereinafter: NFRD) from 2014, is among the first legally binding documents that introduced the obligation to report. The field of application of the NFRD referred to large undertakings that have more than 500 employees and which are public-interest entities (Art. 19a NFRD). The mentioned undertaking was obliged to publish non-financial information from 2017 (Hummel and Jobst, 2024). NFRD tried to introduce transparency and comparative monitoring of non-financial statements among undertakings on the market. In this context, undertakings were obliged to report on various forms of non-financial business, such as a description of business methods and policies, which achieve ESG goals, then related risks and measurement of the success of such business (Koundouri et al, 2022). The main drawback when applying the NFRD was non-binding application in situations where undertakings explain the reasons why they want to hide the requested non-financial information. This led to the fact that many undertakings used the mentioned option and that the expected results of the NFRD were not realized (Cuomo et al, 2024).

The next step of the EU, in terms of non-financial reporting, was the adoption of Regulations 2019/2088 of the European Parliament and of the Council of 27 November 2019 on sustainability-related disclosures in the financial services sector (hereinafter: SFDR) which applied to participants in financial markets, including financial advisors. The SFDR introduced an obligation for the above-mentioned entities to report on non-financial risks. Also significant is Regulation (EU) 2020/852 of the European Parliament and of the Council of 18 June 2020 on the establishment of a framework to facilitate sustainable investment, and amending Regulation (EU) 2019 (hereinafter: Taxonomy Regulation; Hummel and Jobst, 2024) which introduces “the criteria for determining whether an economic activity qualifies as environmentally sustainable for the purposes of establishing the degree to which an investment is environmentally sustainable” (Art. 1. of the Taxonomy Regulation).

The EU noted that the aforementioned legal framework and hybrid model of non-financial reporting did not meet the needs of the market, i.e. that it did not achieve its set goals and purpose. Therefore, the EU adopted Directive (EU) 2022/2464 of the European Parliament and of the Council of 14 December 2022 amending Regulation (EU) No 537/2014, Directive 2004/109/EC, Directive 2006/43/EC and Directive 2013/34/EU (hereinafter: CSRD) which switched to a mandatory model of reporting on non-financial sustainability (Staudt et al, 2023; CSRD; Krueger et al, 2024).

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### 3. CORPORATE SUSTAINABILITY REPORTING DIRECTIVE (CSRD)

#### 3.1. The most significant news and goals of CSRD

The increasing orientation of market participants and international organizations and countries towards environmental protection has led to the need to tighten the obligation of non-financial reporting and expand the field of application, i.e. the obligation to report also to other legal entities on the market and not only to large undertakings with public interest as prescribed in the NFRD (NFRD, Staudt et al, 2023). In other words, the NFRD referred to 11,700 undertakings, and with the adoption of the CSRD, the obligation to report was extended to 50,000 undertakings (Staudt et al, 2023; Zubović). In other words, with the new CSRD, redundant reporting is introduced and the possibility of hybrid reporting is abandoned, and instead of non-financial reporting, the term sustainable reporting is introduced (Lee et al, 2023).

The most important innovation brought by the CSRD is the concept of double materiality, which obliges undertakings to report on the effect of their operations on their business, but also on the effect of the undertaking's operations on the environment and society (Art. 19a (1) CSRD). A significant step forward is Art. 29b of the CSRD which introduces a standardized method on sustainable reporting so-called European Sustainability Reporting Standards (ESRS) developed and published by the European Financial Reporting Advisory Group (EFRAG) (Art. 29b CSRD). The aforementioned standards require detailed and clear reporting on the environmental and social aspects of business undertakings (Staudt et al, 2023). In addition, the new CSRD introduces the obligation of external audit of the sustainable report, promotes digitization and facilitates access to data through the establishment of centralized databases, risks for end users, provisions on cyber security and data protection, etc. (CSRD; Boggini, 2024).

The main goal of CSRD is most often stated to be increasing transparency and standardizing sustainable reporting. All of the above aims to facilitate access to the capital market, facilitate access to information and relevant circumstances for interested stakeholders (Birkmann et al, 2024). The goal of CSRD is, among other things, to establish a balance between all participants and shift the focus from the financial aspect of business to the impact of enterprises on the environment and society (Freeman et al, 2021).

In addition to CSRD, the EU adopted the Directive on in-depth analysis of corporate sustainability (Directive (EU) 2024/1760 of the European Parliament and of the Council of 13 June 2024 on corporate sustainability due diligence and amending Directive (EU) 2019/1937 and Regulation (EU) 2023/2859, hereinafter: CSDDD) to achieve the goals of CSRD, which entered into force on 25 July 2024 ([https://commission.europa.eu/business-economy-euro/doing-business-eu/sustainability-due-diligence-responsible-business/corporate-sustainability-due-diligence\\_en](https://commission.europa.eu/business-economy-euro/doing-business-eu/sustainability-due-diligence-responsible-business/corporate-sustainability-due-diligence_en)). Pursuant to Art. 4. of the CSDDD prescribes the obligation of member states that undertakings carry out an in-depth verification of whether the objectives in terms of conservation of ecclesiastes are achieved and whether the undertakings protect human rights. (Kent, 2023).



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### 3.2. Deadlines and periodicity of reporting

The CSRD should be implemented into national legislation in 4 phases. The directive itself entered into force on 5.1.2023 (Zubović, 2024). The first phase concerned NFRD applicant who had to start reporting for the period from 1 January 2024 in 2025. The second phase affected all other large enterprises that were not NFRD applicant and who had to report from 1 January 2025 in 2026. The third phase concerns small and medium-sized enterprises that will have to report for the period from 1 January 2026 in 2027. The fourth phase concerns undertakings from third countries that will have to report for the period from 1 January 2028 in 2029. (CSRD; Art. 37 CSDDD, for Croatia see 70-73 Accounting Act).

## 4. IMPLEMENTATION IN NATIONAL LEGISLATION

### 4.1. General overview

The obligation to implement CSRD into national legislation was until July 6, 2024 (Zubović, 2024). Discrepancies in national legislation regarding sustainable reporting are the main obstacle to the implementation of CSRD and accompanying regulations. First of all, because the obligations of sustainable reporting in accordance with CSRD impose additional obligations and requirements for undertakings in terms of human resources, time and money (Romé and Renz, 2024). Germany stands out in the EU as one of the most advanced countries in terms of sustainable reporting (<https://www.twobirds.com/en/insights/2024/germany/neues-zur-csrd-und-deren-umsetzung-in-deutschland>). CSRD prescribes sanctions for non-compliance of sustainability reports in the form of fines or sanctions through negative market effects for non-disclosure of required information. The most severe penalties are in Germany, with the maximum sanction of 10 million euros, and in Italy they never exceed 150,000 euros. (Lee et al, 2023).

It is interesting that non-EU member states such as Norway have included CSRD provisions in their national regulations in order to harmonize them with European standards on sustainable reporting (<https://wr.no/en/news/eu-corporate-sustainability-reporting-directive-csrd-implemented-into-norwegian-law>).

In addition, other non-EU countries operating in the EU single market are harmonizing their regulations with the CSRD regulation in order to be competitors on the EU market. It is worth noting that non-EU countries often complain that the EU has a selective "neo-colloquial approach" that relates negatively to (Sgaravatti et al, 2024).

### 4.2. Implementation of CSRD Directive in Croatian Legislation

CSRD and accompanying regulations were implemented in Croatian legislation through amendments to 3 laws: the Accounting Act, the Audit Act and the Capital Market Act (Accounting Act Narodne novine 85/2024, 145/24; Audit Act Narodne novine no. 127/2017, 27/2024, 85/2024, 145/2024 and the Capital Market Act, Narodne novine No. 65/2018, 17/2020, 83/2021, 151/2022, 85/2024).

In the Accounting Act, the term sustainability is mentioned in several places: SUCH AS "a sustainability report is a report on information related to sustainability issues" (Art. 3 (8) of the Accounting Act); "the report on the verification of the sustainability report is the report as

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regulated by the Audit Act” (Art. 3 (9) of the Accounting Act); "sustainability issues are environmental factors, social factors, factors in the field of human rights and management factors, including sustainability factors in the financial services sector" (Art. 3 (15) of the Accounting Act), and in chapter VIII that is titled as Sustainability Reporting (Art. 29 onwards of the Accounting Act). Art. 29 of the Accounting Act stipulates that large entrepreneurs, medium-sized entrepreneurs and small entrepreneurs are obliged to report on sustainability in accordance with the CRSD. (Art. 29 (2) of the Accounting Act). The sustainability report must be clearly published and contain a brief description of the implementation of the entrepreneur's sustainability strategy (Art. 29 (3) and (4) of the Accounting Act).

Furthermore, the law prescribes the criteria for exemption from submitting a sustainability report (Art. 31 of the Accounting Act), and what a consolidated sustainability report looks like (Art. 32 of the Accounting Act). and exemption from submitting a consolidated sustainability report (Art. 33 of the Accounting Act). Art. 33 of the Accounting Act stipulates that the members of the management, executive directors and the management board of the entrepreneur are obliged to report to the representatives of the workers on certain aspects of sustainability.

In Art. 35 of the Accounting Act prescribes the content of sustainability reports for non-EU countries.

In Art. 36 of the Accounting Act stipulates that the aforementioned sustainability reports are compiled and presented using the European sustainability reporting standards, as regulated by the implementing acts of the European Commission. Also, the Accounting Act in the Art 37 prescribes the obligation to verify, or draw a conclusion on the sustainability report by an independent auditor or an auditing company that performs a statutory audit of annual financial statements or annual consolidated financial statements.

Provisions 70-73 of the Accounting Act are also very important, which talk about the deadlines for mandatory submission of sustainability reports for large, medium and small enterprises and for enterprises from third countries (Art. 70-73 of the Accounting Act). The mentioned deadlines overlap with the deadlines from CSRD.

In the revision law, Art. 4. of the Audit Act stipulates that audit services include, among other things, verification of sustainability reports (Art. 4(1) of the Audit Act). Then it is prescribed that the verification of the sustainability report is actually the verification of the sustainability report and the consolidated sustainability report, which includes the implementation of procedures resulting in the conclusion given by the audit company. in accordance with this Law and the law regulating the accounting of entrepreneurs (Art. 4(6) of the Audit Act).

## 5. ISSUES REKATED TO ESG POLICY IMPLEMENTATION AND TRENDS

Despite all the positive aspects of sustainable reporting, numerous authors and practitioners warn of the increasingly frequent false reporting of sustainability. In this context, the most mentioned is greenwashing, which represents the false presentation of action of undertakings as sustainable. Reasons for using greenwashing can be gaining a false green reputation and

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attracting customers, as well as deceiving business partners, financiers, etc. (Gatti et al, 2019; De Freitas Neto; Cornell and Damodaran, 2020).

In addition to the above, numerous authors criticize sustainable reporting, stating that orientation towards sustainability does not necessarily bring better business results. Namely, the authors warn that sustainability is manifested in long-term strategies and that large investments of money and resources are needed, and that the real results of the application of business viability and normative inconsistency (Johnson, 2021). New trends bring facilitation of reporting on sustainability through the use of AI softwares that facilitate the monitoring of sustainability indicators and parameters (Saxena et al, 2022; Sætra, 2023).

## 6. CONCLUSION

CSRD introduced major changes in the EU single market. The aforementioned Directive expanded the field of application from non-financial reporting to sustainability reporting, and expanded the scope of sustainability reporting obligations to include all other large, medium and small entrepreneurs, as well as entrepreneurs from third countries. Also, the concept of double materiality has been introduced, which must be reported not only on the impact of operations on undertakings, but also on the impact of undertakings on the environment and society in general.

All the mentioned provisions must be implemented in national legislation in four stages. The implementation this time affects not only EU member states, but also third countries operating in the EU. This has great implications for the day-to-day operations of undertakings, because now they have to calculate and measure sustainability parameters in their operations.

The Republic of Croatia also implemented CSRD. Implementation was carried out mostly through amendments to the Accounting Act, Audit Act and Act on Capital Market. All the mentioned regulations are harmonized with the EU legislation. At this moment, it is too early to assess whether the correct application has taken root properly in the Croatian business market. It can only be said that there are numerous dangers and negative effects of sustainable reporting. For example, greenwashing, excessive investments and weak investment returns, and the constant need for up-to-date compliance in order to facilitate the monitoring of sustainability parameters and indicators and at the same time facilitate ESG reporting.

It remains to be seen how sustainability policy and regulation will develop in the light of current global politics and international trade, and for now we can only hope that the pipe default CRSD will have a positive impact on the EU market.

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## **THE EU’s PROBABILISTIC DEPENDENCY STRUCTURE TOWARDS THE GOAL OF A CIRCULAR ECONOMY**

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### **Abstract**

This paper explores the interdependencies among key circular economy (CE) indicators across the European Union using data from the EUROSTAT Monitoring Framework. The dataset spans the years 2012–2021 and includes information from 27 EU member states, covering thematic areas such as production and consumption, competitiveness and innovation, and global sustainability and resilience. A Bayesian network is employed to learn the probabilistic structure among seven selected indicators, revealing conditional relationships that characterize the dynamics of the EU’s circular economy. Scenario analysis shows that increased consumption levels are associated with higher material use and waste generation, alongside a notable rise in patent activity related to recycling—suggesting that environmental pressure may stimulate innovation. These findings highlight the value of understanding indicator interdependencies to support evidence-based policymaking and guide the EU’s transition toward a more circular and resilient economy.

**Key words:** Circular Economy, Bayesian networks, Probabilistic dependency, CE indicators, EUROSTAT, European Union

### **Introduction**

The EU’s aim to achieve a circular economy over a linear one requires transformative actions targeting countries’ policy frameworks, governance structures, and operational practices. These actions must prioritize sustainability, resource efficiency, and innovation across all sectors. Key steps include implementing regulations to support circular business models, enhancing local government capacities for waste management and recycling, and fostering public-private partnerships for sustainable development. However, these actions depend heavily on the economic resilience of the participating countries which in turn depend on the continuous availability of resources for production. This challenge underscores a long-overlooked truth: humanity has only recently come to fully recognize that natural resources are, in fact, finite.

The concept of the circular economy (CE) originated from Boulding’s (1966) call for a shift from unlimited resource use to a closed-loop system, recognizing the planet’s finite resources. Pearce and Turner (1989) later formalized this idea by introducing the term “circular economy,” promoting a circular model over a traditional linear one to enhance economic resilience. Since then, as pointed out by Cinicioglu and Korkmaz Tümer (2024)

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interest in CE has grown significantly. On that, Merli *et al.* (2018) document the rise in CE-related publications and offer a comprehensive review of the field. Much of this research has been concentrated in Europe and China, where CE has been adopted as public policy. Europe has advanced the agenda through frameworks like the European Green Deal (European Commission, 2019), while China embedded CE into national laws such as the Circular Economy Promotion Law. Winans *et al.* (2017) emphasize the importance of supportive policies for standardized recycling to encourage industry adoption.

This paper explores the probabilistic dependency structure of EU member states using datasets from the EUROSTAT database, focusing on production & consumption, competitiveness& innovation and global sustainability & resilience. To analyze these relationships, the study employs Bayesian networks, a powerful probabilistic graphical modeling tool that reveals conditional dependencies among the set of selected circular economy indicators. The insights gained from this approach will shed light on the interplay between resource dependency, self-sufficiency, and eco-innovation, offering valuable implications for policymaking and institutional reforms necessary for achieving a circular economy.

The remainder of this paper is structured as follows: In the next section, we present our methodology which will be used as the main tool of our analysis. This is followed by an introduction to the set of indicators obtained from Eurostat database, along with a description of the data cleaning procedures applied on the data set. The subsequent section is devoted on the construction of the Bayesian network and the analysis conducted on it. This includes an exploration of the dependency structure, as well as scenario analysis on it, which provides insights into the interdependencies among EU countries with respect to the circularity indicators. Finally, we conclude the paper by summarizing the key findings and implications.

### Methodology: Bayesian Networks

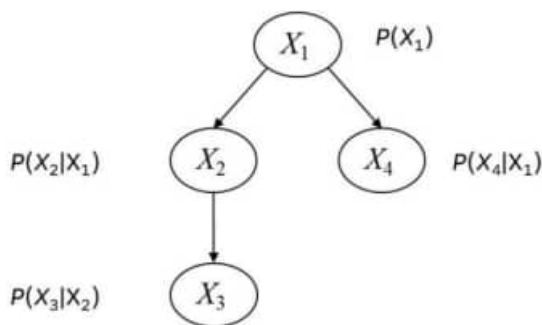
Bayesian networks are acyclic probabilistic graphical networks in which variables are represented through nodes and the probabilistic dependencies between the variables are represented through directed arcs. In a Bayesian network (BN) if there is an arc between two variables then the variable from which the arc is pointed is called as the parent variable of the node to which the arc is pointed. Each variable in a Bayesian network  $X_1, \dots, X_N$  follows a probability distribution conditioned on its parent variables and the joint probability distribution of the network is formed by the product of these conditional probability distributions as it is shown in Equation 1 below. Each variable in a Bayesian network is conditionally independent given its parents.

$$P(X_1, \dots, X_N) = \prod_{i=1}^N P(X_i | Pa(X_i)) \quad (1)$$

Below in Figure 1 a small Bayesian network with four variables  $X_1, X_2, X_3$  and  $X_4$  which follow the probability distributions  $P(X_1)$ ,  $P(X_2 | X_1)$ ,  $P(X_4 | X_1)$  and  $P(X_3 | X_2)$  are represented. In this small Bayesian network  $X_1$  is the parent variable of  $X_2$  and  $X_4$ ,  $X_3$  is the child variable of  $X_2$  and  $X_4$  is the child variable of  $X_1$ . Notice that in the small BN  $X_1$  stands without any parents with its marginal distribution and therefore is called as to root variable of the network. In BNs

there is no limit regarding the parent variables and children that a variable can take. Once an observation(s) for the state(s) of the variables is observed, the BN is updated accordingly, representing the posterior probabilities of the variables in the network. As represented in Figure 1 given below the variables  $X_3$  and  $X_4$  do not possess any children. One of the most important advantages of Bayesian network is that it allows us to use the backpropagation algorithm which ensures that an observation downstream in the network will result in an updating process upstream in the network.

**Figure 1. A Bayesian network representation with four variables**



The chain rule that is represented in Equation 1 ensures that Bayesian networks are acyclic graphical networks in the sense that if you follow the direction of arcs beginning from one node you cannot close the cycle and cannot end up in your starting node. Another aspect regarding the Bayesian network is that it possesses two different layers, one is the graphical network structure which is represented through the graph and the other is the computational background where the conditional probability distributions of the variables are represented which constitute the parameters of the variables. Consequently, the inference process in Bayesian networks relies on continual application of the Bayesian updating rule. The graphical interface of Bayesian network provides an intuitive appeal and understanding to the audience outside the field and the computational background and inference process ensures the correct demonstration of the joint probability distribution represented by the set of variables in the network.

Bayesian networks are first introduced by Pearl (1985) which later became an important part of artificial intelligence, and its use spread to many different application areas from healthcare, risk assessment, medicine, targeted advertising, competitiveness and innovation, finance, Maritime industry and numerous more. Some examples are as follows: Cinicioglu *et al.* (2024) provide a benchmark procedure for the evaluation of the sovereign risk of countries using Bayesian networks which involves a comprehensive analysis involving several steps conducted comprehensive analysis involving conducted on the BNs for each of the 3-month intervals of the COVID-19 pandemic. Their study illustrates the use of artificial intelligence methods to understand the working mechanism of economic systems. Kyrimi *et al.* (2025) advocate the use of BNs as a healthcare governance tool since it allows for counterfactual reasoning which can be used to assess what would have happened if treatments other than those occurred has been selected. Animah *et al.* (2024) provides a comprehensive literature

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review on Bayesian network applications in maritime industry emphasizing that uncertainty-related tasks such as accident investigation, reliability prediction and port sustainability are key priorities of the industry, making Bayesian networks a convenient and reliable method for analysis. Cinicioglu *et al.* (2017) explores the interaction between competitiveness and innovation using Bayesian networks and Cinicioglu *et al.* (2012) analyses the competitiveness of automotive industry using Bayesian networks.

As demonstrated, there exists a broad range of application areas for the use of Bayesian networks. This wide variety exemplified above can be further expanded to include even more domains. The reasons are as follows: The intuitive appeal of Bayesian networks makes it a convenient tool accessible to a wider audience. Additionally, their strong computational foundation and ability to update in light of new evidence allow for accurate inference. Moreover, scenario analysis conducted on Bayesian networks enables the researcher to explore the answers of what-if questions, drawing insights from the updated network after incorporating new evidence(s). Another key advantage is their ability to represent and explore multiple input and output variables, unlike regression analysis, which is limited to a single output variable. This capability significantly enhances their prediction power. Lastly, Bayesian networks support counterfactual reasoning and backward propagation further strengthening their analytical and decision-making capabilities. In the following section, we describe the data set obtained from the EUROSTAT database which will be used for learning the Bayesian network for analysis.

### **Data Set: EU Circularity Indicators**

The Circular economy Action plan was launched in 2020 as a key initiative under the European Green Deal and its goal is set as to transform the EU into a leader in sustainability and resource efficiency. The European Commission’s Monitoring Framework, designed to keep track toward a circular economy, collects data of European countries across five thematic sections of production & consumption, waste management, secondary raw materials, competitiveness and innovation and global sustainability and resilience. These thematic sections encompass a total of eleven statistical indicators, some of which also feature sub-indicators. Seven different sub indicators from the EUROSTAT database are selected in this work to infer the probabilistic dependency structure in EU regarding the selected circularity indicators. For that purpose, using the data set obtained from EUROSTAT database between the years of 2012-2021 containing the data of 27 European countries the corresponding Bayesian network will be learned. The list of the countries is provided in Table 1 below which were selected on the basis of availability of data for the time frame considered. The list of the sub indicators selected for analysis are provided in Table 2 following along with their codes as used in the EUROSTAT database.

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**Table 1. The list of countries included in the data set used to learn the Bayesian network**

|                     |              |                |                  |                     |
|---------------------|--------------|----------------|------------------|---------------------|
| Belgium (BE)        | Estonia (EE) | Hungary (HU)   | Malta (MT)       | Slovenia (SI)       |
| Bulgaria (BG)       | Greece (EL)  | Ireland (IE)   | Netherlands (NL) | Slovakia (SK)       |
| Cyprus (CY)         | Spain (ES)   | Italy (IT)     | Poland (PL)      | United Kingdom (UK) |
| Czech Republic (CY) | Finland (FI) | Lithuania (LT) | Portugal (PT)    |                     |
| Germany (DE)        | France (FR)  | Luxemburg (LU) | Romania (RO)     |                     |
| Denmark (DK)        | Croatia (HR) | Latvia (LU)    | Sweden (SE)      |                     |

**Table 2. The list of countries included in the data set**

| Thematic section                                         | Online data code | Indicator name                                                 | Sub indicator code   | Corresponding sub indicator                                                  |
|----------------------------------------------------------|------------------|----------------------------------------------------------------|----------------------|------------------------------------------------------------------------------|
| <b>Production &amp; Consumption</b><br>(cei_pc)          | pc020            | Material footprint                                             | A, T_HAB, TOTAL, RMC | Annual total raw material consumption per inhabitant                         |
|                                                          | pc050            | Generation of plastic packaging waste per capita               | A,W150102,GEN,KG_HAB | Annual generation of plastic packaging in kilograms per inhabitant           |
| <b>Competitiveness &amp; Innovation</b><br>(cei_cie)     | cie012           | Private investment and gross added value related to CE sectors | A, GVA, PC_GDP       | Gross value added on CE per capita                                           |
|                                                          | cie012           |                                                                | A, INV, PC_GDP       | Private investment in CE per capita                                          |
|                                                          | cie_020          | Patents related to recycling and secondary raw materials       | A,Y02W,P_MHAB        | Annual number of patents related to waste management per million inhabitants |
| <b>Global Sustainability and Resilience</b><br>(cei_gsr) | cei_gsr_010      | Consumption footprint                                          | A_SWS_P_HAB          | Annual single weighted score per inhabitant                                  |
|                                                          | cei_gsr030       | Material import dependency                                     | A_TOTAL_PC           | Ratio of imports over direct material inputs                                 |

According to the EUROSTAT database, the set of variables used for this study are defined as follows:

**Material Footprint (pc020):** This indicator measures the global demand for raw materials (biomass, metal ores, non-metallic minerals, and fossil energy materials) that results

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from consumption and investments by households, governments, and businesses within the EU.

**Generation of Plastic Packaging Waste per Capita (pc050):** This indicator tracks the amount of plastic waste produced per person, specifically focusing on packaging materials. Packaging, in this context, refers to any material used to contain, protect, handle, deliver, or present goods throughout their lifecycle, from raw material to consumer. It also includes non-returnable packaging items.

**Private Investment and Gross Added Value Related to Circular Economy Sectors (cie012):** This indicator assesses the financial investments and value added by private sectors that are directly involved in circular economy activities. It reflects the economic contributions from industries focused on sustainability, recycling, and the reuse of materials.

**Patents Related to Recycling and Secondary Raw Materials (cie\_020):** This indicator counts the number of patents issued that are related to recycling technologies and secondary raw materials. These patents are categorized using the Cooperative Patent Classification (CPC), focusing on innovations that improve recycling processes or create new uses for secondary raw materials.

**Consumption Footprint (cei\_gsr\_010):** The consumption footprint measures the environmental impacts of consumption in the EU and its member states. It combines data on how intensely products are consumed with the environmental effects of producing these goods, helping to assess the overall sustainability of consumption patterns.

**Material Import Dependency (cei\_gsr\_030):** This indicator calculates the EU's reliance on imported materials by comparing the volume of material imports to direct material inputs (DMI). It is expressed as a percentage, highlighting how much the EU depends on external sources for its raw materials.

The data set obtained from EUROSTAT database constitutes 10 years of annual data for the twenty seven countries listed in Table 1. This data set is transformed into a form where a country's data for each year corresponds to a line, resulting in 270 observations for the seven variables given in Table 2. Since the variables used in this study use different range of values all the variables are discretized using hierarchical discretization technique. Hierarchical discretization is an unsupervised method that begins with one bin per record and merges bins with the smallest mean differences until the desired number of states is reached (Cinicioglu *et al.*, 2024). Accordingly, each variable is discretized with five states where the state beginning *s1\_* refers to the lowest values for that variable and the state beginning as *s5* refers to the state referring to the highest values of that variable. In the following section the discretized data set will be utilized for learning the BN.

### Bayesian Network Analysis:

#### *Exploring Dependency Structures via Bayesian Network*

Using the discretized data set described in the previous section we will learn the corresponding Bayesian network demonstrating the dependency structure between the circular economy indicators selected. For learning the structure of the Bayesian network from the data, Bayesian search algorithm is employed which uses the hill-climbing structure with random



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starts. The Bayesian search algorithm identifies the most probable Bayesian Network (BN) structure  $G$  given the data  $D$  by maximizing the log-likelihood scoring function shown below. In this context,  $n$  denotes the number of variables in the BN,  $q_i$  represents the number of configurations of the  $i$ th variable's parent set, and  $r_i$  indicates the number of categories (or states) of the  $i$ th variable (Bouckaert, 1995). The terms  $N_{ijk}$  and  $N_{ij}$  correspond to the number of instances in the dataset  $D$ , where  $N_{ij}$  is the marginal count over the states  $k$  of the variable.

$$LL(G|D) = \sum_{i=1}^n \sum_{j=1}^{q_i} \sum_{k=1}^{r_i} N_{ijk} \log \left( \frac{N_{ijk}}{N_{ij}} \right) \quad (2)$$

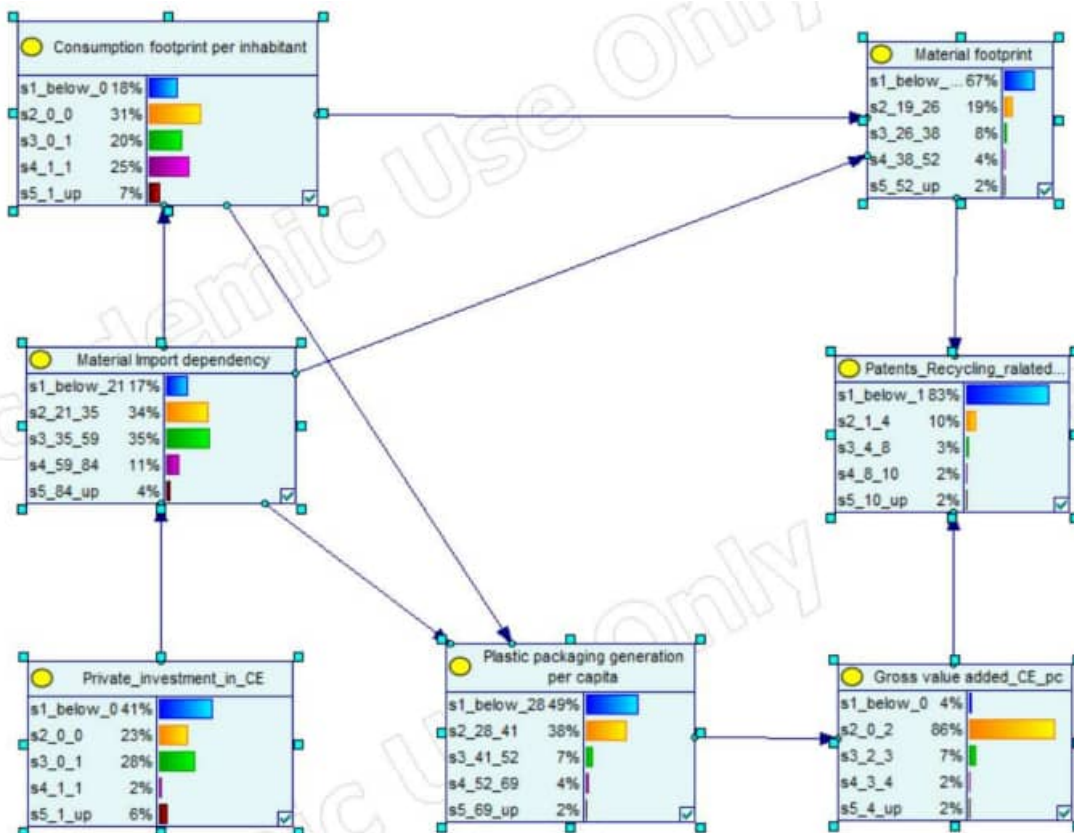
Once the structure learning of the Bayesian Network (BN) is completed, the parameters of the variables are estimated using the Expectation-Maximization (EM) algorithm (Dempster *et al.*, 1977; Lauritzen, 1995). This algorithm follows an iterative process to estimate the conditional probability tables of the variables, aiming to maximize the likelihood of the observed data given the network model.

Figure 2 below illustrates the Bayesian network structure learned directly from the dataset. Each node in the network represents a variable, and alongside these nodes, marginal probabilities for each distinct state are displayed, providing clear insight into the distribution and trends of each variable across the data. For example, consider the node labeled "Patents related to Recycling," which reflects the annual count of patents filed per million inhabitants in relation to waste management and recycling technologies. Observing the probabilities, we note that state  $s_1$ , representing the lowest category (below a value of 1), holds a substantial marginal probability of 83%. This significant finding indicates that, across most European countries examined during the ten-year span covered by the data, innovation and patent activity in recycling-related technologies remain strikingly limited. Given the context where a higher number of patents would indicate more robust innovative efforts and potential advancement towards circular economy goals, the observed concentration in the lowest patent state clearly highlights a notable gap in scientific and technological developments. Consequently, this analysis reveals a somewhat concerning stagnation in research outputs and innovation, suggesting that the current trajectory of scientific effort dedicated to advancing circular economy practices may not yet be sufficient to meet the ambitious targets envisioned by policy frameworks and sustainability initiatives.

Moreover, as illustrated in Figure 2 below, which shows the Bayesian network structure learned from the data, we observe a direct dependency between “Material import dependency” and both “Material footprint” and “Plastic packaging per capita”. Specifically, “Material import dependency” acts as a parent node to the other two variables. While in a Bayesian network the use of the chain rule and the assumption of conditional independence allows the influence of a variable to extend beyond its immediate children, the presence of an arc between two nodes always indicates a strong dependency structure. In this case, the arcs from “Material import dependency” to the other two variables confirm a substantial direct influence. More generally, wherever an arc is present between two variables in the network, it signals that a significant statistical dependency exists between them.

Another noteworthy observation concerns the variable “Consumption footprint,” which measures the sustainability of consumption by combining product use intensity with the environmental impact of production across EU member states. As illustrated in Figure 2, the marginal probabilities associated with this variable reveal a high degree of variation across its different states, encompassing low, medium, and high consumption profiles. This pattern stands in contrast to most other variables in the Bayesian network, which tend to exhibit one or two dominant states characterized by significantly higher marginal probabilities. Notably, two other variables—“Material import dependency” and “Private investment in the Circular Economy”—also exhibit broader variation across states, though less pronounced than that of “Consumption footprint.” This wider distribution suggests diverse structural conditions and policy environments across EU countries, as well as significant heterogeneity in consumption-related environmental pressures. It also reflects the longitudinal nature of the dataset, which spans a 10-year period during which consumption patterns and related indicators may have shifted considerably. In the following subsection scenario analysis will be conducted which will further shed light in the dependency structure and explain how the realization of different scenarios is changing our inferences regarding the set of variables.

**Figure 2. The Bayesian network structure showing the probabilistic dependencies and marginal probabilities of the variables**



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### *Scenario Analysis*

As the next step in our analysis, we apply the evidence propagation functionality of Bayesian networks to perform scenario analysis. This approach involves setting one or more variables to a specific state—effectively assigning a probability of 1 to that state—and then examining how this observation influences the posterior probabilities of other variables throughout the network.

In Figure 3, the variable “Consumption footprint per inhabitant” is observed in its fifth state  $s_5$ , representing the highest level of consumption. By comparing the updated posterior marginal probabilities in Figure 3 with the baseline probabilities presented in Figure 2 (prior to the evidence), we observe a substantial increase in the likelihood of higher states for both “Plastic packaging waste per capita” and “Material footprint.” This result aligns with expectations: as consumption intensifies, both plastic waste generation and material usage tend to rise accordingly.

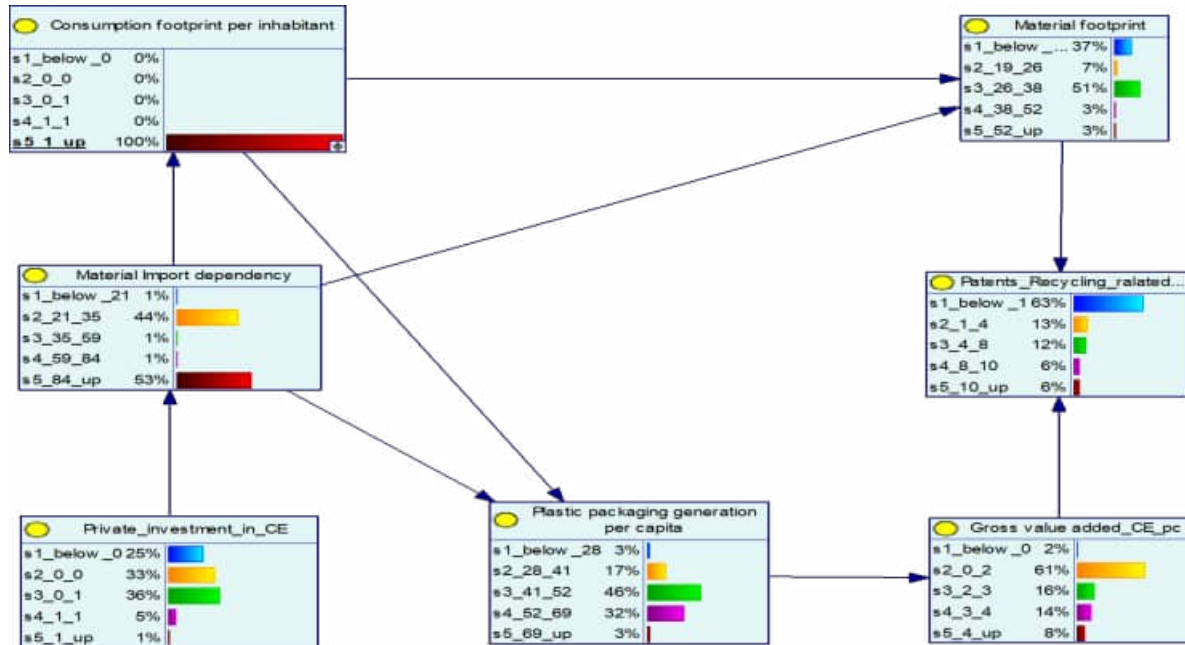
However, more nuanced insights emerge when examining the response of two other variables—“Material import dependency” and “Patents related to recycling.” Following the observation of high consumption ( $s_5$ ), the posterior probabilities for both variables shift towards higher states. This suggests a potential causal chain where increased consumption leads to greater reliance on imported materials, likely due to the depletion or insufficiency of domestic resources. Simultaneously, the rise in the state associated with patent activity implies that as environmental pressure from consumption intensifies, greater scientific and technological efforts are directed toward recycling and waste management solutions.

It is important to note, however, that this observed relationship might also reflect structural patterns in which countries with the highest consumption levels are concurrently those investing the most in circular economy research and innovation. Therefore, while the scenario analysis supports intuitive dependencies, it also highlights the potential influence of underlying economic and policy environments that shape both consumption behavior and CE-related advancements.

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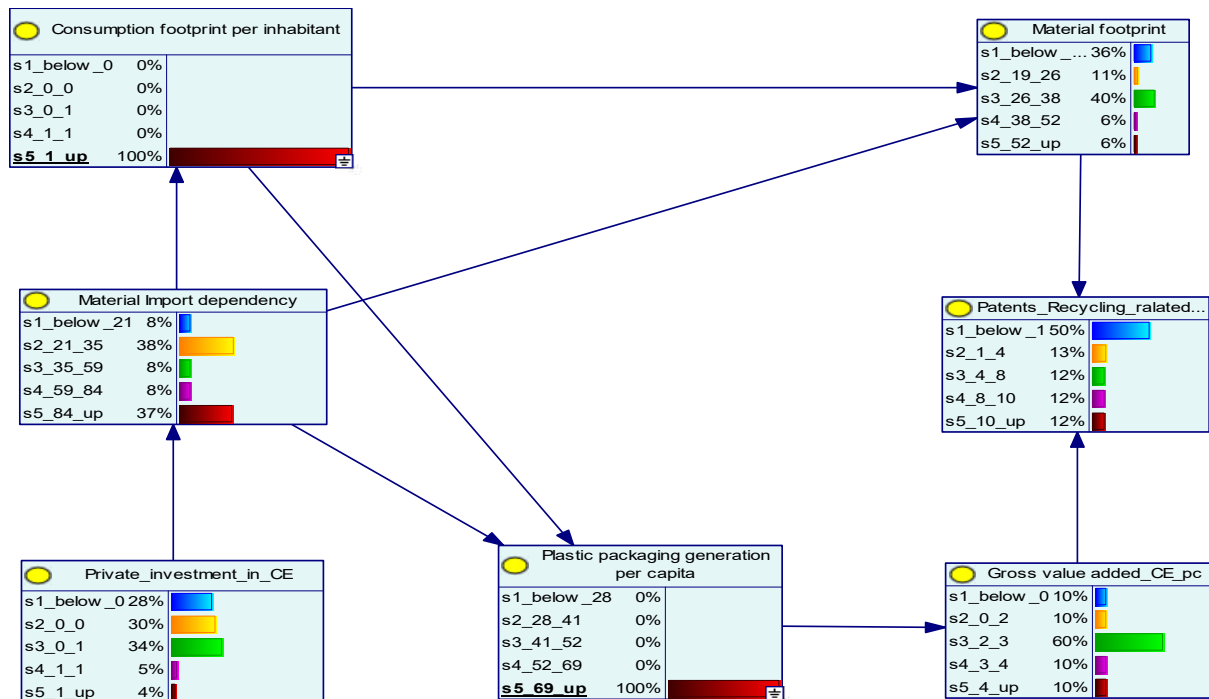
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**Figure 3. The updated BN after observing the evidence for  $P$  (Consumption footprint per inhabitant = s5|Material Import Dependency)**



As the next step of the analysis, we extend our investigation by incorporating additional evidence: namely, that “Plastic packaging generation per capita” is in its fifth state ( $s5$ ), representing the highest level of plastic packaging use which is represented in Figure 4 below. At this stage, both observations—“Consumption Footprint per inhabitant” and “Plastic packaging generation per capita”—are simultaneously set to their fifth state ( $s5$ ), indicating the highest levels for each. Upon entering this evidence, the updated posterior probabilities in the Bayesian network reveal slight improvements in the probabilities of higher-value states for the variables “Patents related to CE” and “Gross value-added CE”. These two indicators reflect positive developments in the context of the circular economy, where higher values represent a more favorable position. Consequently, one may interpret this result to suggest that increased environmental waste can potentially trigger a counter-response by accelerating progress toward circular economy solutions. As represented through these scenario analyses conducted Bayesian networks represent a favorable tool in terms of the policy analyses. In the following section, we summarize our research and conclude.

**Figure 4. The updated BN after observing the evidences for  $P$  (Consumption footprint per inhabitant = s5|Material Import Dependency) &  $P$  (Plastic packaging generation per capita= s5 |Material Import Dependency, Consumption footprint per inhabitant = s5)**



## Conclusions

The fast depletion of natural resources and the substantial increase in the amount of waste generated over the years is the result of the reckless consumption pattern that humankind has followed over the last century. As a response to the resource-intensive and environmentally harmful patterns of consumption and production, the circular economy has emerged as a significant and rapidly growing concept. Launched alongside the 2015 UN Agenda for Sustainable Development, the EU’s Circular Economy Action Plan and European Green Deal aim to promote sustainable growth, improve resource efficiency, and reach climate neutrality by 2050. On the other hand, for impactful consideration and implementation of circular economy, it is important to apply the right set of Circular economy indicators to assess the current state and guide progress effectively. Moreover, it is also very important to observe the dependency structure between the set of CE indicators used for identification purposes. Understanding how changes in one or more circular economy (CE) indicators affect others is essential for effective policy analysis and responsible legislation. In this study, we use seven CE indicators from the EU Monitoring Framework published by Eurostat, covering the thematic areas of production and consumption, competitiveness and innovation, and global sustainability and resilience. Our analysis shows that “Consumption footprint” varies significantly across EU countries, reflecting diverse environmental pressures. Scenario analysis reveals that higher consumption levels increase plastic waste, material use, and

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import dependency, while also correlating with greater innovation in recycling. These findings suggest that rising environmental impact may drive circular economy advancements, highlighting the value of Bayesian networks for policy analysis.

### Acknowledgments

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# A REVIEW OF GREENWASHING AND CIRCULAR INDUSTRIAL PRACTICES FROM CONSUMER’S PERSPECTIVE

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## Abstract

Conscious consumers prefer green products and actively seek information about companies' circular practices. Demonstrating the role of consumers as key drivers of sustainable consumption is crucial for adequate supply chain management. Different industry branches have different potential for the application of circular processes such as reducing, reusing, and repairing. The paper is based on critical reviews of the relevant literature and aims to emphasize the biggest strengths and benefits for organizations from implementing circular strategies from the consumer's point of view. In this regard, effective transitioning towards sustainable supply chains involves tackling greenwashing. Therefore, it is important to understand to what extent industries are using greenwashing to mislead their stakeholders in the supply chain. It was possible to identify possible solutions to prevent greenwashing across four main dimensions: consumers, relationships between companies and suppliers, certification programs and reporting assessment; and corporate leadership. Due to the significance and validity of the research, the paper highlights the impact of sustainable consumption on the development of greenwashing practices.

**Keywords:** Circular economy, Customers behavior, Sustainability, Greenwashing, Industry sector, Informational asymmetry

## Introduction

There is growth of the production and consumption of circular products. However, greenwashing is a marketing practice of presenting products as environmentally responsible without reasons, which can influence consumer perceptions and attitudes toward the consumption of circular products. In this regard, greenwashing tactics can increase consumer confusion. In the field of sustainability, circular consumption and greenwashing have gained significant attention. The recent study by the European Commission (2022) revealed that 80%

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of online shops, web pages, and advertisements searched contained green claims such as “green” or “friendly to nature”, of which 55.45% were implicit (images, design, color suggesting environmental benefits), 35% were explicit (logos and labels), and about 21% were vague or general environmental claims.

By supporting sustainable businesses and circular consumption, consumers can proactively create more sustainable society. Understanding consumer attitudes to sustainability and sustainable behaviors is a major driver of changing consumer behavior. Despite consumers’ willingness to make decisions with sustainability and the environment in mind, consumers often make a trade-off between managing higher prices and making sustainable lifestyle choices. Consumer spending accounts for over a quarter of all emissions and it is the single largest contributor to total greenhouse gas emissions. Some of the consumers most valued sustainable or ethical practices are producing sustainable packaging and products; Reducing waste in manufacturing processes; Committing to ethical working practices; Respect for human rights; Reducing carbon footprint. Some of the main reasons for not adopting a more sustainable lifestyle are high costs, a lack of interest in sustainability, and not having enough information (Deloitte, 2025).

First, this paper contributes to the literature on greenwashing by empirically examining how consumers’ perceptions of greenwashing affect circular economy practices. While most previous research has predominantly focused on corporate behavior, this paper is focused to individual consumer perceptions and behaviors, thereby filling research gap. In this regard, accelerating the transition to a circular economy is a policy priority in Europe. With a circularity rate of 11.8% in 2023, Europe consumers have higher proportion of recycled materials than other world regions. Monitoring the circular economy involves tracking material flows environmental degradation. Undertakings and consumers are showing early signs of adopting new business models and consumption patterns, but linear business models continue to prevail (European Environment Agency, 2024). To reduce waste and maximize resource use, circular consumption involves strategies including repairing, recycling, and reusing. On the other hand, greenwashing refers to the practice of businesses using exaggerated or misleading environmental claims to take advantage of customers’ growing environmental concerns. Green consumerism is now a politically and economically acceptable and ecologically benign presumption. However, the rise of greenwashing techniques is causing many to question the veracity of businesses’ environmental promises (Lopes, Gomes, & Trancoso, 2023).

In according to the main purpose of the paper, paper is organized in the next interconnected sections. Besides Introduction, the second section is devoted to literature review, the third section is related to research results and discussion about the consumer behavior in environmental issues and circular economy. The last section gives concluding remarks and policy recommendations which can ensure adequate regulation in this area.

### Literature review

There is several monitoring frameworks currently focused on Europe’s circular economy, including the European Commission’s Circular Economy Monitoring Framework (CEMF) which provides effective understanding of macrophenomena (Eurostat). On one hand,

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knowledge creation and innovation are essential pillars to support circularity, so in 2023, almost 4000 scientific articles were published related to circular economy. This shows a growing level of research and innovation activity for circularity (European Environment Agency, 2024). Some studies investigate whether the phenomenon of environmental, social, and governance (ESG) issues has given rise to a new form of greenwashing in a broad sense, not limited to the environmental sphere, but also extended to social and governance issues. Whether companies engaged in the transition to sustainable and to circular models are actually focusing on concrete sustainable actions and less on distorted communication (Todaro, & Torelli, 2024).

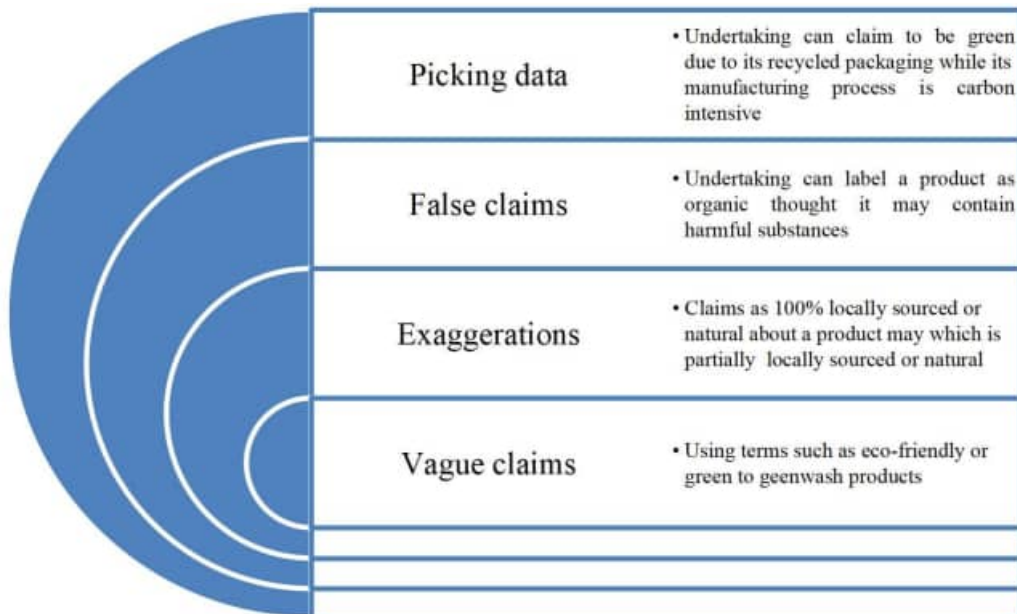
On the other hand, a growing number of consumers are choosing sustainable solutions as environmental awareness grows. Due to this change in customer behavior, marketing and advertising campaigns that highlight how goods and services affect the environment have increased. But not all sustainability claims are as truthful as they appear.

According to a 2020 European Commission investigation, 42% of online environmental claims were either misleading, inflated, or overstated (Carbon Train, 2024).

Environmentalist Jay Westerveld coined the phrase "greenwashing" in 1986 to describe a deceptive practice employed by undertakings to make their goods or services appear more environmentally friendly than they are. This is accomplished by using deceptive marketing techniques to appeal to customers who care about the environment. Therefore, greenwashing is a tactic used by undertakings to profit from the growing demand for eco-friendly goods. Greenwashing also happens when businesses highlight a product's sustainable features to draw attention away from their involvement in ecologically harmful activities. Greenwashing, fake green marketing, or eco-manipulation are terms that refer to the act of making exaggerated or false claims about the environmental benefits of a product or service (Savić, & Frfulanović, 2024). Greenwashing activities use information asymmetry and misleading buyers (Jakubczak & Gotowska, 2018).

There are several examples of greenwashing used by undertakings to encourage the consumption, such as (a) powerful images that companies use related to ecology and nature to convey that they are responsible and environmentally aware; (b) misleading labels claiming that products have environmental benefits; (c) certifications that do not exist on how the products are natural and sustainable; (d) red herrings to try to divert consumers' attention, highlighting aspects of the products as ethical and sustainable; and (e) approximate terminology with self-denomination by companies that their products are green (Safdie, 2023). Figure 1 shows different forms of greenwashing which are most found in industrial practice. It can be product oriented, process oriented, image oriented or can emphasize the environmental facts or combination of the mentioned phenomena.

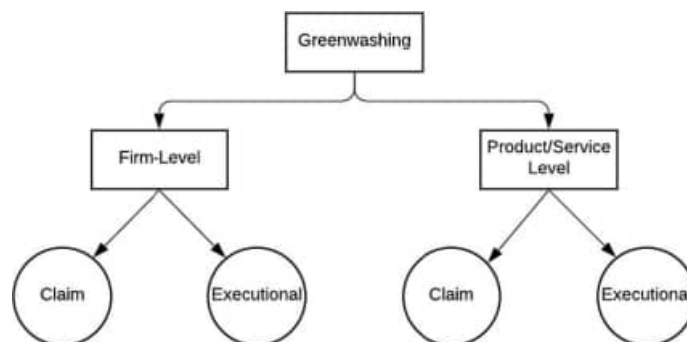
Figure 1. Types of greenwashing



Source: Authors illustration

Two different major classifications of greenwashing: Claim greenwashing and Executional greenwashing. Figure 2 shows the main classifications in the phenomenon of greenwashing.

Figure 2. levels of greenwashing implementation



Source: de Freitas Netto, S. V., Sobral, M. F. F., Ribeiro, A. R. B., & Soares, G. R. D. L. (2020). Concepts and forms of greenwashing: A systematic review. *Environmental Sciences Europe*, 32, 1-12.

Greenwashing refers to the practice of falsely promoting an organization’s environmental efforts or spending more resources to promote the organization as green than are spent to actually engage in environmentally sound practices. Recent researches show what extent greenwashing may endanger the industry in addressing challenges related to the implementation of more sustainable circular economy in the context of designing with intention of recycle, reduction of by-products, lower energy consumption, and wise purchase

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habits (Adamkiewicz, Kochańska, Adamkiewicz, & Łukasik, 2022). In other words, greenwashing is based on highlighting one good practice. Some studies on the consumption theory showed that there is a strong relation between consumption values and the green trust. Eco-labeling influenced the consumer perception as a mark of superior quality, higher value, and an indicator of a lifestyle (Zaidi, et al. 2019).

Greenwashing is more likely in the sectors of consumer staples, energy, industrial, information technology, materials, and utilities, all which impact environmentally sensitive areas. Greenwashing firms have a lower-weighted average cost of capital due to a higher debt-to-capital ratio. They are larger, have higher institutional ownership, and lower dividend yields. On the other hand, greenwashing firms have more ESG-related controversies that can hurt firm revenues and market value, they have higher unsystematic risk, and they have lower dividend yields and return on equity (Gregory, 2024). In greenwashing, there is a complicated link between customer intentions and behavior. Greenwashing positively affects consumers' environmental concerns and their propensity to seek sustainable information. These positively impact consumer intentions toward circular consumption. The findings challenge the traditionally negative perception of greenwashing, suggesting its paradoxical contribution to promoting sustainability. Insights into consumer behavior related to sustainability has practical implications for policymakers in shaping effective circular economy strategies (Lopes, Gomes, & Trancoso, 2023). Some authors outline the predicted effects of greenwashing on green consumer confusion, green perceived risk, and green trust. Decrease in greenwashing and an increase in green initiatives and more transparent marketing are definitively beneficial to promote the customers' green trust. Green marketing is more efficient and can encourage green consumption (Adamkiewicz, Kochańska, Adamkiewicz, & Łukasik, 2022).

Greenwashing poses a significant obstacle to consumer intentions. When perceived, it decreases purchase intention and creates a discrepancy between what customers intend to do and what they do. Greenwashing hurts consumers who care about the environment and are willing to pay more for goods (Testa, et al. 2021), whereas the suppliers who sell the goods don't honestly address how the items affect the environment (Apaolaza, et al. 2023). Although consumers' determination to combat greenwashing has grown, the results have been unclear (Rotkirch, & Lenk, 2021). Greenwashing can have negative effects on both consumers and the environment, as it can lead to confusion and mistrust among consumers and encourage the production and consumption of products that are not sustainable. It is important for consumers to be aware of greenwashing and to look for evidence to support companies' environmental claims. Additionally, undertakings can take steps to be more transparent and honest in their ecological claims, build consumer trust, and promote truly sustainable practices (Savić, & Frfulanović, 2024).

Numerous studies analyze the direct and indirect practices of greenwashing in the fashion industry and its impact on consumers and highlight the existence of greenwashing in the industry's supply and consumption chain. Greenwashing has a disruptive impact on the fashion industry's supply chain. Some undertake resort to greenwashing by promoting a green image without making substantial environmental or social changes. Therefore, transparency and honesty in the industry's green marketing strategies is *conditio sine qua non* (Badhwar, et al. 2024). Braga, et al. (2019) found that when greenwashing is recognized in a product, its



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aspects of loyalty, satisfaction, and benefits are lost, and it becomes a product that causes confusion in the consumption of it. Bulut et al. (2021), show that the perception of greenwashing diminishes the effects of environmental concern on green behavior., while Zhang et al. (2018), claim that the perception of greenwashing has a direct negative effect on green purchasing intent.

### Research results and discussion

Some of the main motivations for greenwashing are: attracting eco-conscious consumers, enhancing brand image, competitive advantage which can lead to customer loyalty and increased market share, meeting regulatory and investor expectations, cost savings due to greenwashing, companies get an image of being environmentally conscious without any costs for implementing real environmental change, and mitigating negative publicity. Greenwashing occurs in a variety of sectors:

- Greenwashing, as used in the automotive industry, is the practice of deceiving consumers about the environmental benefits of cars by inflating efficiency or reducing environmental effect in marketing campaigns.
- When businesses significantly rely on fossil fuels while claiming to be ecologically benign by employing renewable energy sources, this is known as "greenwashing" in the energy sector.
- In the food industry, greenwashing refers to companies making misleading claims about their products, while ignoring sustainability issues in their supply chain. Single-use plastic is not sustainable due to it cannot be recycled 100%, and recycling can never make up for the volume of plastic produced.
- Greenwashing in fashion takes place when brands assert unfounded statements about the eco-friendliness of their clothing collections or methods, disregarding the environmental consequences of fast fashion and inadequate labor practices.
- Certain furniture companies practice greenwashing by misleadingly advertising the environmental advantages of their products, such as asserting the use of sustainable materials or techniques.
- In the banking sector, greenwashing happens when financial institutions promote "green" financial offerings or sustainability efforts while simultaneously funding industries that negatively impact the environment.

Monitoring changes in material flows and waste generation and management is key to assessing the impact that the circular economy has on the environment and consumer behavior. Figure 1 outlines the trends among EU citizens in environmental and circular economy efforts in Europe: the EU's material footprint, waste generation, recycling of total waste and the circular use of materials.

Figure 1. Trends among European union consumer behavior in environmental issues and circular economy



Source: European Environment Agency (2024). Available at:

<https://www.eea.europa.eu/en/analysis/publications/europes-circular-economy-in-facts>,

Accessed on: 20<sup>th</sup> January 2025.

The material footprint reflects the resources needed to produce the goods and services Europeans consume. It stood at 14.1 tons per capita in 2023 while waste generation was at 5 tons in 2022. The results suggest that high numbers stem from an unsustainable use of resources. If the world consumes resources at the level of the EU, the capacity of the planet to provide these resources will be exceeded. On the other hand, resource productivity in the EU is increasing in 2022, for every kilogram of material consumed in the EU economy, 2.1€/kg worth of production activity was generated. This is more than 2.5 times the global average. The material footprint does not show dramatic changes over time so it can be concluded that circularity has not yet taken off. On the other hand, in the period from 2010 to 2023, the EU economy grew, meaning that we were able to produce more with a stable material input. If major mineral waste is excluded, the EU landfills only 306kg per person annually (2022) and it recycles almost half of the waste it generates. However, recycling is not enough to establish

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circularity in Europe. Functional secondary markets are required so that secondary materials find their way back into manufacturing, thus offsetting primary resources.

Data supplied by all stakeholders in the recycling value chain needs to be trustworthy and validated to address the life cycle of waste generation, prevent contamination of recycled materials by hazardous substances, and protect recycling operations from legal risks, financial losses and reputational damage. Transparency in waste data is also a powerful tool against greenwashing (The [Global Waste Management Outlook 2024](#)). Moral hazard in greenwashing is exacerbated by the lack of stringent regulatory frameworks and enforcement mechanisms. When companies realize that the penalties for being caught are minimal or non-existent, they are emboldened to make false or exaggerated environmental claims. This behavior not only damages the reputation of individual brands but also erodes the credibility of the entire organic product industry (Srisathan, & Naruetharadhol, 2025). According to certain studies, a company's market power may be diminished if regulators uncover greenwashing and it becomes widely known.

### Conclusion and policy recommendations

Customers should be educated in how to recognize greenwashing so that they can make informed decisions. Businesses that engage in greenwashing leverage the attitudes of customers who are fostering green consumption. The lack of information of consumers favors the development of disinformation practices regarding the alleged pro-ecological activity of companies. It can be concluded that the phenomenon of greenwashing is aimed against green consumption and thus against sustainable development.

Greenwashing is a persistent issue in today's markets. Together, consumers can play an instrumental role in building a more sustainable future by demanding transparency and accountability from companies. Advocating for genuine sustainability and making informed choices can contribute to a healthier planet. The Negative Impact of Greenwashing refers to: consumer distrust, Damage to Genuine Sustainability Efforts, Hindrance to Environmental Progress, regulatory and Legal Consequences. False or misleading environmental claims can lead to fines, penalties, and damage to the company's reputation.

Fundamental shifts in consumption patterns are needed through using low impact products and services or by switching to sharing and product-as-a-service models. Consumption culture is under the strong influence of marketing and needs to change. Consumers' choices are framed by current production systems. The recently adopted eco-design for sustainable products regulation (EU, 2024) is geared to promote safe and sustainable products and was designed for circularity from the outset. One of the main findings highlight the importance of consumer education to prevent misinterpretation of green-related terms and to promote sustainable consumption practices. The question is where the limit in environmental awareness and who should be responsible for it. Consumers and undertakings should work together for a more sustainable industry, and transparent and reliable certification schemes should serve as a guarantee of sustainability.

The objectives of the circular economy must be taken into consideration when enforcing competition law. Customizing competition strategy involves undertakings that use the circular economy approach rather than those that impose the linear economy approach.

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Competition authorities must exercise caution due to the possibility of greenwashing. In that case these undertakings couldn't have a circular economy friendly approach of the antitrust regulations. When regulators discovered greenwashing and this became public recognized, it can reduce market power and market share of the company (Liu, Wang, & Wang, 2025).

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# APPLY THE PRINCIPLES OF CIRCULAR ECONOMY AND INDUSTRIAL SYMBIOSIS ON THE PRODUCTION SECTORS OF CYPRUS: THE BENEFITS FOR CONSUMERS

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## Abstract

The recent growth of industrial production in Cyprus resulted in an increasing stream of wastes and by-products, thus creating a significant challenge for achieving sustainable development. Industries that mainly belong to the construction sector are facing challenges concerning the efficient and environmentally friendly waste management. Furthermore, the rising prices in building materials burdening the local consumer market, affecting thus the house affordability.

Therefore, there is a need for developing new sustainable building solutions with lower cost that are in line with the efforts currently undertaken within the EU to reduce carbon emissions and improve waste management. An effective strategy that addresses these challenges is the development of industrial symbiosis schemes along local industries. This strategy is well defined by the LIAISE COST Action CA22110 “Cooperation, development and cross-border transfer of industrial symbiosis among industry and stakeholders”.

The aim of this study is to present a recently developed industrial symbiosis scheme based on a cross-sector collaboration, the overall methodological approach, the identified barriers, challenges, market drivers, and potential benefits for the consumers. This scheme supports the vision of European Union to promote the principles of circular economy across the production chain as it includes a cement industry, a quarry company, a manufacturing enterprise, and an academic and research organization. The aim of the consortium is to valorize the industrial wastes/ by-products into valuable raw materials and then to incorporate them in production processes of innovative and environment-friendly products. The re-developed products will have lower cement content, offering, thus, to the market, a solution with lower cost, higher environmental performance and lower material footprint. Finally, using industrial by-products to develop cementitious materials will promote circular economy, improve waste management in Cyprus and establish an effective symbiosis process among the local industries.

**Key words:** Industrial symbiosis, construction, innovative products, barriers, challenges, market drivers, consumer benefits



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# THE CONTRIBUTION OF LOCAL GOVERNMENT ORGANIZATIONS AND CITIZENS TO THE ACHIEVEMENT OF THE 12<sup>TH</sup> SDG IN GREECE

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## Abstract

One of today's most pressing global challenges is ensuring sustainable production and consumption patterns, as outlined in Sustainable Development Goal 12 (SDG 12) of the United Nations 2030 Agenda. Waste generation—from food and construction waste to plastics and electronic equipment—is closely linked to unsustainable consumption models, posing significant environmental, social, and economic risks. This paper investigates the implementation of SDG 12 in the Greek context, with particular emphasis on waste and refuse management policies.

Adopting a qualitative policy analysis approach, the study explores legislative frameworks, strategic planning, and funding mechanisms at the European, national, and local levels. Special focus is placed on the role of local government organizations (LGOs) in operationalizing national strategies, citizen engagement, and behavioural practices that support sustainable waste management.

The study identifies challenges and progress in achieving waste reduction, reuse, and recycling targets from official EU documentation, national legislation, and policy instruments. Comparative insights are also offered regarding best practices from other European Union member states.

The findings underline the importance of a multi-level governance model integrating top-down regulatory action with bottom-up civic participation. The paper concludes by proposing targeted policy recommendations and individual actions to enhance Greece's alignment with SDG 12 and support the broader transition toward a circular economy.

**Keywords:** SDG 12, Greece, waste management, circular economy, local governance, citizen participation

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### Introduction

The present study focuses on waste and refuse management, one of the 17 Sustainable Development Goals (SDGs) adopted on 25 September 2015 during the 70th General Assembly of the United Nations and established by the United Nations (UN).

Regarding the subject of this work, it is important to note that more than 7 billion of us produce waste daily. Astonishingly, half of this waste is not collected, treated, or safely disposed of, creating a global waste crisis. Generating massive volumes of municipal solid waste (MSW) and its mismanagement creates serious environmental problems with social, political, and economic implications. Developing integrated waste management systems is imperative to reduce the impact on the environment, human health, and the economy.

More specifically, waste management in the European Union is a key sector in transitioning to a circular economy and consolidating overarching goals such as secure access to resources, social well-being, economic development, and environmental protection. Furthermore, the rapidly growing waste management industry enables the use of waste as a resource and the recovery of raw materials. At the same time, the health and environmental impacts of waste management must also be considered (European Commission, 2015).

Before delving deeper, it is essential to briefly highlight some of the major concerns surrounding waste management to fully understand why it constitutes such a critical issue in our time.

Firstly, globally, we produce vast quantities of waste: food and garden waste, construction and demolition debris, mining waste, industrial waste, liquid waste, old televisions, cars, batteries, plastic bags, paper, sanitary waste, old clothes and furniture, and the list goes on. The quantity of waste we generate is closely tied to our consumption and production patterns. The overwhelming number of products entering the market is a further challenge. Demographic changes—such as the rise in single-person households—also impact the volume of waste produced (e.g., goods are increasingly packaged in smaller units).

At the same time, it is widely known that poor waste management contributes to climate change and air pollution and directly affects many ecosystems and species. Some ecosystems, such as marine and coastal areas, can be severely affected by inadequate waste management and illegal or "irresponsible" individual littering. Marine litter is increasingly concerning—not only for aesthetic reasons: entanglement and ingestion are serious threats to many marine species.

Waste also indirectly impacts the environment, as any material not recycled or recovered represents a loss of raw materials and other inputs used throughout the value chain—in the production, transport, and consumption phases. The environmental impacts across the life cycle of a product are significantly greater than those solely linked to waste management (EEA Signals 2014 – *Well-being and the environment. Waste: a problem or a resource?*, 2021).

Moreover, illegal activities such as dumping, burning, and exporting play a role, though it is difficult to estimate their full extent or impact accurately. In general, directly or indirectly, waste affects our health and well-being in numerous ways.

Therefore, it is reasonably clear that the SDGs cannot be achieved unless waste management is treated as a priority. Failed economic models treat resources as infinite, and

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current consumption patterns encourage the perception of their endless availability. We must recognize that we cannot continue with a growing and increasingly urbanized global population without sorting and managing waste appropriately.

The goal of this study is to present the long-term strategic planning of waste management through legislative and administrative measures, infrastructure projects, and funding initiatives by the European Union and to investigate, as thoroughly as possible, the implementation of the proposals and projects of the National Waste Management Plan (NWMP) for the management of Municipal Solid Waste (MSW) by the Regional Authorities.

Accordingly, the main themes of this paper include a comprehensive description of the relevant SDG, an analysis of the current situation, EU policies, actions, and funding instruments; Greece's national policies and projects, and the role of Local Government Organizations (LGOs) in ineffective waste management. Finally, the paper attempts to present concise proposals for individual actions that can contribute to achieving this goal.

### **Chapter 1: Description of SDG 12 (Responsible Consumption and Production): Waste and Refuse Management**

The Sustainable Development Goals (SDGs), also known as the Global Goals, were adopted by the United Nations in 2015 as a universal call to action to end poverty, protect the planet, and ensure that all people enjoy peace and prosperity by 2030. This paper focuses on Goal 12, which concerns the "promotion of sustainable consumption and production patterns (SCP)," and more specifically, on the target related to environmentally sound waste and refuse management.

According to the United Nations Regional Information Centre (UNRIC), the sub-targets of this goal include:

- By 2030, per capita global food waste will be halved at the retail and consumer levels, and food losses along production and supply chains, including post-harvest losses, will be reduced.
- By 2020, achieve environmentally sound management of chemicals and all wastes throughout their life cycle, per agreed international frameworks, and significantly reduce their release into the air, water, and soil to minimize adverse impacts on human health and the environment.
- By 2030, substantially reducing waste generation through prevention, reduction, recycling, and reuse.

*(Goal 12 – Responsible Consumption and Production, <https://unric.org/el/στοχοσ-12-υπευθυνη-καταναλωση-και-παρα/>)*

First, let us clarify the waste terminology and its types and classifications. A fundamental legislative text for the definition of waste is Directive 2008/98/EC of the European Parliament, which states: *"Waste means any substance or object which the holder discards or intends or is required to discard."*

As for waste classification, many scholars group waste into various categories with different characteristics. Based on their physical state, waste can be classified into three main types:

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- Liquid
- Solid
- Gaseous (Amasoumo & Baird, 2016)

**Liquid waste** refers to solid residues dissolved in a liquid medium (water or some organic solvent) and constitutes one of the main sources of environmental pollution today. Major sources include domestic, municipal, and industrial waste. (*modernanalytics.gr, Chemical and Microbiological Analyses › Waste*)

**Solid waste** includes urban refuse, industrial waste (e.g., packaging remnants, empty barrels, cardboard, plastic wrappings), construction and demolition debris, petroleum-based waste, agricultural and livestock waste, mining and excavation waste (from both land and sea), sludge from urban wastewater treatment and industrial processes, hospital waste, tyres, and scrap materials.

(*modernanalytics.gr, Chemical and Microbiological Analyses › Waste*)

**Gaseous waste** (or aerosols) includes urban aerosols and gaseous by-products from processing, typically consisting of fine particulate matter or misted liquid substances (e.g., solvents, acids) with high volatility. (*modernanalytics.gr, Chemical and Microbiological Analyses › Waste*)

Additionally, the **waste producer** is defined as any person whose activities generate waste (the original producer) or any person involved in pre-processing, mixing, or other operations that alter the nature or composition of the waste. The **waste holder** is either the producer or the natural/legal person possessing the waste.

**Waste management** itself is also defined in various ways. Solid waste management refers to handling waste in a manner that is safe for both the environment and the public, and it is inherently interdisciplinary, incorporating theory and practice from economics and public administration (Tchobanoglous et al., 1993). The main objectives of waste management are to protect human health and the environment and to conserve resources (Brunner & Fellner, 2007).

Directive 2008/98/EC states, "*Waste management means the collection, transport, recovery and disposal of waste, including the supervision of such operations and the after-care of disposal sites.*"

To support stakeholders in waste management regarding the complex issue of waste definition and classification, the European Commission has published a guidance list. This **European Waste Catalogue (EWC)** (see Appendix) classifies waste by its origin and its risk to human health and the environment (Wild et al., 2013).

The EWC is divided into 20 chapters, corresponding to 20 broad activity categories. Each category is further subdivided, specifying production activities and identifying specific types of waste.

Furthermore, the catalogue categorizes waste based on the risk it poses:

- **Inert waste:** Waste that does not undergo significant physical, chemical, or biological changes.
- **Hazardous waste:** Waste containing explosive, infectious, flammable, corrosive, or toxic substances or those causing mutagenesis, carcinogenesis, teratogenesis, irritation, or other reactions. These are marked with an asterisk (\*) in the EWC.

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- **Non-hazardous waste:** Waste that contains no hazardous characteristics and poses no harm to health or the environment.

At a European level, the **main principles of waste policy** include:

- The principle of health and environmental protection.
- The waste hierarchy principle.
- The proximity principle (disposal close to the point of generation).
- The producer responsibility principle.
- The life-cycle principle.
- The precautionary and remediation principles. (Amasoumo & Baird, 2016)

The **fundamental goals** of waste management are:

1. Waste prevention,
2. Recovery (recycling and secondary raw material or energy production),
3. Safe disposal of non-recoverable waste.

Finally, a key policy tool is the **waste hierarchy**, which evaluates actions from most to least favourable regarding resource and energy use. It aims to maximize the practical benefits of products and minimize waste generation. Proper application of the waste hierarchy can contribute to reduced greenhouse gas emissions, less pollution, energy savings, conservation of resources, job creation, and green innovation (*Wikipedia, Waste hierarchy*).

## Chapter 2: Description of the Current Situation – Problems

Given the rapid urbanization and growing global population, annual waste generation worldwide is projected to reach **3.4 billion tonnes** within the next 30 years, up from **2.01 billion tonnes** in 2016.

According to the study *Material-Efficient Utilization of Waste Oils—Biodegradability and Other Chemical Properties of Vegetable Recycling Oils* (2012), high-income countries, although comprising only 16% of the global population, generate over one-third (34%) of the world's waste. In addition, the East Asia and Pacific region is responsible for nearly one-quarter (23%) of total waste. It is also projected that by 2050, waste generation in Sub-Saharan Africa will triple, while in South Asia, it will double. (*THE WORLD BANK Website, 2018*)

Simultaneously, waste management and disposal practices have significant environmental implications. For instance, landfilling occupies land resources and may pollute the air, water, and soil depending on construction quality, while incineration can lead to atmospheric emissions. Landfills, which are considered the final option in the waste hierarchy, release methane—a highly potent greenhouse gas linked to climate change. Methane is formed by microorganisms acting on biodegradable waste such as food scraps, paper, and yard waste. Once waste is collected, it is transported and processed, releasing carbon dioxide—the most prevalent greenhouse gas—as well as other air pollutants, including particulate matter. Based on the volume, composition, and treatment methods of waste, it is estimated that **1.6 billion tonnes of CO<sub>2</sub>-equivalent emissions** were generated globally in 2016 from waste treatment and disposal—approximately **5% of total global emissions**.

As **Laura Tuck**, former Vice President for Sustainable Development at the World Bank, aptly stated:

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"Poor waste management harms human health and the local environment, contributing to the climate challenge. Unfortunately, the poorest in society are often the most adversely affected by inadequate waste management. However, it does not have to be this way. Our resources must be used and reused continually so they do not end up in landfills."

Solid waste management is critical to developing sustainable, healthy, inclusive cities and communities. Nevertheless, it remains overlooked, particularly in low-income countries. While over one-third of waste is recovered through recycling and composting in high-income nations, **only 4%** of waste is recycled in low-income countries.

Supporting countries in making strategic decisions regarding financing, policy, and planning of Solid Waste Management (SWM) systems is critical. Key solutions include:

- **Providing funding** to countries most in need—especially those experiencing rapid development—for implementing state-of-the-art waste management systems.
- **Supporting large waste-producing regions** in reducing plastic and marine litter through comprehensive waste reduction and recycling programs.
- **Food waste is reduced through consumer education, organic waste management, and coordinated programs.**

Since 2000, the World Bank has committed **over \$4.7 billion** to more than **340 solid waste management projects** across the globe. (*THE WORLD BANK Website, 2018*)

Consequently, the overarching aim of waste management policies—particularly those of the European Union, which are a focal point of this paper—is to mitigate waste's environmental and health impacts and improve resource efficiency. The long-term objective is to **reduce waste generation** and, when unavoidable, to promote waste as a **resource**, achieving **higher levels of recycling** and ensuring **safe final disposal**.

### Chapter 3: Policies and Actions – European Union Funding for Waste and Waste Management

In 2015, the European Commission adopted the **Circular Economy Action Plan**, establishing a long-term strategic framework to promote **waste prevention**, increase **recycling and reuse**, and reduce **landfilling and incineration**. The plan outlines specific measures to assist businesses, citizens, and public authorities in benefiting from the transition to a greener and more resilient economy.

The circular economy seeks to "close the loop" of product life cycles by maintaining the value of resources within the economy for as long as possible, thus promoting more efficient use of raw materials, products, and waste. It contributes directly to achieving the European Union's environmental and climate objectives while fostering local and regional development. Waste prevention, eco-design, and similar practices contribute to cost savings, increased business turnover, and job creation—particularly in the sectors of **reuse, refurbishment, repair, and product innovation**. The circular economy is also one of the 12 themes of the **Urban Agenda for the EU**, through which cities collaborate with the European Commission, Member States, and stakeholders to address waste, resource efficiency, and the sharing economy.

The **EU Cohesion Policy** is the cornerstone of circular economy implementation. The 2014–2020 investment framework allocated substantial resources to **waste management**,



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**resource efficiency**, and **low-carbon investments**. Investment data can be accessed through the European Commission's **Open Data Platform** and are often complemented by private funding and other EU instruments such as **Horizon 2020**, **LIFE**, and **COSME**. (*European Union Website, Cohesion Policy Support for the Circular Economy*)

EU investments are tailored to local needs and opportunities and have supported:

- Greater recycling capacity,
- Improved waste management systems,
- Resource and energy efficiency,
- Strengthening of the bio-economy,
- Innovative product design solutions,
- New business models, and
- Creation of green jobs.

During 2014–2020, the EU allocated approximately **€4.3 billion** to actions focused on waste prevention, reuse, and recycling. In less-developed regions, investments targeted critical infrastructure for waste treatment, resulting in an **additional 4.5 million tonnes/year of recycling capacity**. Furthermore, **€1.5 billion** was invested in green production and resource-efficient processes for **Small and Medium-sized Enterprises (SMEs)**. The circular economy package also promotes **water reuse**—many EU regions already recycle treated wastewater for park irrigation, street cleaning, or groundwater replenishment.

In May 2018, new legislative targets on recycling and landfilling were adopted. Specifically, **Directive 2018/851** of the European Parliament set ambitious targets for the **reuse and recycling of municipal waste—at least 55% by weight by 2025 and 65% by 2035**. Additionally, the share of municipal waste going to landfills will be reduced to **10% by 2035**.

(*European Commission, 2018a & 2018b*)

In March 2020, the European Commission proposed a new **Circular Economy Action Plan** aligned with the EU's goal of **climate neutrality by 2050** under the **European Green Deal**. This updated plan focuses on waste prevention and management and aims to strengthen EU leadership in green innovation and competitiveness at the global level. (*European Parliament Website, Circular Economy Transition Plan*)

On **9 February 2021**, the European Parliament called for **stricter recycling regulations** and **legally binding targets** on material use and consumption, noting that limited resources and climate challenges necessitate a shift from the "take-make-dispose" model to a **climate-neutral, environmentally sustainable, and fully circular economy** free from toxic pollutants by 2050.

(*European Parliament Website, Circular Economy Transition Plan*)

Cohesion policy, however, extends beyond funding mechanisms. It offers a **comprehensive policy framework** for integrated regional development, emphasizing each region's unique strengths in implementing circular economy principles. It closely cooperates with local stakeholders, supporting regional authorities in building capacity and driving sustainable transformation. *A summary of the EU's legislative framework on waste management is provided in the Appendix.*

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### Project Example – Slovenia

With support from EU funds, Slovenia has achieved remarkable progress in waste recycling. In particular, the citizens of **Ljubljana** now benefit from a more sustainable waste management system. Since joining the EU, the Slovenian capital has enhanced **separate waste collection, increased recycling rates, and reduced landfill waste by 59%**. Investments also prioritized **waste prevention and reuse initiatives**. Ljubljana currently produces **41% less waste per capita** than the EU average and has **abandoned plans to construct two incinerators** originally scheduled.

A central element of this transformation is the **Ljubljana Regional Waste Management Centre**, an EU-funded project that initially served **17 municipalities** and later expanded to **37**, rendering additional waste treatment facilities unnecessary. (*European Union Website, Cohesion Policy Support for the Circular Economy*)

### Chapter 4: Greece's Policies and Projects for Achieving the Waste Management Goal

Greece's newly emerging environmental policy sector is currently undergoing a transitional phase, focusing on addressing long-standing challenges across several thematic areas, including waste management, wastewater, environmental permitting, and renewable energy. The country has recently developed key strategies in circular economy, climate change adaptation, and biodiversity. These are supported—among other initiatives—through the **EU's LIFE Programme**, particularly via three integrated projects with a total budget exceeding **€47 million**, expected to leverage an additional **€1.5 billion** in complementary funding over the coming years.

Nevertheless, Greece continues to face long-term challenges in several environmental sectors. Identifying investment needs for green technologies and sustainable solutions and ensuring sufficient funding will be essential to achieving the country's climate and energy goals and shaping a new development model. While EU funding has already contributed to building a greener economy in Greece, further investment is required—especially in **energy and transport infrastructure**—to promote sustainable development. In 2019, new initiatives were launched to address environmental and energy challenges, including investment plans focused on **efficient waste management** and **clean energy** to boost the competitiveness of the renewable energy sector.

The first attempt to establish a **national waste management strategy** at both national and regional levels occurred in 1997 with **Joint Ministerial Decision (JMD) 113944/97 (Official Gazette B' 1016/1997)**. This was later supplemented by **Ministerial Decision 14312/1302/00 (Official Gazette B' 723/2000)** and replaced by **JMD 50910/727/2003 (Official Gazette B' 1909/2003)** in order to ensure full compliance with **EU Directive 91/156/EEC**. JMD 50910/727/2003 established the guidelines, measures, and procedures required to mitigate the negative environmental impacts of waste through improved management.

Additionally, the **National Waste Management Plan (NWMP)** defines Greece's overarching waste policy and serves as the strategic framework for developing Regional Waste Management Plans (RWMPs), which cover the entire national territory.

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The NWMP outlines national strategy, objectives, and quantitative/qualitative targets for managing various waste streams. It also specifies the policy axes and necessary actions in alignment with Greek and European legislation. The NWMP is prepared by the **Ministry of Environment and Energy** and approved by the **Council of Ministers**, ensuring political commitment and a unified national approach to waste management. (*Ministry of Environment & Energy Website, Solid Waste Management*)

The central goal of the NWMP is to promote environmental and public health protection by developing strategic policies and action plans. In pursuit of this objective—and ultimately of the legal requirement to transition toward a circular and sustainable economy—two core actions are emphasized:

1. **Waste prevention and reduction**, and
2. **Reduced use of natural resources**, with improved efficiency in their utilization.

Regarding waste, the plan sets an ambitious target: to reduce **landfilling of Municipal Solid Waste (MSW)** to less than **10% by 2030**.

The NWMP is aligned with Greece's **National Energy and Climate Plan (NECP)**, ensuring a coherent approach to securing **long-term competitiveness**, promoting **sustainable economic growth**, and supporting **job creation** in the context of the EU's 2050 climate neutrality goal.

(*Official Government Gazette, Approval of the National Waste Management Plan – FEK A' 185*)

The latest NWMP (2020–2030) introduces ambitious targets aligned with EU legislation and the **Circular Economy Package**, particularly concerning **source separation**, **recycling**, and **reuse**. It aims to achieve:

- **At least 55% preparation for reuse and recycling of MSW by weight by 2025 and 60% by 2030**,
- Limiting **landfilling to 10%** of generated MSW by 2030.

To reach these goals, the NWMP outlines concrete measures and responsible stakeholders. It particularly emphasizes:

- Expansion of **separate waste stream** collection,
- Promotion of **source separation**,
- Implementation of the **"Pay-As-You-Throw"** principle,
- Upgrading and reinforcing **Material Recovery Facilities (MRFs)**.

(*Ministry of Environment & Energy Website, Solid Waste Management*)

Furthermore, the plan includes **public awareness and outreach campaigns**, which are critical for achieving these targets. It also introduces a series of **legislative measures** aimed at:

- Waste prevention,
- Enhanced recycling, and
- Improving overall waste management in line with the strategic directions of the NWMP.

## Chapter 5: Policies and Actions of Local Government Organizations (LGOs) for Achieving the Waste Management Goal

**In Greece, local Government Organizations (LGOs)** are public legal entities established within specific territorial jurisdictions that administrate local affairs. Their governing bodies

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are elected through universal suffrage by the local electorate. Implicit in the term is both a **geographical and demographic definition**, as each LGO has a defined area, headquarters, and population. According to the current administrative structure of Greece, every point in the country (except for Mount Athos) falls under the jurisdiction of a **primary-level LGO** (municipality) and a **secondary-level LGO** (region). (*Wikipedia, Local Government Organizations*)

The current administrative division of the country is detailed in **Official Gazette B' 1327/17.4.2019**, under the title: *"Primary and Secondary Local Government Organizations of the Country, in accordance with Law 3852/2010, as amended."* Ministerial Decision **28549/2019** provides an exhaustive list of all municipalities and regions, as established by Articles 1 and 3 of Law **3852/2010**.

Regarding the responsibilities of municipalities, **Article 75 of Law 3463/2006** specifies that they are responsible for the **cleanliness of public spaces, waste collection and management, construction and maintenance of sewage and biological treatment systems**, and the **implementation of preventative and corrective measures** to protect waste disposal sites, including fire safety compliance.

Furthermore, under **Article 228 of Law 4555/2018**, primary-level LGOs (municipalities) are assigned the following waste management responsibilities:

- Developing and implementing **Local Waste Management Plans (LWMPs)** and waste reduction/prevention programs;
- Establishing separate collection systems for at least **four recyclable waste streams**: glass, paper, plastics, and metals;
- Organizing a separate collection of **biowaste**, particularly from restaurants, households, large producers, and green waste from parks and gardens;
- Collecting and transporting **residual mixed municipal waste** and **source-separated recyclable materials** to suitable recycling, recovery, or disposal facilities following the respective **Regional Waste Management Plans (RWMPs)**;
- **Eradicating illegal waste disposal sites** and restoring existing **Uncontrolled Waste Disposal Areas (UWDA)**;
- Conducting **citizen awareness and outreach campaigns** within the municipal boundaries and encouraging actions aligned with circular economy principles;
- Registering all relevant data in the **Integrated Waste Management Information System**, developed by the General Secretariat for Waste Coordination and Management of the Ministry of the Interior, for monitoring project implementation and target achievement.

(*Article 228, Law 4555/2018*)

One notable initiative, **"Open Municipality – Active Citizens,"** includes proposals for promoting **recycling and source separation** at the municipal level. (*Theofilopoulos G., Open Municipality – Active Citizens, Recycling & Source Separation: Our Proposals*)

In parallel, each region's **RWMP** constitutes a comprehensive framework for managing all waste streams generated within its boundaries. It sets forth general management guidelines in alignment with the national NWMP and Articles 22 (Management Plans) and 23 (Waste Prevention Programs). The RWMP proposes appropriate measures that promote, in a hierarchical and integrated manner:

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- a) Prevention,
- b) Reuse,
- b) Recycling,
- d) Other forms of recovery (e.g., energy recovery), and
- c) Safe final disposal.

The RWMP's policy pillars are centred on:

- **Preserving the public character** of waste management to protect public health and the environment under a sustainable development framework for the benefit of society;
- **Integrated planning** for all waste streams in the Attica Region at both regional and local levels, consistent with the National Waste Prevention Strategy;
- Ensuring **high-level protection of the environment and public health**, with adequate and appropriate infrastructure for collection, recovery, and disposal;
- Promoting **resource-efficient practices** for the benefit of society in an equitable manner;
- Strengthening the implementation of **Extended Producer Responsibility (EPR)** mechanisms;
- Enhancing the **quality of municipal waste management services** provided to citizens and businesses;
- Fostering **public engagement and participation** in waste-related initiatives;
- **Rationalizing service costs** and encouraging environmentally and economically sustainable investments.

*(Special Inter-Municipal Association of the Attica Region, 2021)*

## Part II – Chapter 6: Proposals for Individual Actions to Achieve the Waste and Refuse Management Goal

Achieving sustainable waste management is not solely the responsibility of governments and institutions—it also depends heavily on the **daily behaviour of individuals**. The following actions, though simple, can significantly contribute to minimizing waste generation and promoting circular practices at the household and community levels.

### ***Composting***

Though often perceived as an advanced environmental practice, **composting** is a simple and highly effective method to divert food waste from landfills. Approximately **25% of household waste** could be removed from the waste stream and converted into nutrient-rich compost. While composting may require a certain commitment, the return on investment is tangible: within **3 to 12 months**, households can produce natural fertilizer for their gardens or plants.

### ***Responsible Recycling***

Recycling standards differ across regions. Familiarizing oneself with **local recycling guidelines** is crucial to avoiding common mistakes—such as recycling contaminated materials (e.g., greasy pizza boxes), which may result in entire loads being sent to landfills.



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Effective recycling begins with understanding **what is and is not recyclable** in each local context.

### *Waste Auditing*

Awareness begins with self-observation. By monitoring one's daily waste output—**maintaining a record for a day or week**—individuals can identify opportunities to **replace disposable items with reusable alternatives**. This habit can gradually evolve into a **personal goal** to reduce single-use consumption and embrace more sustainable practices.

### *Sustainable Purchasing Habits*

Households can reduce waste by purchasing products with **minimal or recyclable packaging**. Not all plastics are created equal: the **number within the recycling triangle symbol** indicates the recyclability of each item. In general:

- **PETE (1) and HDPE (2)** are **highly recyclable**.
- **PVC (3), LDPE (4), PP (5), and PS (6)** are **less or not recyclable**.
- **Type 7 (Other)** is **generally non-recyclable**.

Choosing products with packaging types 1 or 2 can ensure greater compatibility with local recycling systems.

### *Reducing Kitchen Disposables*

Convenient items like plastic wrap, aluminium foil, paper towels, and zip-lock bags generate a significant volume of kitchen waste. Alternatives like parchment paper, reusable silicone baking sheets, and washable cloth napkins can reduce disposable usage and waste production.

### *Buying and Donating Second-Hand Items*

**Second-hand goods**, especially clothing, are valuable to a sustainable consumption model. Purchasing or donating used clothing extends product life cycles and reduces textile waste. Initiatives like **Fabric Republic** offer structured systems for managing surplus clothing in line with **EU Directive 2008/98/EC**, contributing to developing a **European recycling society**. Moreover, buying second-hand supports **local charities** encourages **conscious consumption**, and promotes **cost savings**.

### *Supporting Local Farmers and Bulk Markets*

Shopping at **local farmer's markets** helps reduce packaging waste while supporting **regional agricultural producers**. These products often require less refrigeration and transportation, contributing to lower environmental impact.

### *Avoiding Plastic Bags*

Every hour, **200,000 plastic bags** end up in landfills. Investing in **fabric or reusable shopping bags** is a simple yet highly effective way to reduce plastic waste and its long-term environmental footprint.



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### ***Reducing Bottled Water Use***

An estimated **60 million plastic water bottles** are discarded daily worldwide. The use of **reusable water bottles** offers an environmentally sound and cost-effective alternative.

### ***Limiting Paper Use***

In today's digital age, **paperless billing** is increasingly common. Many businesses offer incentives for choosing electronic communication. Reducing paper consumption—whether through digital receipts, notes, or subscriptions—can significantly contribute to reducing household waste.

## **Conclusions**

It is evident that **sustainable waste and refuse management** constitutes a central pillar of the broader effort to transition toward a **circular and climate-resilient economy**, both at the European and national levels. The challenges are multifaceted—environmental, social, economic, and institutional—and call for coordinated actions across all levels of governance. The legislative framework and funding mechanisms have been significantly reinforced at the European Union level through successive **Circular Economy Action Plans**, legally binding **recycling targets**, and a wide range of **cohesion policy instruments**. These measures aim to reduce environmental burdens, enhance resource efficiency, and generate green jobs through innovation, investment, and systemic change.

In **Greece**, significant progress has been made in aligning national strategies with European directives. The formulation and implementation of the **National Waste Management Plan (NWMP)** and the corresponding **Regional Plans** reflect a growing institutional commitment to modernize infrastructure, adopt new technologies, and promote best waste prevention, reuse, and recycling practices.

The role of **Local Government Organizations (LGOs)** is also pivotal. Municipalities and regional authorities serve as the operational backbone for implementing waste management policies, with responsibilities ranging from separate collection and recycling schemes to citizen awareness campaigns and digital monitoring systems. Their capacity to integrate local knowledge with national priorities enhances the effectiveness and inclusiveness of waste policy interventions.

However, technical solutions alone are not sufficient. The transition to sustainable waste management requires a **cultural shift**—a reconfiguration of values, habits, and consumption models. This underscores the critical role of **citizen participation**, **individual behavioural change**, and **community engagement** in complementing institutional efforts.

In this context, small-scale individual actions—such as composting, responsible recycling, sustainable purchasing, and reduction of single-use plastics—can collectively generate significant environmental benefits. Furthermore, promoting second-hand use, reducing food waste, and embracing minimal packaging practices contribute to a societal model in which **waste is no longer a by-product but a resource** to be reintegrated into the economic cycle.

In conclusion, achieving **Sustainable Development Goal 12** in waste and consumption is an **ongoing process** that requires strategic planning, regulatory coherence, robust

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infrastructure, informed policy-making, and an empowered and environmentally literate citizenry. Sustainability ambitions can only be translated into tangible outcomes for future generations through a holistic, multi-level, and participatory approach.

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### **EU CIRCULAR ECONOMY NETWORK FOR ALL: CONSUMER PROTECTION THROUGH REDUCING, REUSING, REPAIRING**

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#### **Abstract**

Achieving the objectives of the 2030 Agenda for Sustainable Development through sustainable consumption is a key priority for modern society. However, significant regional disparities within the EU and beyond, coupled with the absence of a cohesive strategic policy framework for regional development, highlight the urgent need for enhanced regional and cross-border cooperation.

This paper will explore strategies to foster awareness, reflection, and knowledge dissemination on circular economy principles among diverse audiences, including youth, academics, young researchers, public administration staff, the business community, and civil society. By emphasizing sustainable consumption, resource conservation, and waste prevention, the paper aims to empower stakeholders and promote consumer protection. A central focus will be on encouraging manufacturers to adopt responsible practices during product design and marketing, particularly by prioritizing reducing, reusing, and repairing strategies. These efforts aim to create a circular economy that benefits consumers while contributing to sustainable development goals.

**Key words:** Circular economy, sustainable consumption, consumer protection, reducing, reusing, repairing, regional cooperation, waste prevention, sustainable development.

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Session:

**“Climate Change”**

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# A REVIEW OF CLIMATE RISK ASSESSMENT METHODS FOR WATER INFRASTRUCTURE IN GREECE

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## **Abstract**

Climate crisis is inseparably linked to water as it heightens fluctuations in the water cycle, leading to extreme weather patterns, impacting water supply and quality, and posing risks to sustainable development across the globe. Considering this, climate risk assessment in water infrastructure is a growing research field, driven by the increasing vulnerability of systems to climate-induced hazards. We need more investment in improved hydrological data, institutions and governance, education and capacity development, risk assessment and knowledge sharing (UN-Water Policy Brief on Climate Change and Water). This Review Paper analyses existing research and methodologies developed to evaluate climate risks in water infrastructure, with a focus on Greece's specific challenges and environmental contexts. The study systematically reviews key approaches, including innovative technologies, such as digital twins of water supply networks (GIS and hydraulic modelling), along with simulation scenarios. By examining existing climate risk assessment methods and recent pilot projects, this review highlights the strengths and limitations of each method, addressing gaps in data integration and predictive accuracy. Additionally, the paper identifies opportunities for future research in enhancing risk assessment models by integrating Artificial Intelligence (AI), fostering adaptive infrastructure planning, and integrating stakeholder engagement and capacity building. This comprehensive analysis aims to guide public authorities, policymakers, and market participants in selecting and improving climate risk assessment tools to support sustainable water management and water resilience.

**Key words:** Climate Risk Assessment, Water Infrastructure, Water Management, Water Resilience, Artificial Intelligence, Digital Twins



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### CLIMATE DATA-DRIVEN URBAN POLICIES: A NEW CHALLENGE FOR GREEK LOCAL AUTHORITIES

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#### Abstract

Data has become an essential resource for economic growth, job creation, and societal advancement. This global trend offers vast potential across various sectors, including health, environmental sustainability, climate resilience, resource efficiency, energy, urban development, intelligent transport systems, smart cities and more others.

A data-driven public sector is transforming how public policies and services are designed and delivered through strategic data management, sharing, and utilization. As governments increasingly recognize data as a critical asset for creating public value, efforts have been made to bridge legacy systems and dismantle organizational, operational, and infrastructure silos, paving the way for a more data-centric public sector. Making more data accessible and optimizing its use is crucial for addressing societal, climate, and environmental challenges, ultimately fostering healthier, more prosperous, and sustainable cities.

More specifically, the availability of environmental data has the potential to improve urban governance, particularly in building resilience and facilitating climate change

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mitigation and adaptation. Better environmental data is essential to confront urban challenges posed by the climate crisis. Such data is crucial for improved monitoring and management of urban systems and enables thorough evaluations of policy and planning interventions.

In this paper, we explore how local authorities are adopting data-driven tools to pave the way for more effective and sustainable urban transformations. We specifically present the case of a data-sharing platform developed to assist municipalities in Thessaloniki's metropolitan area in enhancing their policies for climate change adaptation and mitigation. This initiative, undertaken by the Major Development Agency of Thessaloniki and the Open Knowledge Foundation Greece, showcases a data-sharing platform developed in the framework of the Horizon Europe UPGAST project, which addresses components for safe, fair, and interoperable data exchange.

**Keywords:** data-driven urban policy, climate urban policy, data economy, data ecosystems, open data, open governance

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### **HERitage MONitoring (HER-MON) FOS INCREASING RESILIENCE IN THE CLIMATE CHANGE ERA**

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#### **Abstract**

As an implementation study funded by "The Greek Green Fund," the project "HERitage MONitoring" aims to investigate whether it is possible to monitor and predict the alteration and collapse of historic buildings due to the changing environmental conditions caused by climate change. With the medium- and long-term study of the data in combination with the prevailing climatic conditions, conclusions will be drawn about the relations between them, and a system of early intervention will be proposed to deal with possible collapses and losses of essential elements of the monuments. The pilot application is in the city of Ermoupolis (Syros, Greece), where ten historic buildings from the digital database "HERMES" were selected in the first phase for monitoring. These buildings have an adequate geographical dispersion within the city and belong to different typologies and pathology phases. Buildings owned by the Municipality (or legal entities that the Municipality also participates in), the wider public sector, unknown owners, and well-known owners who gave their consent were selected. Along with the selection of buildings, the choice of parameters monitored in real-time was made. To record the values of the parameters, the basic infrastructure for the collection, transmission, storage, and visualization of data (databases, application server) was developed with the supply, installation, and trial operation of the equipment to evaluate and implement its final installation in the selected buildings. The data are collected in real-time and digital form using special sensors connected and powered by a small unit with a battery

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installed in the buildings. The collection of these data, and their study will allow the categorization of problems in buildings according to their criticality risk. This enables targeted priority conservation and better use of human, technical and financial resources and sets the foundation for the design of an alert system. The visualization of data in a web application allows remote access to them and thus both their study by external researchers and the information and awareness of citizens and the planning of interventions by the competent services. Finally, innovative data collection and transmission technologies should allow the system to be further exploited for use in other areas of interest (environment, health, urban mobility).

**Keywords:** Monitoring, Architecture, Heritage, Risk, Climate Change, Prevention, Sensors, LoRaWAN

### Introduction

Monumental structures are reflections of civilization and the builders who constructed them. They serve as a record of societal and cultural development. The way and timing of a building's conception, construction, use, abandonment, and eventual destruction reveal a society's growth and collapse. According to this perspective, preserving monuments as a part of a location's cultural history is especially significant because it can reveal a lot about the development of our culture and can also attract visitors, producing basic income from tourism. [1] On a grand scale, all cities can be considered "pieces of art." Except that this form of art is transient and cannot be controlled or altered as quickly as other forms of art, like music. Diverse people will eventually have different experiences in the city [2]. "Building is a process that goes on forever, as long as people inhabit an environment. It does not start here with a preconceived design and end there with a finished object. The 'final form' is nothing but fleeting..." writes Ingold, Professor of Anthropology at the University of Aberdeen, in his book 'The Perception of the Environment: Essays in livelihood, dwelling, and skill' [3]. However, humans inhabit a city in a short amount of time compared to the life of the city itself and should not impose predetermined patterns on it and its environment. Humans should adapt to the city, develop it according to the demands of the environment, and bequeath it to the next inhabitants.

An architectural monument has an essential role: to promote human memory and serve as a connecting link between the present and the past. The role is twofold, as the monument answers the problems of the present and preserves the memories of the past. When the monument is placed in the urban environment, it charges memories, ignites the imagination, and creates specific psychology in humans [4], [5]. The monument as a work of art is perceived only in a specific cultural environment, not everywhere, and certainly not always and not by everyone. Heidegger uses the word "Bewahrung," which means "preservation," but it has the same root as the word "Wahrheit," which means "truth," giving preservation the direction of preserving the "truth" of the monument [6]. But the monument, like any building, has a life cycle: It is born, it lives, and it dies, having its own life expectancy that differs significantly from building to building. Engineers are usually trained in the construction of buildings and complete their work when their creation is finished. Then the building begins to

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play its role, i.e., to accept all stresses and remain stable in its position [7]. The need to safeguard the unique characteristics of historic locations and their monuments is therefore indisputable. Monuments play a crucial role in tourists' aesthetic evaluation in historical and traditional towns where authenticity, originality, time, and scale are fundamental components of their image. The following logical question is, "How can one monitor the monuments of a historical site to safeguard them?"

Ermoupolis is a unique neoclassical ensemble at the national and global level, as the NTUA research records more than 1,200 buildings that have survived to this day. At the same time, since 2013, the Syros Institute, in collaboration with the Municipality of Syros-Hermoupoli, has been digitally monitoring all the historic buildings through the digital database "HERitage Management e-System (HERMES)," which has been distinguished for its innovation by the European Union [8]. HERMeS proved that a large number of buildings (more than 137) currently have serious pathology problems, and some of them may collapse. In the last year, the collapses of historical buildings and monuments in Ermoupoli have increased, attracting the media's attention to the risk of losing National cultural heritage [9]. The purpose of the project "HERitage MONitor" (HER-MON) is the installation of a real-time pathology data collection network of the historic and preserved buildings of Ermoupolis, intending to immediately utilize this data for the early diagnosis of problems and the planning of the necessary intervention actions as a priority. Digital data are collected by autonomous measuring devices (sensors) installed in the selected buildings, transmitted at regular intervals, and stored in a database for further study and visualization. For the needs of the HER-MON, we used innovative technology that allows data transmission over long distances with extremely low energy consumption and without the obligation for user licenses. This reduces the maintenance cost of the equipment and increases its sustainability, expandability, and repeatability in other cities and regions.

### **Methodology**

#### ***Preparation and Research***

The first phase selected the historical buildings to be studied through the "HERMES" digital database. The selected buildings are geographically dispersed in Ermoupolis; they belong to different typologies and are in various states of pathology. The above data are in possession of the Syros Institute in a geodatabase [10]. The selected buildings are owned mainly by the Municipality (or by legacies in which the Municipality also participates) and by an unknown owner. In this way, the proposed activities in the buildings do not bind owners who would have to allow equipment to be installed in their buildings. To select the historical buildings, we followed a four-step inquiry: (i) Researching in HERMES database (1.200 buildings), (ii) Filtering buildings with different typology, style, year of construction, and conservation state (32 buildings selected), (iii) Spreading the buildings to different geolocation (18 buildings selected), (iv) Visiting the final 18 buildings in-site to understand the challenges (10 buildings selected as shown in Figure 1

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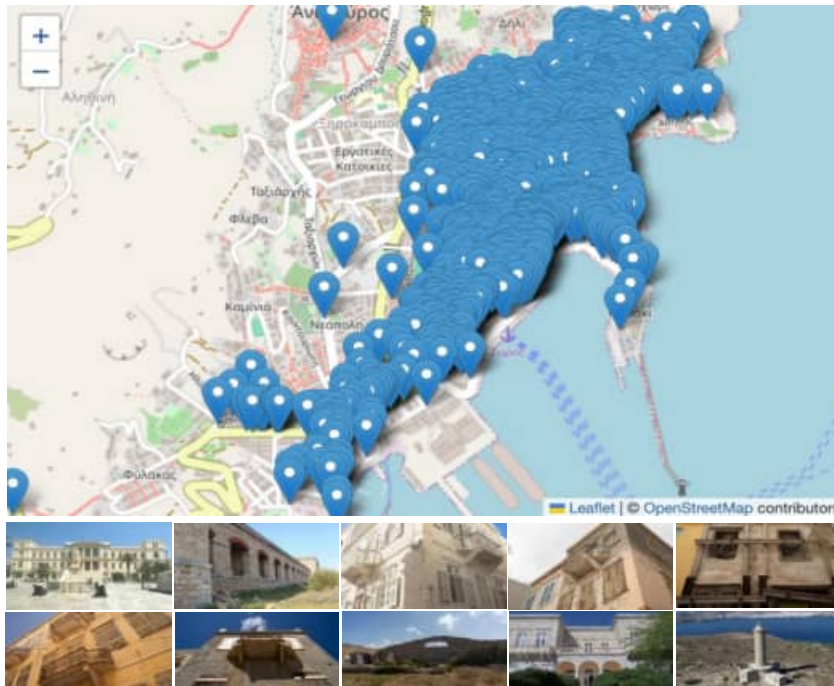


Figure 3. From 1.200 historical buildings (left), ten buildings were selected to host HERMON sensor devices (right).

Along with the selection of the buildings, the parameters that are monitored in real-time were also chosen. Indicatively, such parameters are temperature, relative humidity, and atmospheric pressure in closed buildings with the aim of early warning about the water inflow. Also, the inclination of the stone structures - especially the facades of the buildings or main structural components, such as the roof beams- the range of selected cracks and gaps, the vibrations in the building, and other elements of their pathology are recorded. It was important to install an essential infrastructure for the data study: visualization applications (databases, application server) were developed. We tested the operation of part of the equipment to evaluate and propose the technological solution that was developed.

### ***Field Activities***

The next step was the study and installation of the telecommunications infrastructure and the structure of the monitoring devices at the selected points. The proposed monitoring network is technologically innovative and does not require a connection to a power network or the Internet (WiFi). Therefore, the installation is direct, without special requirements. The placement was done with the help of specialized staff (from partner “Kudzu”) and members/volunteers of the Syros Institute and HERMeS NGO. After the installation was complete, the entire system flow was tested, starting from the collection of the data, sending it in time, storing it, and ending with its presentation. The Kudzu IoT hardware platform measures and monitors the required parameters. It is a modular sensor data collection and transmission system that can operate autonomously in the field for a long time. It consists of



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three distinct parts that will be described in detail below, the power and communication accessories and the sensor elements, which may vary according to the needs of the installation. It provides excellent flexibility in collecting and transmitting data, significant energy autonomy, low construction cost for mass monitoring and easy installation. It allows the collection of data from different sources (sensors) and their parameterization in the field even after the end of the installation, thus providing the opportunity to enrich the prediction model with new data where this is deemed necessary [11]. Another feature of Kudzu IoT that makes it suitable for this project is the ability to feed from different sources. Thus, it can be modified according to the needs of each installation, allowing its uninterrupted operation for an extended period. It allows operation with battery power or direct power supply where possible. Conclusively, it allows the use of solar power to help supply energy to remote installations where it is impossible to change the energy source periodically. Lastly, Kudzu IoT allows data transmission using the most basic wireless transmission protocols without selecting a predefined mode. Thus, the collected data can be transmitted via WiFi technology where this is available (e.g., homes or public buildings in operation) or by making use of the mobile telephony data network or even using LoRaWAN technology that allows the transmission of data over long distances with minimal energy consumption [12] [13]. It is still possible to transmit data via satellite link, which is not considered necessary in this project but may be helpful in the future for monitoring buildings and monuments that are outside the coverage of traditional telecommunications infrastructure.

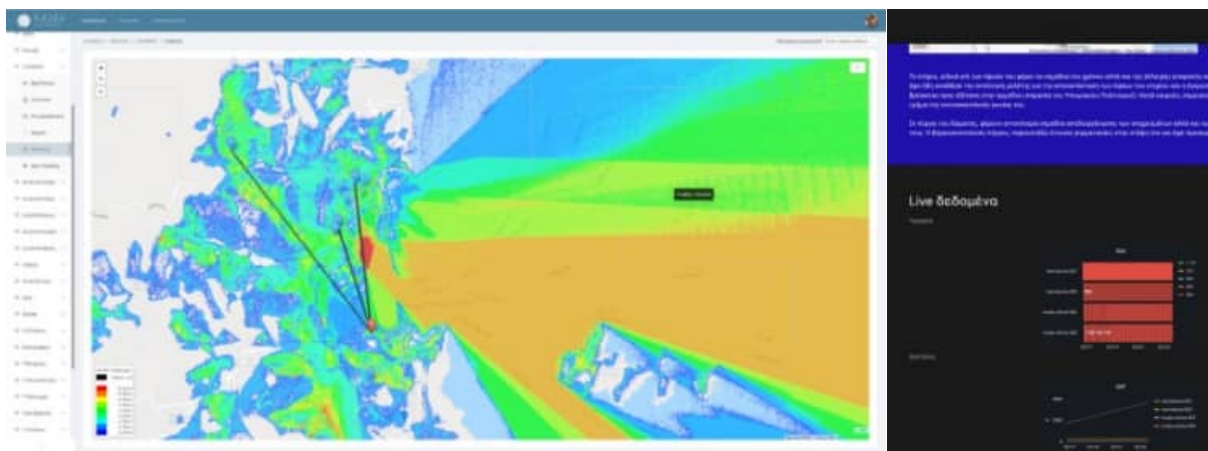


Figure 2. Left: An example of the coverage of the LoRaWAN network for one of the selected historical buildings that the HER-MON monitors. Right: Screenshot of live data from HERMON web portal ([www.hermon.gr](http://www.hermon.gr))

After that, a website was created to present the data in real-time, covering the need to disseminate the project results. It features access control to separate its use between system administrators and external visitors. After the pilot operation, the necessary corrections were made, and the network installation was finalized. The network was announced through the appropriate actions of the Syros Institute, including a Workshop on the topic of Cultural Heritage at Risk (Heritage at Risk) in collaboration with local, national, and European bodies (Municipality, Region, Ministries, Europa Nostra, etc.), an analytical training with the aim

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informing the local agencies of the island, and in particular the intervention agency (Directorate of Technical Services of the Municipality of Syros-Hermoupoli) regarding the operation and objectives of the monitoring network of historic buildings, and the issuance of a digital guide for the operation and installation of similar networks in other buildings or places.

### ***Exploitation and Dissemination Activities***

In a “Digital Tools in Cultural Heritage” workshop in Syros, Greece, we presented the project's ideas and outcomes to various national and international experts, professionals, architectural heritage activists, and students. We also cooperated with other projects that use IoT for monitoring with sensors similar variables for natural and cultural heritage [14][15], exchanging valuable knowledge.



Figure 3. Dissemination Workshop demonstrated the use of sensors in a variety of projects for cultural heritage

## **Results and Discussion**

The project HER-MON successfully addressed several difficulties and challenges in using IoT for monitoring the conservation state of historic buildings at risk:

1. The buildings to be studied are usually off-the-grid (there is no power supply). Collecting data and monitoring their condition has always been exceptionally high in cost, material, services, and maintenance.
2. Many recording devices collect the data locally, so their physical collection is required for their utilization. When the study of the information is delayed, there is no possibility of early intervention.
3. While there is a wide range of accurate monitoring sensors that measure the pathology state of buildings, the industry doesn't offer options for low-cost monitoring systems that are easily accessible and installed in mass on a historical settlement consisting of many buildings.
4. The collected data are usually transmitted via mobile networks within the urban web. Data transmission is expensive (data usage private contracts) and requires high energy consumption, increasing maintenance costs (battery replacement, charging, etc.)
5. Also, the possibility of using mobile networks is limited to the areas where it is covered by cell phone companies, making it impossible to transmit data from remote locations. Especially in the South Aegean region, many important historical monuments are not covered due to insularity.

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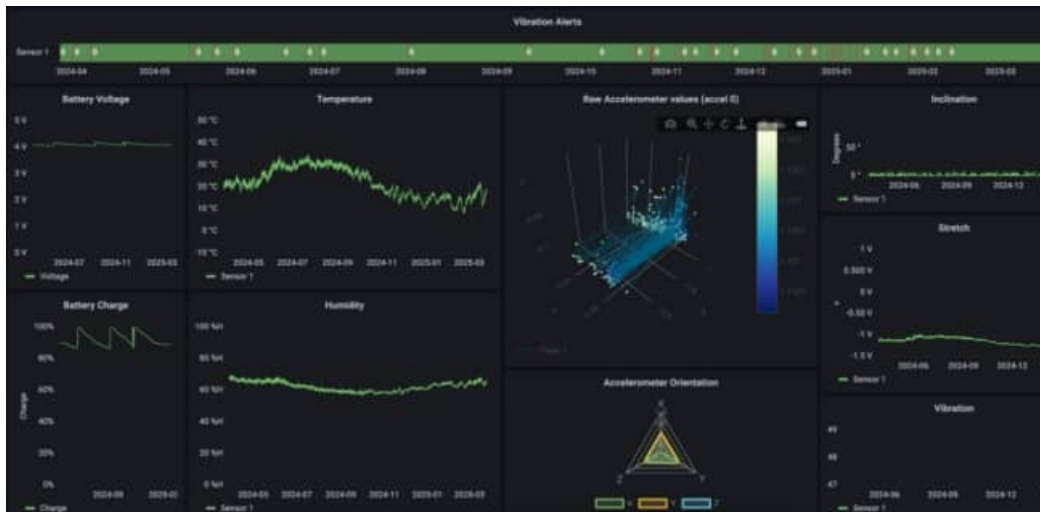


Figure 4. Visualization of selected data of Building n.05: Municipality of Ermoupolis, from March 2024 to March 2025 (1 year).

Until today (March 2025), the installed sensors are still successfully transmitting data. The installation has proven unexpectedly durable for over 2 years, considering some of the sensors are installed on the exterior façade of buildings, exposed to extreme wind and temperature. Collecting these data will help the stakeholders of HERMON to analyze and compare them over several years and calibrate a sensing pattern that can create an alert system for possible collapse. This way, valuable results will be produced on climate change's effect on these historical buildings, a theory strongly supported by the scientific community [16] [17]. It is stated that the ageing of materials is caused by their inherent physical and chemical properties and environmental conditions [18]. Extreme fluctuations in temperature and heavy rainfall stress the materials systematically. With the climate change observed in the last decades, these phenomena seem to become more intense and frequent. Climate changes in the coming years are expected to bring about:

- ✓ Increase in the frequency of extreme temperatures (single days but also hot episodes lasting at least three days)
- ✓ Increase in the intensity of phenomena (absolute maximum temperatures, amount of rain per hour)
- ✓ Increase in the duration (persistence) of the phenomena
- ✓ Time shift of the appearance of the phenomena [19]

The already burdened buildings will have to deal with these new conditions, even in a state of reduced strength. HERMON could become a helpful technology tool that senses the changes, records the data, and informs the stakeholders to take immediate action if necessary.

## Conclusions and future work

The project's general goal is to protect the man-made cultural environment of Ermoupolis through research and utilization of measurement data concerning the alteration of the city's historical buildings and monuments. To achieve the goal, the live monitoring of the pathology of ten (10) historic and preserved buildings of Ermoupolis is required, with the study and

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installation of an innovative network of sensors. Data collection in real-time and in digital form allows early prediction of problems. Analyzing these data will also enable categorizing issues according to their criticality. This way, priority-targeted rehabilitation, and the best utilization of human, technical and financial resources become possible. At the same time, the appropriate selection of buildings to be the most representative in terms of date of construction, problems and alterations, location in the city, and cultural value, allows the drawing of valuable conclusions for the whole of Ermoupolis. Based on these records, one can predict what to expect from all similar buildings. The visualization of the data in an online application allows remote access to them and thus both their study by external researchers as well as the information and awareness of citizens. An essential objective of the project is training the competent intervention service in dangerous buildings, namely the Technical Services Directorate, whose engineers will learn how to monitor the network and intervene when necessary. Finally, innovative data collection and transmission technologies allow the system to be further exploited for use in other areas of interest (environment, health, urban mobility).



Figure 5. Installation of a “HERMON” device in a 19th-century wooden beam on a roof

Future work includes research and analysis of the collected data to support the correlation between the increased rhythm of pathology problems in historical buildings and the intense environmental conditions because of climate change [20].

### Acknowledgment

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### KIFISSOS RIVER – A POSSIBLE DISASTER IN ATHENS

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#### Abstract

Kifissos river is the largest and most important river of the Attica basin. The wide network of streams and the continuous flow have created a catchment area, which covers about 70% of the Athens basin making it the dominant river in the wider area and the main recipient of the rainwater of the Athens basin. The intense development of the wider urban complex of Athens has led to the disappearance of many kilometres of streams, while Kifissos river as the main passage to sea and draining the 70% of the waters of the Athens basin, suffers reduction in its width, arbitrary building, and pollution, as well as damaged by major hydraulic or road works. The decision of covering the river from the Three Bridges to Neo Faliro (A1 motorway /Kifissos Avenue) has no contribution of addressing the serious flood protection and environmental degradation problems of Athens basin which bound to become more severe in the future, especially after the recent fires in Parnitha and Penteli mountain.

The present paper investigates a possible disastrous flooding of Kifissos river from the area of Three Bridges and upstream. The covering of Kifissos river from the Three Bridges to its outfall at Faliro bay, does not allow any intervention to increase its drainage capacity, resulting in an increased possibility of flooding in case of extreme precipitation in the surrounding mountainous areas. The results have shown an increased possibility of flooding in a huge area at the west suburbs of Athens with high potential in human losses and properties and therefore a new facility for the floodwater diversion is imperative.

**Key words:** flooding, climate change, Kifissos river, Athens basin

#### Introduction

According to ancient Greek tragedian Euripides, Kallinaos Kiffisos was the biggest river of ancient Athens. It was referred and honored as the protector of Athens basin. The river springs in north and northeast mountainous mainland and it spreads through an extended network of small streams and rivers before reaching the modern mouth in Neo Faliro Bay. From ancient time till 19th century, the mouth was located at the nowadays modern port of Piraeus (Attiki Odos, 2009) (see image 1).

The area of Kifissos basin is 380km<sup>2</sup> and the river length is 22km. The longest part of this length runs through urban area with extended human interventions. There are still forestry and cultivated areas but most of Kifissos basin is built-up over 70% and it is still increasing.



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**Image 1: Athens and surrounding areas (The Topography of Athens with Some Remarks on its Antiquities W.M.Leake, London 1821)**



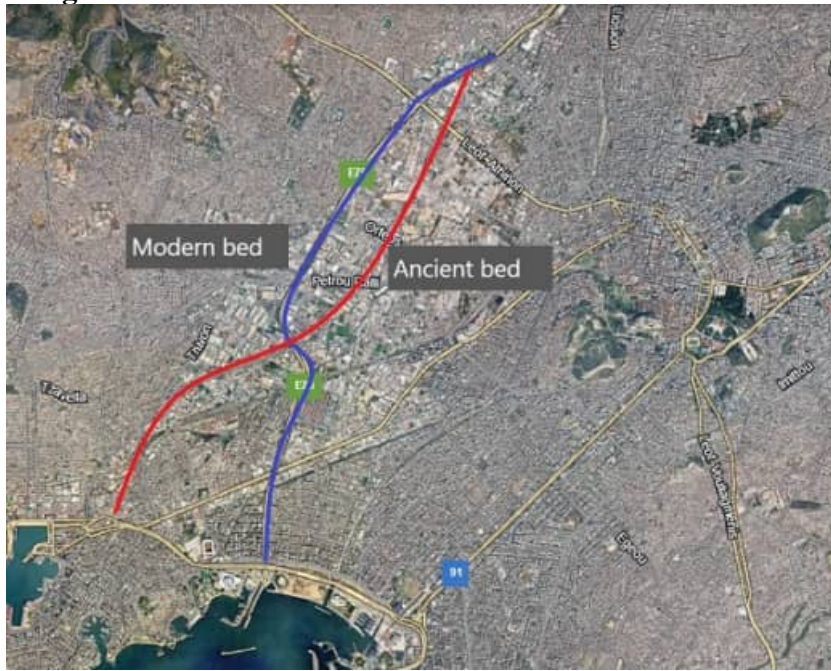
In modern times, the flow of the lower river has changed comparing to ancient times. Modern bed runs western comparing to the ancient one from Sepolia and south, while modern mouth is located at Neo Faliro Bay (see image 2).

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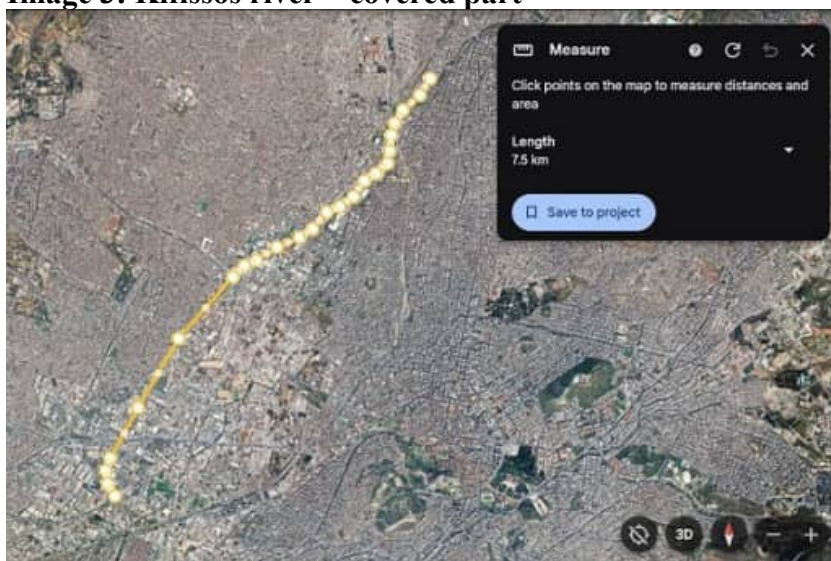
**Image 2: Kifissos river – ancient bed vs. modern bed**



During modern times, Kifissos river has suffered multiple interventions with reductions in its width, significant pollution from human activities and hydraulic or road works. The covered part from Three Bridges to Neo Faliro has caused some serious problems in water drainage and capacity of the river (see image 3).

According to published articles (Nikolopoulos 2008), the capacity of the settled part of Kifissos river ranges from  $400\text{m}^3/\text{s}$  (beginning of the closed section at Three Bridges) to  $700\text{m}^3/\text{s}$  (end of the closed section at Ag. Annis street). Then the capacity is increased from  $1,100\text{ m}^3/\text{s}$  (beginning of open section at Ag. Annis street) to  $1,400\text{m}^3/\text{s}$  (outfall).

**Image 3: Kifissos river – covered part**





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### The river network of Athens basin

Athens basin is run by an extended river network. The biggest and most extended is Kifissos river network which is flanked by the smaller river networks of Podoniftis, Iridanos, Ilissos, Pikrodafni and Trachones (Geomithiki, 2021) (see image 4).

**Image 4: River network in Athens basin**



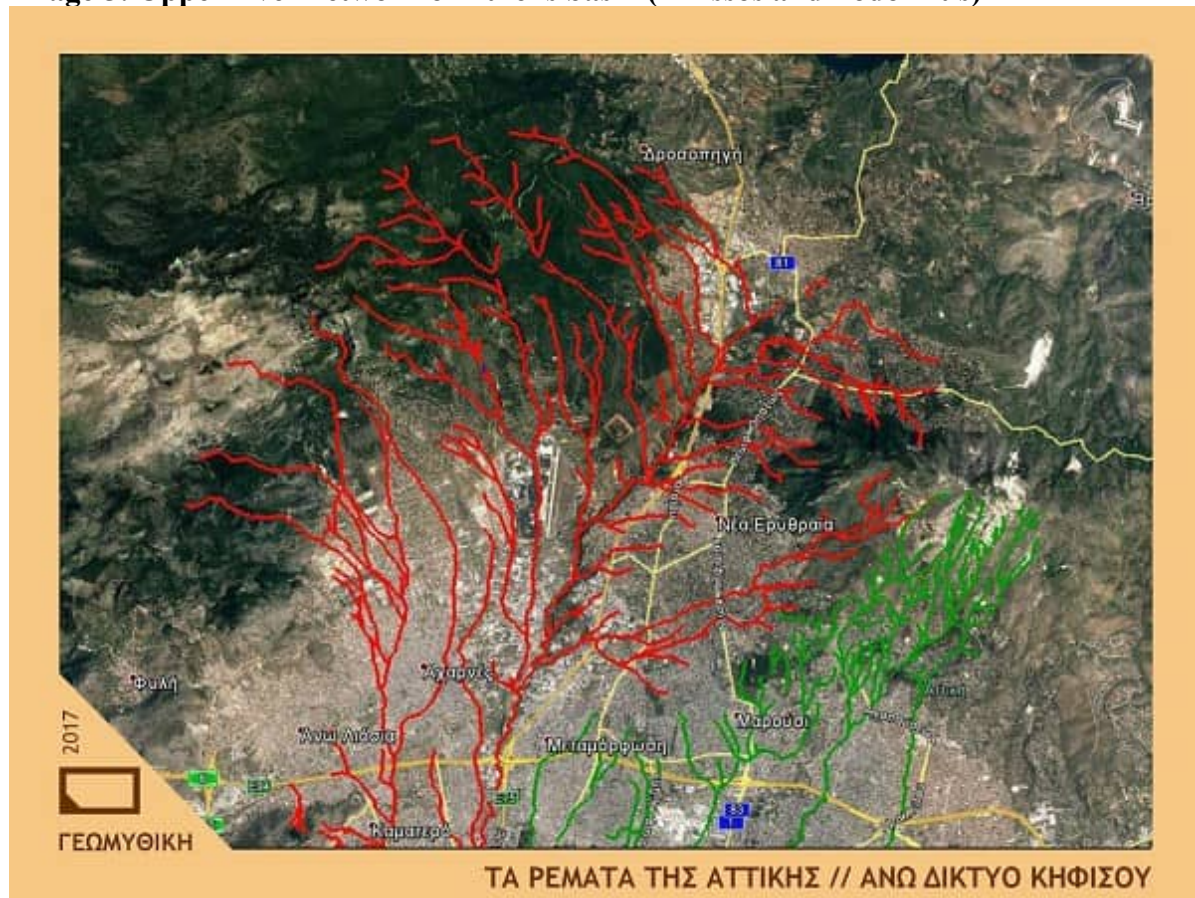
At the closed section of Kifissos river, one major (Podoniftis) and some minor streams (Kanapitseri, Chaidarorema, Masha, Rontaki and Liosion) are contributed, collecting rainwater from most of the area of the upper river network. (Geomithiki, 2021) (see image 5). These streams spring from Mt.Egaleo, Mt.Parnitha and Mt.Penteli, while part of the south river network of Podoniftis spring from Mt.Ymittos as well.

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**Image 5: Upper river network of Athens basin (Kifissos and Podoniftis)**



The basin area of both river networks suffers of massive deforestation due to disastrous wildfires. Years 2021 and 2023, wildfires in Mt.Parnitha destroyed more than 140.000 acreages of forest, while year 2024 a wildfire in Mt.Penteli destroyed more than 85.000 acreages of forest. Under these conditions, the ability of ground to hold rainwater has been reduced rapidly and therefore massive volumes of water may expected in case of high precipitation in east and southeast slopes of Mt.Parnitha and to the south slopes of Mt.Penteli.

What appears as a critical issue, is the question of how sufficient the capacity of 400m<sup>3</sup>/s is (start of covered part in Three Bridges), to drainage massive volumes of rainwater during an extreme weather event and how possible is a weather event like this to happen.

### **Possible disasters – Past and Present**

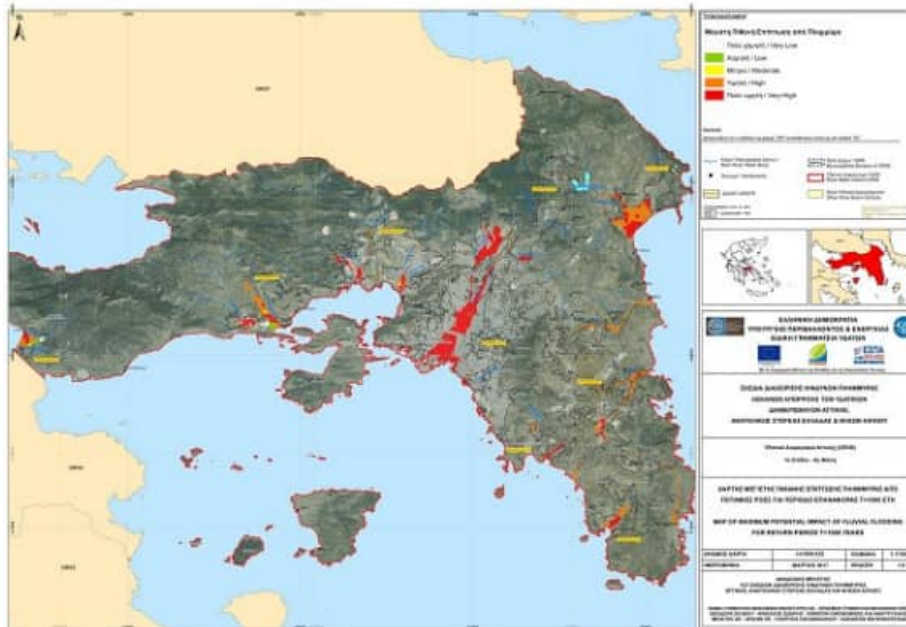
Numerous studies have been published about possible floodings in Kifissos river. Most of them are focused on the lower part which has suffered extended fluvial floodings during the past. The ministry of Environment and Energy has introduced maps of possible disasters, drawing attention in parts of Athens basin (ypoka 2018) (see image 6) which are neighbored to Kifissos river.



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Image 6: Map of the maximum potential flood impact of river flows for a return period of T=1000 years



According to records, Athens basin has suffered numerous of disastrous flooding during the past. 14 November 1896, 23 November 1925, 22 November 1934, 2 November 1977, 21 October 1994, all these events with human losses and extended damages. But the worst disaster happened on Sunday 5th of November 1961. During that day, extreme weather conditions resulted in massive fluvial flooding in areas of Athens basin with 40 dead people and 4.500 homeless. Newspapers of that era, imprint the huge tragedy (see image 7).

Image 7: Greek newspaper “Ta Nea” - 7<sup>th</sup> November 1961



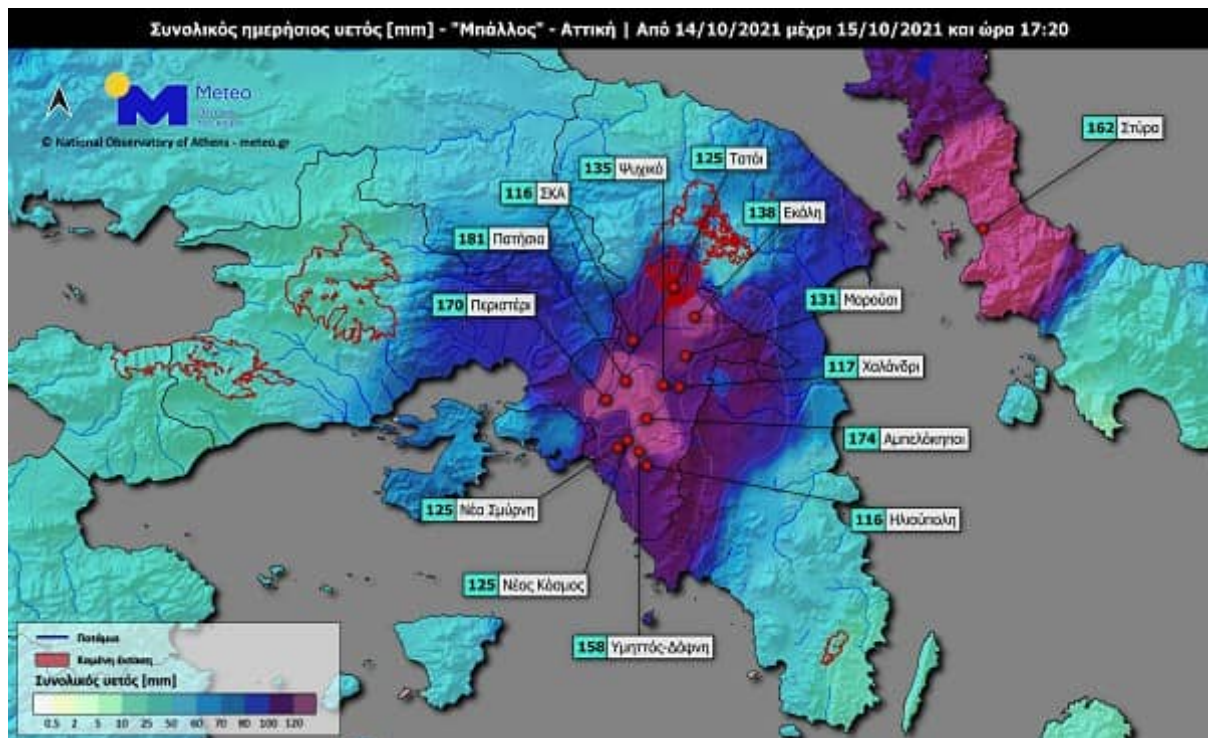
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Based on the previous events, the frequency of a disastrous flooding in Athens basin is around 6 times per century. In 21st century, we meet two (2) severe weather events, on 3 September 2002 and on 14 October 2021 (Ballos storm) – the last one was close to end as a very serious flooding disaster. During that day, numerous weather stations of the National Observatory of Athens measured precipitation higher than 110mm in 24 hours (image 8). The highest precipitation (181mm) was measured in Patisia while Kifissos river reached its max capacity - both in lower and upper part (1100m<sup>3</sup>/s and 400m<sup>3</sup>/s respectively).

**Image 8: Precipitation heights during Ballos storm - 14<sup>th</sup> October 2021**



### Valencia flooding and Athens interpolation

2 November 2024 a disastrous flooding took place in Valencia, Spain with 205 dead people, thousands of homeless and billions of euros in financial losses. This was the most severe flood disaster in Spain's modern history and one of the worst in Europe since 1970. This incident has come as a reminder to the vulnerability of places with major human interventions and how the changing climate produces extreme weather incidents. Having as a fact that these incidents are increased and observed in many places around the world, the question is what the consequences will be if this scenario happens in Athens basin.

Valencia basin is 6.393km<sup>2</sup> while Athens basin is 380km<sup>2</sup>. Both basins are run by river networks with similar characteristics but in a different scale. In Valencia, Turia river has a drainage capacity of 5.000m<sup>3</sup>/s while in Athens, Kifissos river has a drainage capacity ranged from 1.100 m<sup>3</sup>/s (lower bed) to 400m<sup>3</sup>/s (upper bed). During the storm, Valencia weather



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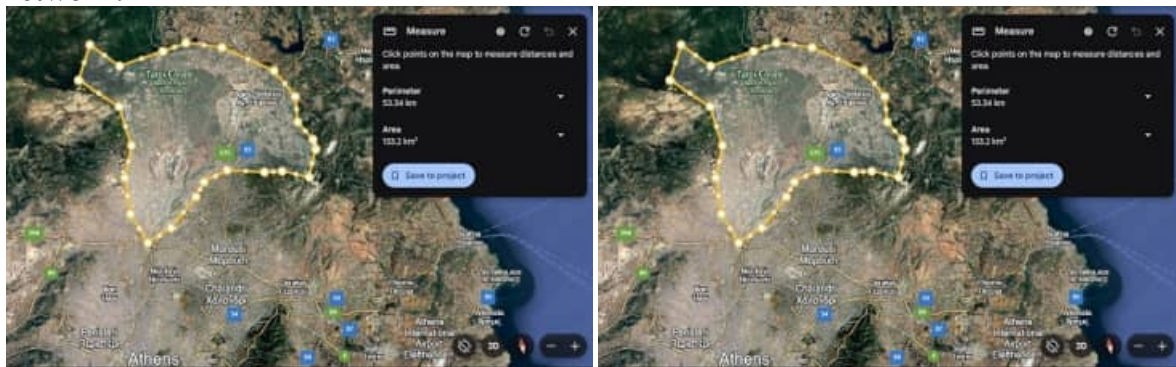
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stations have measured precipitation of 500mm in a time duration of 6 hours while the maximum measured precipitation rate reached 184,6mm/h.

### Methodology

Two studies will be implemented for two (2) different catchment areas, with focus at the upper part of Kifissos river and before the covered part in Three Bridges (400m<sup>3</sup>/s drainage capacity). The first catchment area (Catchment 1) is the river network of Kifissos with a surface of 135km<sup>2</sup> (image 9) and the second catchment area (Catchment 2) is the combined river network of Kifissos and Podoniftis with a surface of 290km<sup>2</sup> (image 10).

**Images 9,10: Catchment areas of Kifissos river network and Kifissos-Podoniftis river network.**



Next step is to calculate the volume of water in catchment areas ( $V_e$ ) which is based on the following equation:

$$V_e = h_e \times S \text{ (Mimikou \& Mpaltas, 2012)}$$

where  $V_e$ : the volume of water,  $h_e$ : the precipitation height and  $S$ : the catchment area.

We proceed the calculations for both catchment areas and for precipitation height of 180mm.

$$V_{e \text{ (Catchment 1)}} = 2.430.000\text{m}^3 \text{ and } V_{e \text{ (Catchment 2)}} = 5.220.000\text{m}^3$$

Since the examined area is a combination of deforested, soft rock and hard rock mountain with urban and suburban areas, the runoff coefficient should be a weighted average of ~0.7 and therefore harvested water will be:

$$V_{e \text{ (Harvest Water in Catchment 1)}} = \sim 1.700.000\text{m}^3 \text{ and } V_{e \text{ (Harvest Water in Catchment 2)}} = \sim 3.650.000\text{m}^3$$

The precipitation height of 180mm is simulated in three rain duration scenarios for each catchment area (table 1,2): 30mm/hr (6 hours duration), 90mm/hr (2 hours duration) and 180mm/hr (1 hour duration).

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**Table 1: Catchment 1**

|            | Rain Duration | Precipitation rate (mm/hr) | Drainage (m <sup>3</sup> /s) |
|------------|---------------|----------------------------|------------------------------|
| Scenario 1 | 6 hours       | 30mm/hr                    | ~80m <sup>3</sup> /s         |
| Scenario 2 | 2 hours       | 90mm/hr                    | ~240m <sup>3</sup> /s        |
| Scenario 3 | 1 hour        | 180mm/hr                   | ~470m <sup>3</sup> /s        |

**Table 2: Catchment 2**

|            | Rain Duration | Precipitation rate (mm/hr) | Drainage (m <sup>3</sup> /s) |
|------------|---------------|----------------------------|------------------------------|
| Scenario 1 | 6 hours       | 30mm/hr                    | ~170m <sup>3</sup> /s        |
| Scenario 2 | 2 hours       | 90mm/hr                    | ~510m <sup>3</sup> /s        |
| Scenario 3 | 1 hour        | 180mm/hr                   | ~1015m <sup>3</sup> /s       |

Catchment 1 is exceeding the drainage capacity of 400m<sup>3</sup> for scenario 3, while Catchment 2 is exceeding the drainage capacity of 400m<sup>3</sup>/s for scenario 2 and scenario 3.

We proceed simulationg Scenario 2 of Catchment 2 for flooding event before the covered part of Kifissos in Three Bridges, using the software program Fast Flood. According to the simulation, extended areas of western suburbs of Athens will be affected by fluvial flooding. Most affected areas will be parts of Peristeri and Egaleo municipalities with extended damages in an area >3km<sup>2</sup> (image 11). These areas are described by narrow streets and many underground properties which increase the possibility of human losses.

**Image 11: Flooding simulation (Scenario 2 for Catchment 2 and for 1m height of full damage)**





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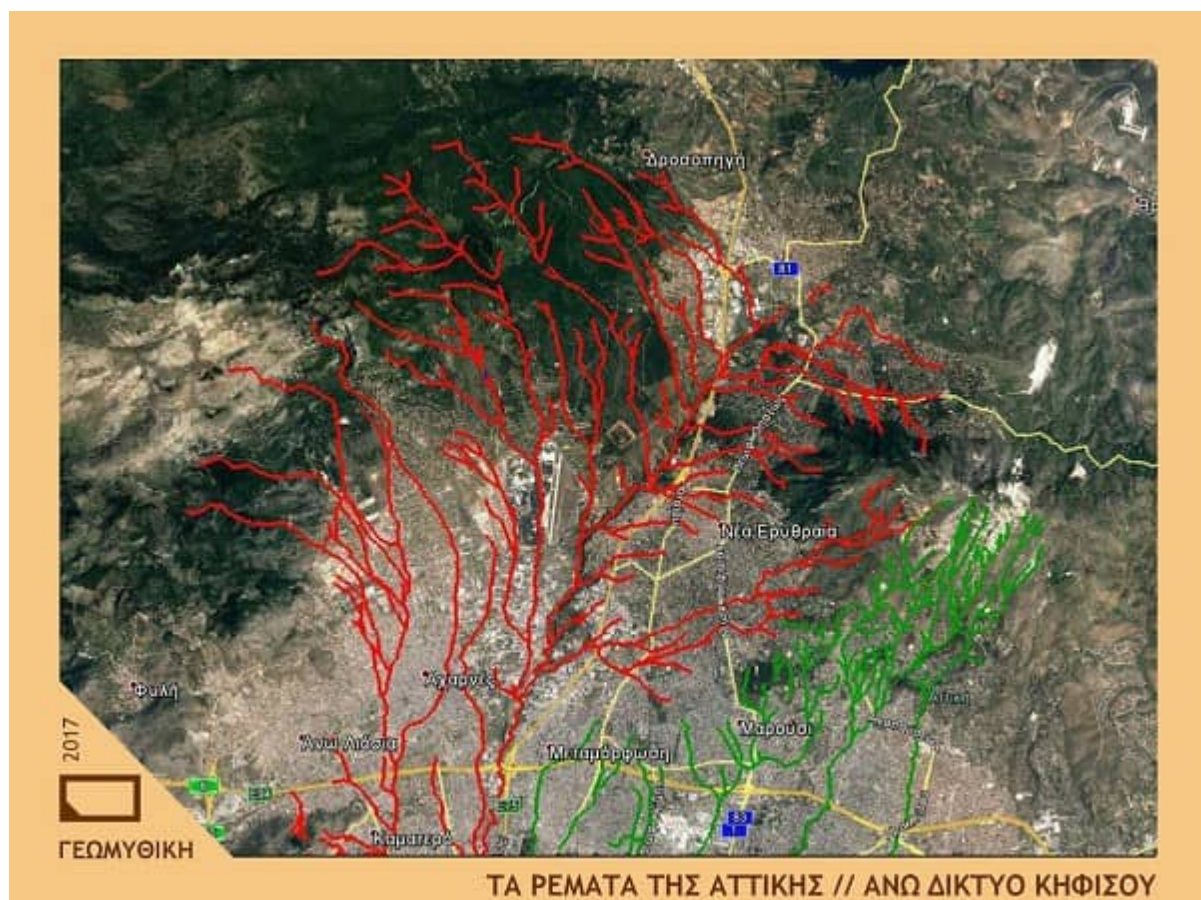
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### Solution

We have proved that in a weather event of precipitation rate  $> 90\text{mm/hr}$ , the harvested water from both catchment areas will cause fluvial flooding in west suburbs of Athens. To reduce the volume of drainage water from both catchment areas, we must proceed in drainage reduction of upper Kifissos river network. We focus on the join point of Floga stream, Varibobi stream and Kifissos river because in that point we have concentration of a big volume of waters before they proceed in the upper bed of Kifissos river (Geomithiki, 2021) (image 12)

**Images 12: Upper Kifissos river network**

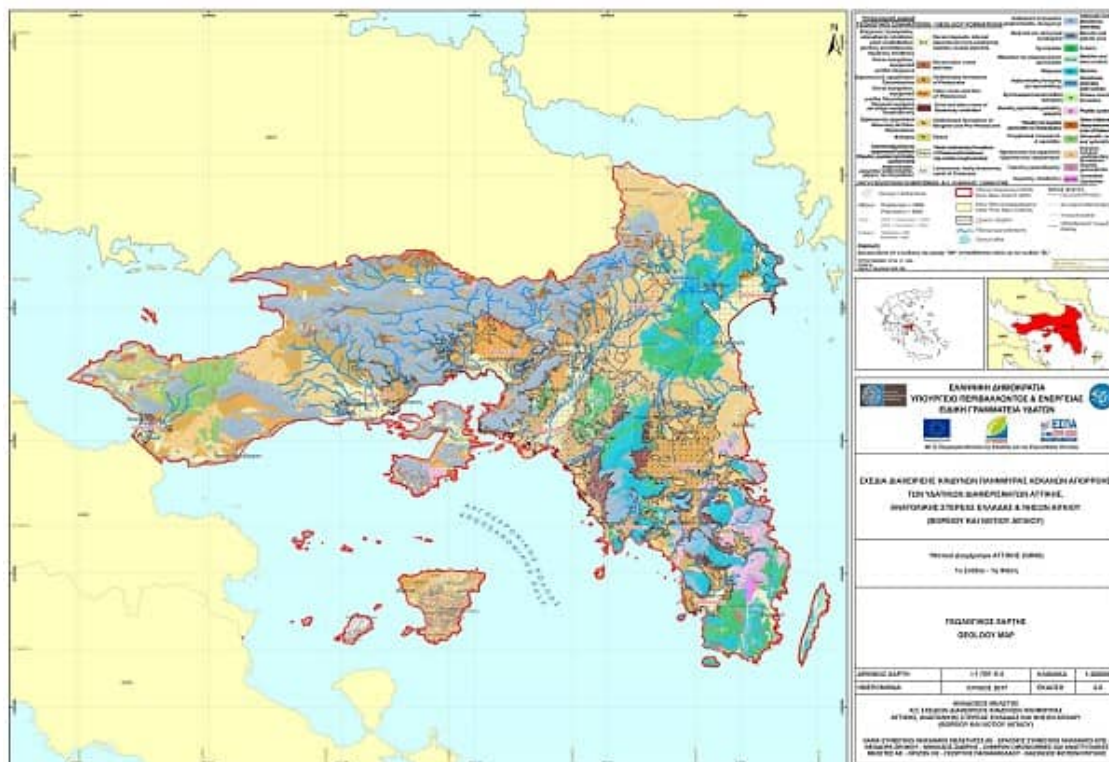


Since there is no ability to increase the capacity of the covered part of Kifissos river, we should focus on water redirection to another basin. The only solution is the construction of a drainage tunnel starting from the joint point of Floga stream, Varibobi stream and Kifissos river ( $38^{\circ}03'59''\text{N}$ ,  $24^{\circ}45'01''\text{E}$ ) and exiting to Thriassio plane ( $38^{\circ}03'49''\text{N}$ ,  $23^{\circ}39'57''\text{E}$ ). The length of the tunnel will be approximately 8km, with 10m outer diameter (capacity  $\sim 300\text{m}^3/\text{s}$ ), with the trenching of the tunnel to be implemented in a depth 25 to 50m under Attiki Odos and the old railway network to Aspropyrgos Refineries (image 13).

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A screenshot of the Google Maps interface showing a measured path in Jordan. The path is highlighted in yellow and passes through several locations, including Waterfun Waterpark, Sklaventis, and Zafyn Zegadi. A 'Measure' overlay is visible in the top right corner, displaying the total length of the path as 8.08 km. The map also shows various landmarks and roads, such as the E6 highway and the Jordan River.

**Image 14: Geological map of the trenching area**



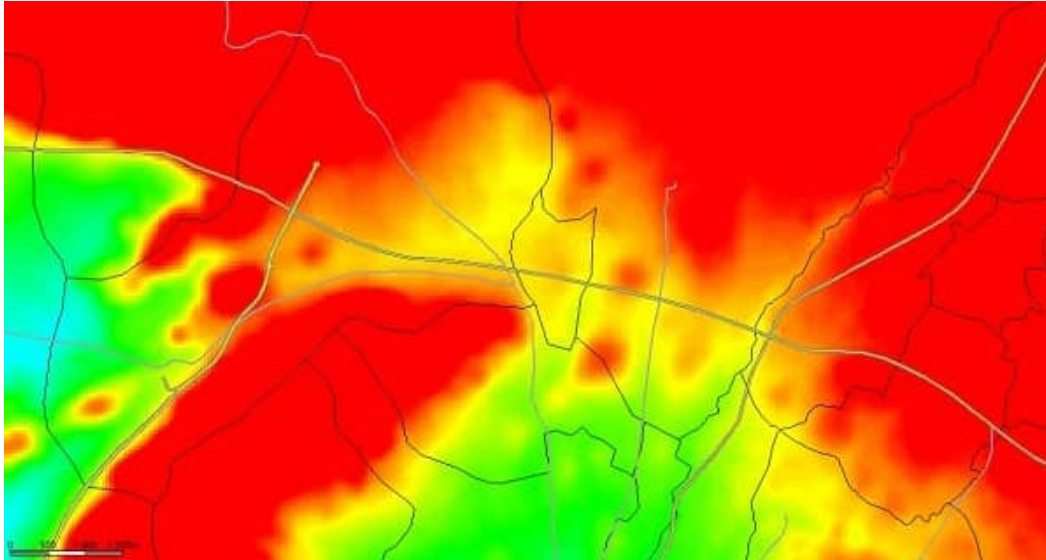


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**Image 15: Contour map of the trenching area**



Kifissos Drainage Tunnel (KDT) is a tested solution based on similar projects around the world (constructiondive.com, 2023) (halff.com, 2019). Having these projects as a reference, the cost of KDT is estimated in a total cost of 300 to 330 million euros (construction with TBM). It is a relatively expensive project, but necessary to avoid losses of lives and material damages of billions of euros like Valencia case (Reuters, 2024). Comparing to the solution of reforest to reduce runoff coefficient and therefor reduce the harvested water, an investment like KDT is preferable both in time and cost saving. It is estimated that for 50.000 acreages the cost is around 50 million euros and therefor the total cost of reforest the destroyed from wildfires area in Mt.Parnitha and Mt.Penteli is around 200 million euros. Additionally, even if the reforest could be implemented in one (1) year, which is impossible, it needs more than 10 years for a mature flora growth and under the condition of no new wildfire.

Following years are crucial, due to increased severe weather incidents like Daniel storm and due to massive deforestation of mountainous areas in Attica region - conditions that increase rapidly the possibility of a disastrous fluvial flooding in Athens basin. Investments in public works, environmental design and in scientific equipment are necessary to analyze data to reduce risk. The warnings are continuous, and the time is shortened.

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<https://fastflood.org/>



**SYSTEMIC, TRANSVERSAL, DYNAMIC: AN INTEGRATED  
APPROACH TO ACHIEVE SUSTAINABILITY IN A COMPLEX  
LANDSCAPE**

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**Abstract**

As researchers interested to territorial studies, the future of our cities is one of our most important concerns. Considering the strong transformative process in which the different accelerations are accompanied by the climate crisis, we should ask ourselves a question: how can we ensure that design truly acts with a sustainable approach and strives for a sustainable future?

The experience intends to fit into the framework of those proposals that try to ground sustainability, in addition to debate about it. More precisely, the idea is to materialize a transition from a design attitude that researches connections with the Agenda 2030 to an approach that integrates the sustainable development goals to the different design phases, from the analytical-interpretative to the strategic-prefigurative one. To achieve this idea, the research proposes to explore sustainability by searching a systemic vision, to experiment sustainability by assuming a transversal behavior and to interact with sustainability by working with a dynamic attitude.

The city of Mantua has been identified as a field of application where the idea can be linked to a transition process. Since 2023, the city has been involved in the European project HyMantoValley, an initiative of a broader program aimed at creating a hydrogen valley within the limits of the province. This context becomes an opportunity to reflect on new forms of energy production and distribution and to investigate the effects on the city and the landscape caused by these new relations. The case study intends to present a possible attempt to ground the different principles proposed by United Nations in a complex landscape.

**Key words:** cities of tomorrow, transition, sustainable future, integrated approach, new energy production, complex landscape.

**Striving for a sustainable future**

Over the past fifty years, great progress has been achieved in terms of theoretical knowledge, leading to a gradual growth of common awareness and consciousness around the topic of sustainability. Parallel to the theoretical understanding, however, the practical approach to the subject has not progressed to the same extent, remaining the experience of a few.

In the light of this, the study questions how to advance sustainable thinking in the context of planning the future of our cities, proposing a series of reflections in part useful for

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the growth of a common idea of sustainability, and in part intended to broaden the possible solutions for putting the topic into practice, moving from knowledge to know-how.

Today, those who work in the field of sustainability inevitably face two challenges: on the one hand, to act in continuity with a now consolidated concept, the ideals of which have been expressed since the second half of the last century; on the other hand, to undertake and trace new trajectories in order to operate coherently, taking into consideration the urgencies that the contemporary world offers. Following this, the paper proposes an initial in-depth examination with respect to the development of the concept of sustainability over time, which culminates in the proposal of a series of considerations that today we cannot overlook. The comparison with this subject requires first a marked propensity for connection aimed at recognising the links between different episodes, as tiles of a single representation, and then a certain dynamic ability aimed at understanding different perspectives, linked to the involvement of different institutions and territorial dimensions.

Taking the broader panorama as a starting point, the institutional body that has made the history of sustainability worldwide is the intergovernmental organisation of the United Nations, which, starting with the drafting of a common treaty in the 1940s, succeeded in outlining the prospects for the construction of the protection of human rights and the promotion of sustainable development. From this point of view, the 1970s-1980s represent a particularly decisive two decades. In 1972, the United Nations Conference on the Human Environment was organised in Stockholm, a convention that, for the first time, induced people to look at natural resources through a new, distinctly more responsible gaze, starting an educational process that is still ongoing.

Fifteen years later, in 1987, in the face of the growing need to understand and disseminate the impacts of mankind on nature, the “Brundtland Report” and what would later become the guiding definition for understanding sustainable development were born. The commission, chaired by Herlem Brundtland, president of the World Commission on Environment and Development, presented a document entitled “Our Common Future”, which shone a light on two important questions: the unsustainable production and consumption models against which the various countries of the North had gradually settled and the increasingly urgent need to adopt a balanced posture between development and the environment. This strategy that calls for integration and is called ‘sustainable development’ is described as follows in Chapter 2 “Towards Sustainable Development” of the report: ‘Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs’ (United Nations, 1987).

Following the guidelines formulated in these years, a long and dense debate began that would find a pivot point in the 2015 United Nations Summit. Among the various initiatives of this period it’s important to remember the “Rio de Janeiro Earth Summit” Conference of 1992, during which “Agenda 21” and other agreements were signed; the “Millennium Declaration” of 2000, through which eight goals to be concretely achieved by 2015 were defined; and finally, the “Rio+20” Conference of 2012, which, in continuity with the meeting on the environment and development held twenty years earlier, established the elaboration of goals for sustainable development.

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The year 2015 takes on an exceptional role thanks to the emission of two important conventions: the “2030 Agenda”, a bold plan of action signed on 25 September in New York to work on the three dimensions of sustainable development, and the “Paris Agreement”, a treaty negotiated at the 21st Conference of the Parties to the United Nations Framework Convention on Climate Change (COP 21) aimed at combating ongoing climate change. Although the “Paris Agreement” represents a pivotal moment in the history of safeguarding our living environment, aiming at decreasing greenhouse gases and keeping the global temperature within 1.5 °C of pre-industrial levels (United Nations, 2015a), the “2030 Agenda”, with its broad horizons and highly integrated vision, constitutes the most ambitious design of all, capable of embracing all the other initiatives around it. A total of 17 Sustainable Development Goals and 169 targets that align the 193 UN member states to act in a cohesive and coordinated manner to achieve a better future, for people and for the planet.

Analysing the official text of the Agenda allows us to understand the true nature of the 17 Sustainable Development Goals and, above all, to identify those features with which we should relate in order to reduce the distance between our activities and the issue of sustainability: the SDGs are universal in nature, so they address the totality of countries without distinction of development; they have a plural nature based on the concept of integration and indivisibility that embraces the paradox of the single and the multiple; and, finally, they are designed to balance the three dimensions of sustainable development, the economic, the social and the environmental (United Nations, 2015b). The realization of human rights, gender equality and the empowerment of women, goals desired but not achieved through the MDGs, constitute three of the main interests defined by the Agenda, a program that recognises the inseparable link between the well-being of humanity and the health of the planet.

Over the years, since 2015, several COPs have followed one another to work in a synergical way around Goal 13 of the “2030 Agenda” related to contrasting climate change. The latest of these conferences is COP29, an event organised in 2024 in Azerbaijan on the basis of a sad awareness: the earth's temperatures are progressively rising and the one-and-a-half-degree threshold will most likely be crossed before the end of the century.

This journey through the stages of sustainability allows us to understand several issues: the presence of a constant delay with respect to the achievement of the set goals, which often require the development of new agreements capable of transforming the failure of previous stages into nourishment for new trajectories; the involvement and responsibility of the community in the design of a better future, in this sense the titles of the documents drafted over the decades are declined with respect to the first person plural; the growing desire to move from theory to practice, a concept further reiterated in 2015 through the expression “Transforming our world”, the title of the resolution adopted by the General Assembly for the communication of the “2030 Agenda”.

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**Figure 1: reference framework on sustainability issues (author's elaboration).**



### **Renewable energy as a key element of sustainable development**

In the context of policies aimed at the sustainable development of our cities, the continuous advancement of technologies, together with the use that mankind makes of them to relate to the external environment, has made it increasingly necessary to raise awareness of certain specific issues.

From this point of view, the topic of energy production plays a central role. This theme acts as a link to the guidelines issued by the UN at global level and the directives developed within the European context. For ten years now, since the Paris Agreement on climate change, constraints have been defined that limit common action to protect the living environment and contrast climate change.

Following the dedication of the various member states' commitment to the “Paris Agreement”, in 2019 the European Commission launched the “Green Deal”, a package of initiatives with a strong strategic value that definitively set the European Union on a course towards a green transition process. More precisely, the agreement focuses on three fundamental pillars: ensuring secure and affordable energy supplies, designing an economic system around energy of an integrated and digitalized type, and shifting the focus to energy efficiency by working specifically on renewable energy production.

Today, energy from renewable sources is one of the key elements of European policy to succeed in combating ongoing climate change and achieving carbon neutrality by 2050. In fact, as data on the EU's official website show, 75 per cent of European countries' greenhouse

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gas emissions come from energy production and use. To realize this ambitious decarbonisation process, Europe is increasingly promoting a shift from systems based on the use of fossil resources to systems based on the use of renewable resources.

The transformation process was strongly influenced by the difficulties that emerged with the covid-19 pandemic and by the plans that were defined following that period. Part of this overall design is the “NextGenerationEU”, a 750 billion euros temporary financial instrument, the largest in the history of the European Union, designed specifically to initiate a process of economic recovery of the parties and to trigger social proactivity in the face of possible unforeseen events.

If Europe responded to the pandemic crisis through the definition of the NGEU and the allocation of the “Recovery and Resilience Facility” (RRF), Italy in 2021 tried to look at this programme as an opportunity to rethink and invest in its own development, through the study of a long-term perspective condensed in the “National Recovery and Resilience Plan”. The plan consists of six missions developed in line with the major areas of intervention identified by the RRF Regulation, one of which is strongly focused on the energy issue.

The second mission, entitled “Green Revolution and Ecological Transition”, encourages the environmental transition of society and the economy with a strong push towards the use of different energy sources than in the past. This mission is in turn divided into several components, four in total, the second of which covers renewable energy, hydrogen, network and sustainable mobility.

The achievement of the strategic decarbonisation objectives highlighted by this component is obtained through the activation of five lines of reform and investment. The third line, entitled “Promoting the production, distribution and end uses of hydrogen”, focuses on promoting hydrogen as a strategic energy vector for rethinking the future of the productive landscapes that characterize our territories. Italy, in line with the European strategy, intends to pursue the production and use of hydrogen by “i) developing flagship projects for the use of hydrogen in hard-to-abate industrial sectors, starting with the steel industry; ii) favouring the creation of “hydrogen valleys”, leveraging in particular areas with disused industrial sites iii) enabling - through recharging stations - the use of hydrogen in heavy transport and in selected railway lines that cannot be electrified; iv) supporting research and development and completing all necessary reforms and regulations to enable the use, transport and distribution of hydrogen” (Italia Domani, 2021).

Although from a theoretical point of view this plan has all the potential to be identified as the most courageous political intervention of recent decades, a critical reinterpretation of the device with respect to the sustainability theme is considered useful.

Considering the more operational dimension, in fact, if all the targets were met by 2026, it would still not be enough to make it possible to achieve the SDGs by 2030 (ASviS, 2021). Among the most evident critical points: the absence of any reference to the seventeen goals, a fundamental element for achieving effective multi-level governance; the lack of quantitative and qualitative targets linked to socio-environmental aspects; a certain misalignment between the missions identified by the plan and the pillars of the guidelines designated by the European Union.

To confirm this, the Italian Alliance for Sustainable Development (ASviS) proposes a process of reclassification of the missions offered by the plan in relation to the goals of the



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“2030 Agenda”, from which emerges an inadequately effective commitment to the energy transition planned by the European Green Deal (ASviS, 2021). Although positive innovations, such as the development of agrophotovoltaics or the creation of energy communities in small municipalities are identified, the realization of an effective decarbonisation process still seems distant.

### **A field to ground sustainability: the HyMantoValley project**

The considerable extension of industrial areas on Italian territory, and the high level of pollution produced by some of these, does not allow the weight of manufacturing activities to be ignored in relation to the environmental crisis we are experiencing. While the influence of these realities has reached extreme levels, it's also true that change is still possible.

The Energy Transition Commission, a group of experts from different sections of the energy sector, speaks of a “mission possible”: to achieve zero carbon emissions by mid-century to limit global warming by keeping temperatures as close as possible to 1.5 degrees (Energy Transitions Commission, 2018). Achieving zero carbon dioxide emissions in so-called ‘hard-to-abate’ sectors is technically feasible by investing in three complementary actions: limiting demand growth, improving energy efficiency, and finally, applying decarbonisation technologies. Among these, hydrogen plays a decisive role.

As experts point out, achieving the goal of zero CO<sub>2</sub> emissions by mid-century will require an increase in global hydrogen production from 60 Mt per year today to around 425-650 Mt by mid-century. Not only that, it will be essential to promote large-scale production of zero-emission hydrogen through one of these possibilities: electrolysis, which will become increasingly affordable as renewable energy prices fall; the application of carbon capture to methane reforming and the subsequent storage or utilisation of the captured carbon dioxide; and the reforming of biomethane, although it is unlikely to play a major role given the limited biomass resources (Energy Transitions Commission, 2018). In this perspective, the use of green hydrogen assumes a decisive role because through its characteristics it can convey a wide variety of advantages, primarily its strong integrability with renewable energy sources and other green energy technologies (Ficco et al., 2022).

From 2023, Mantua represents one of the Italian cities in which it is possible to experiment with the energy transition through the project of a Hydrogen Valley within the province's borders, which would avoid the emission of tons of CO<sub>2</sub> every year. The ambitious project aims to invest 60-70 million euros to achieve the following objectives: optimising the production and storage of renewable energy, its conversion into green hydrogen, its distribution, storage and multiple uses.

As described on the website of the Province of Mantua, the territorial body in charge of coordinating the project, in addition to the PNRR funds, the initiative is 70% supported through the European call for proposals I3 “Interregional Innovation Investment”, an investment facility managed by the European Innovation Council Executive Agency (EISMEA) dedicated to innovation within the European Regional Development Fund (ERDF). The project is based on the activation of a wide network of relationships involving 16 partners from 3 European countries besides Italy, i.e. Austria, Belgium and the Netherlands, and



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various stakeholders, such as public bodies, private entities, logistics companies, universities and research centres.

The Politecnico di Milano, with the detached territorial pole “Mantua Campus”, is one of these partners involved in the project to create a Lombardy Hydrogen Valley. In this initiative, the Politecnico, through the work of the interdepartmental Unesco Research Lab, accompanies the energy transition in an exceptional production context in which it is important to visualize change in a long-term logic.

Today's configuration of the Mantua production pole is the result of numerous transformations over time through very different drives and needs, not always interconnected and mutually coordinated. All this, together with the more recent development linked to the settlement of new and large companies operating in the transport and logistics sector, has made the area of interest rather fragmented, with scattered buildings and often incomplete urbanization works. The location of the area close to the historic city, a UNESCO heritage site, the proximity of the environmental system of the river Mincio and the lakes, the proximity of the disused industrial area, the presence of a supra-local infrastructural network in which the Valdaro river port stands out, are all aspects that allow the area to be considered as a complex landscape, a crossroads of heterogeneous flows and interests.

The group of Politecnico is in charge of the 3D monitoring of the area of interest, drafting the area's master plan and dealing with the architectural design of a Research Hub, the core of hydrogen-related innovation, where researchers, students and companies can work together to develop innovative solutions for the decarbonisation of the Po Valley. This in-depth study arises from the working group related to territorial planning and is based on the reflections that emerged before and during the realization of the master plan.

More precisely, planning activities are oriented towards achieving sustainability objectives through the integration of flows, production processes and research activities. With the awareness that the diffusion of new forms of energy on the territory often advances in a disconnected manner with respect to landscape valorization and protection policies (Laviscio, 2019), the research proposes an approach that intends to incorporate the theme of landscape quality in order to succeed in safeguarding the distinctive traits that make the Mantuan context recognisable to today's communities and tomorrow's generations.

### **Turning ideas into perspectives by exploring, experimenting and interacting**

The method we are experimenting within the Mantuan context is intended to be a small step towards the construction of an imaginary of future cities through the definition of a shared approach capable of integrating sustainability throughout the entire design process.

The main intention is to act with and for sustainability by moving from a more conceptual dimension, useful for increasing awareness around the topic, to a proactive one, able to ground the various objectives, anchoring them to the characteristics of a specific context. This means defining a process to move from a set of ideas, the result of an activity carried out mostly on a theoretical level, to a set of perspectives directly linked to action. In other words, if the concept of an idea is linked to a more abstract dimension, acting at a higher level without entering the merits of territorial confirmation, the concept of a perspective

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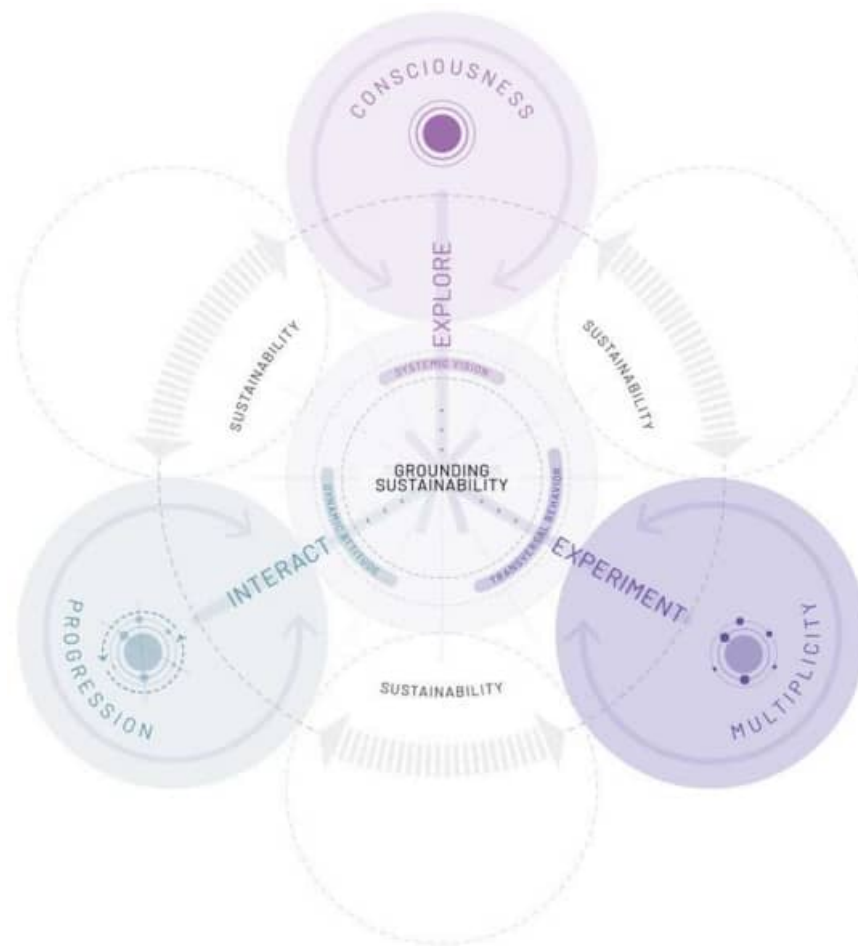
communicates a sense of trajectory, a focused direction, capable of tracing directions and projecting intentions inside the territory.

To do this, we suggest testing different ways of relating to sustainability at three stages of the project process:

- in the stage of consciousness, we propose an exploratory type of relationship with sustainability to be fully aware of the topic;
- in the stage of multiplicity, we propose an experimental type of relationship with sustainability to construct a diversified frame for the development of the topic;
- in the stage of progression, we propose an interactive type of relationship with sustainability to grow and increase along with the topic.

Consciousness, multiplicity and progression should not be interpreted as consequential steps in the design process but as challenges and urgencies that can be grasped along the way.

**Figure 2: three interpretative keys to ground sustainability (author's elaboration).**



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### *Explore by searching a systemic vision*

To explore sustainability, that is to examine it and reveal it in all its various shades, we suggest adopting a systemic view.

Using the systemic vision as a cognitive paradigm means looking at sustainability in its complexity, as ‘a fabric of heterogeneous constituents’ that confront us with the ‘paradox of the one and the many’ (Morin, 1993). Adopting this approach allows us first to keep the link between the particular and the general, or between detail and the whole, learning to discern the various components and recompose them in a renewed way, highlighting any criticalities and potentialities (De Giovanni, Sposito, 2020).

With reference to systemic design, this type of posture necessarily passes through the adoption of ‘framing’, a tool that allows to carefully analyse different information and organise it in a different way, activating a new perspective, often capable of generating new associations of meaning (Ryan, 2014). Selection, therefore, induces the creation of integrations and hierarchies of meaning without ever losing the importance and role of the whole, which is much more than the mere summation of the parts. Viewing always requires a broad pragmatism in linking together two different predispositions: the ability to grasp wide-ranging gazes and relationships and, at the same time, an aptitude for a detailed perspective (Gasparrini, 2015).

In the case of the HyMantoValley project, the adoption of a systemic vision served to define a critical and personal reading of the “2030 Agenda”, leading to the identification of a framework of strongly interconnected SDGs that find several points of contact with the initiative.

The different aims of the HyMantoValley project contribute synergistically to the achievement of target 7 related to clean and accessible energy by working mainly around two different perspectives: to increase the share of renewable energy in total energy consumption (target 7.2) and to increase international cooperation by facilitating access to clean energy research and technologies and promoting investment in energy infrastructure and clean energy technologies (target 7.a)

Pursuing an integrated logic, objective 7 can be accompanied by a series of other targets that collaborate towards the same general intent, in a direct or indirect manner. The focus on the theme of sustainable energy generates the involvement of a broader cluster of objectives described below: number 4, objective aimed at a quality, equitable and inclusive educational offer; number 6, objective that intends to guarantee the availability and sustainable management of water for all; number 8, objective aimed at lasting, inclusive and sustainable economic growth; number 9, objective aimed at building a resilient infrastructure and promoting responsible innovation and industrialization; number 11, objective that aims to make cities and human settlements inclusive, safe, long-lasting and sustainable; number 12, objective that intends to guarantee sustainable production and consumption models; number 13, objective linked to the promotion of multi-level actions to combat climate change; number 15, objective related to the protection, restoration and encouragement of sustainable use of the terrestrial ecosystem; last but not least, number 17, objective aimed at strengthening the means of implementation and renewing the global partnership for sustainable development.

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The diversity of the network further reinforces the evidence of an inseparable bond between man and nature that requires synergic action on multiple fronts, balancing the three dimensions of sustainability: economic, social and environmental.

### *Experiment by assuming a transversal behavior*

To experience sustainability, or to concretely approach its plurality through immersive methods of verification and assessment, we suggest adopting a transversal behavior. The transversal, flexible, open approach is intended as a non-linear attitude that proceeds through gradual advances and possible intersections.

In this sense, transversality can be interpreted as multiscalarity, that is, the ability to move between the different scales of the project without losing continuity and coherence between the parts. Far beyond the proportion and metrics of the design, the scale refers to a model of reality, to a specific dimension and to a context with clearly distinguishable characteristics. Beyond any uniform need, the effort of cohesion between the different scales of the project concerns the contents, criteria and quality objectives of the project.

The theme of multiscalarity has its roots in the field of ecological sciences, knowledge in which the direct or indirect observation of facts and phenomena requires frequent “cross scaling” operations to distinguish the criteria and themes that each level of observation includes (Di Venosa, 2014). Michelangelo Russo, in one of the critical reflections on the notion of scale, states that “Thinking of the territory as a multiscalar assembly of complex and heterogeneous materials and phenomena represents a way to constantly cross the physical, material and visible components of space with the immaterial, invisible dimension of the subjects who are the active protagonists of space” (Russo, 2015).

To grasp this type of connection and relationship between extremely different components, it is not enough to limit the approach to the implementation of a process of enlargement or reduction of the view similar to an optical instrument, but rather it is appropriate to operate through a continuous action of “abstraction and verification” adequately articulated to restore the complexity of the different perceptive thresholds (Secchi, 2000).

In the HyMantoValley project, the multi-scale approach served to explore the area of interest at 360 degrees by observing the production hub through three complementary perspectives. The territorial scale (1:400,000-1:200,000) allowed us to frame the hub as one of the main industrial and infrastructural nodes of northern Italy, the landscape scale (1:200,000-1:25,000) allowed us to grasp the human-nature relationships that have guided the evolution of the place over time, highlighting the different identity values and the various connections, finally, the urban scale (1:25,000-1:10,000) served to understand the ongoing urban phenomena and to read the formal and functional aspects that distinguish the area of interest.

By focusing on different aspects of the area, the work around each scale has allowed us to emphasize a different connection with the objectives of the “2030 Agenda”. For example, in the context of the knowledge phase, the framework at the territorial scale has allowed us to emphasize the infrastructural network in which the Mantua hub is inserted and to underline the spatial relationship with the European planning of a hydrogen pipeline that longitudinally

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crosses the entire Italian peninsula. This allows us to underline the involvement of a group of strongly interrelated SDGs among which the following stand out: objective 7 linked to obtaining clean energy, objective 9 linked to building a resilient and renewed infrastructure and objective 13 connected to the fight against climate change.

In addition, the transversal approach can be interpreted as cooperation or multi-sectorality, as well as the ability to work at the intersection between territorial entities that, despite their diversity, work for a common goal, the future of the territory. Unifying different structures, skills, views and sensibilities is not an easy task, but it is one of the necessary steps to allow a logical and cohesive operation. Public, private, research institutions, must necessarily converge in a single direction by offering their own point of view and their own information or tools for the construction of an effective overall vision (Qianjan, 2023).

In the HyMantoValley project, one of the main challenges was to be able to weave relationships with a wide range of subjects that offer different skills and communicate through diversified languages. Moving between the supra-local and the local, the project has collected the different projects of the Province and the Municipality with the aim of moving from a fragmented set of knowledge and strategies to an organized system of geographic information, superimposable and comparable in a GIS environment. More specifically, the main geographic data adopted for the creation of the representations derive from the Provincial Territorial Coordination Plan drawn up by the Province of Mantua, from the Regional Topographic Database provided by the Municipality of Mantua and from the navigation plan managed by the Interregional Agency for the Po River.

### *Interact by working with a dynamic attitude*

To interact or act mutually with sustainability, relating through actions that give rise to relationships of mutual influence, we propose a dynamic attitude. The dynamic attitude can be interpreted as a non-static and unconventional attitude towards the project, a dimension in which movement predominates on both a physical and conceptual level.

By breaking down the usual hierarchies and sequences that traditional planning has accustomed us to, this type of attitude calls for the adoption of an iterative process capable of putting together results in a progressive manner with the possibility of moving cyclically between the different steps. This means placing oneself in the conditions of repetition, evaluating a possible revision or reconsideration with respect to some steps already crossed, in the idea that this is one of the most effective ways to fully understand the complexity of the territory, made up of specificities, systems, multidimensional relationships, interdependencies, practices, flows, stories, people and much more (Russo, 2015).

The adoption of an iterative approach within the HyMantoValley project has allowed us to work synergistically within three operational phases that inform and redefine each other within a mutual relationship: the analytical phase responds to cognitive needs, the strategic phase deals with the need for staging, and finally, the applicative phase offers possible solutions to the needs of project implementation.

More precisely, the first phase intends to interpret the complexity of the territory through the understanding of its different resources and peculiarities, the second phase intends to prepare an overall vision for the territory through the development of an effective system of

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objectives, finally, the third phase intends to prefigure the spatial effects of the strategy through the definition of site-specific design solutions.

This challenge, intersecting with the use of a multi-scalar approach, motivates the development of different project outputs that attempt the progressive experimentation of new expressive languages: some cartographies transfer the reading of the territory to the different temporal thresholds, other representations summarize the overall vision associated with the development of the production hub, finally, some graphic works describe the different design solutions.

Furthermore, the dynamic attitude can be interpreted as the ability to move between a multiplicity of options and alternatives. This implies first the abandonment of an exclusive vision aimed at reaching a single scenario and, secondly, the development of an open and flexible procedural attitude that allows to look at reality in a more complex and responsible way. The evaluation of alternatives implicitly includes a series of attentions aimed at the landscape and the people who, depending on the hypothesized transformations, will collect different outcomes and impacts.

In the specific case of HyMantoValley, the transition between the knowledge framework and the implementation phase of the Research Hub was addressed by identifying 9 possible locations, i.e. areas differently attractive for the placement of the research center. The mapping phase was supported by an investigation phase aimed at developing an information form that, evaluating qualitative and quantitative aspects, offers a judgment of suitability and interest with respect to the specific site. Wanting to define a project that advances progressively considering multiple possible futures, the basic idea is not to converge towards the definition of a single masterplan but to prepare different alternatives that verify the possible scenarios that the best locations are able to generate.

### **Approach & thinking**

The research activity within the HyMantoValley initiative, although not yet concluded, constitutes an important testimony to the usefulness of a strongly integrated approach in the construction of an imaginary for the future of our cities.

Reflecting on the various experiments underway, the contribution promotes research as a possible reference to ground sustainability by offering a highly integrated model resulting from the fusion of different attentions and approaches: a systemic vision, a transversal behavior and a dynamic attitude.

To proceed in this direction, a change of perspective is essential, achievable only and exclusively working on awareness. Recovering the words of Edgar Morin, a French sociologist and philosopher known for having associated the theme of complexity with today's society, what we really need is "a radical thinking (which gets to the root of problems), a multidimensional thinking, and an organizational or systemic thinking" (Morin, Kern, 1999). The thinking described by Morin can reassemble the disjointed and compartmentalized parts, it is able to respect diversity while recognizing its unitary dimension and it is able to grasp interdependencies.

If to obtain an integrated approach, it is appropriate to adopt a radical thought, it is equally evident how the practical dimension is strongly connected to the sphere of the



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intellect and, due to mutual dependence, how operational progress almost always derives from conceptual efforts.

In this direction that sees sustainability as a shared work site, the construction of a unitary approach appears to be a particularly difficult challenge. Thinking about sustainability, a particularly diversified, divided, sometimes fragmented dimension emerges: seventeen objectives, more than one hundred and fifty targets, countless subjects involved between the public and private spheres, an infinity of interests and needs, a wide range of initiatives spread throughout the world, different skills and attitudes, etc. The perspective becomes progressively more complex when we try to associate all this with the precariousness that we experience today in our cities due to the innumerable risks, natural and anthropic, to which settlements are subjected.

Despite the many doubts, the first step to try to trigger widespread change is to escape the staticity that concern for the future entails, freeing oneself from the defensive logic of what should not be done to become part of a proactive dimension that does not demand certainties but offers possible solutions to stimulate a sustainable metamorphosis of our cities (Gasparrini, 2017).

“Grounding sustainability”, the claim underlying the Mantua initiative, underlies precisely this idea: today is no longer the time for reflection but the moment to act and consciously project concrete proposals on our territory for a better future.

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Session:

**“Energy Management and Sustainable Mobility”**

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### DECODING EUROPE’S ‘RENOVATION WAVE’ ENERGY STRATEGY: REAL ESTATE SHIFTS FOR SUSTAINABLE CITIES

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#### Abstract

The European Union’s Renovation Wave initiative, an integral pillar of the European Green Deal, endeavors to fundamentally transform Europe’s building stock in pursuit of climate neutrality, social equity, and resilient economic growth. To double the annual rate of energy renovations by 2030, the initiative addresses the pressing environmental challenges posed by buildings, which are responsible for nearly 40% of Europe’s energy consumption and 36% of its greenhouse gas emissions.

By synthesizing insights from key research and regulatory frameworks into an incisive SWOT analysis, this paper elucidates the Renovation Wave’s far-reaching implications for the real estate sector, underscoring its transformative potential and inherent complexities. The findings reveal substantial strengths, including cohesive regulatory support, a robust funding apparatus, and a strong commitment to digitalization and inclusivity, thus positioning the real estate sector as a linchpin in the EU’s green transition. Nevertheless, critical barriers - financing deficiencies, skill shortages, and marked regional disparities- pose significant constraints on the initiative’s broader efficacy. Despite these obstacles, the Renovation Wave presents unparalleled opportunities, from enhancing property values and catalyzing green job creation to fortifying climate resilience within the sector.

This study concludes that realizing the Renovation Wave’s ambitions will necessitate coordinated, strategic action among policymakers, industry stakeholders, and regional authorities. Addressing these challenges is vital to unlocking the initiative’s transformative potential, positioning the EU as a global exemplar in sustainable building practices and climate-adaptive urban development.

**Keywords:** Urban Sustainability, Sustainable Real Estate, Circular Economy, Affordable Housing, Energy and Buildings, Climate-Resilient Buildings, Environmental Resilience

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### END-USER PERCEPTIONS TOWARD THE REQUIREMENTS OF INNOVATIVE THERMAL INSULATION MATERIALS

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**Abstract**

This study investigates end-users perceptions of innovative construction solutions, specifically thermal insulation materials. Initially, a literature review was applied to categorize insulation requirements into economic, environmental, social, and technical. Through the review, various drivers and barriers to the adoption of innovative materials within these categories were also identified.

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To gather further insights, a survey targeted end-users across several European countries, particularly those participating in the SNUG European project (<https://snugproject.eu/>, Horizon Europe, 2023-2027). Conducted in March 2024, the online questionnaire received 115 responses from 12 countries, with Spain, Austria, Greece, and Portugal contributing the most responses. The respondents mainly consisted of architects, engineers, building occupants, and private homeowners, most of whom reported either high or average knowledge regarding insulation materials.

Survey findings revealed that the most essential criteria for insulation materials were cost efficiency, durability, energy efficiency, health impacts, the release of harmful substances, and thermal performance. Conversely, aesthetics, bio-based materials, biodegradability, and weight/density were deemed least necessary. In addition, the criteria for selecting insulation materials were ranked in terms of importance as technical, economic, environmental, and social.

Additionally, an analysis was performed to identify the differences based on the knowledge level of the participants (low, average, high). All groups rated energy efficiency and health impact highly, while weight/density and bio-based materials ranked lower in importance in all three groups. Statistically significant differences were noted, with low-knowledge participants regarding biodegradable materials and sustainability as less critical, whereas the high-knowledge group undervalued aesthetics.

The findings aim to guide building component manufacturers in developing innovative products that meet user needs and preferences.

**Keywords:** Circular economy, bioeconomy, construction sector, insulation material requirements, end-user, perceptions

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### CONSUMER PERCEPTIONS TOWARD THE USE OF BIOMETHANE – SURVEY RESULTS FROM 11 EUROPEAN COUNTRIES

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#### Abstract

Biomethane (bioCH<sub>4</sub>) is expected to significantly contribute to the EU's energy decarbonization efforts by reducing reliance on natural gas imports and enhancing the share of renewables across various sectors. While most EU countries have the necessary gas infrastructure and regulatory frameworks, few facilitate upgrading biogas to bioCH<sub>4</sub> for grid injection. The EU Green Deal and "Fit for 55" package present new opportunities for expanding bioCH<sub>4</sub> deployment, but effective national policies must align with industrial capacities and market conditions to foster development and investment.

The GreenMeUp Horizon project (2022–2025) aims to enhance bioCH<sub>4</sub> market uptake in Europe's energy and transport sectors by improving policies in less-developed markets. The initiative brings together the European Biogas Association, experienced countries (Germany and Italy), and target nations [Greece, Spain, Poland, Latvia, Estonia, Czechia, and the Danube Region (including parts of Hungary, Romania, and Serbia)], along with Mission Innovation Countries (USA, Canada, China, Brazil, and India) to share best practices and insights. This collaborative effort aims to inform and refine policies in target countries, ultimately fostering a robust bioCH<sub>4</sub> market.

The project has explored social perspectives in all target countries, starting with a literature analysis of existing research, which was applied to develop a theoretical model presenting the determinants of consumers' perceptions. Based on the conceptual model, a questionnaire was formulated, focusing on consumers' interpretations and perspectives on bioCH<sub>4</sub> for energy and transportation purposes. Following, a survey was performed in 11 European countries (November 2024); 200 responses were collected per country with the collaboration of a surveying company. The topics addressed included a) knowledge and awareness, b) perceptions, attitudes and behaviour towards using biomethane-based fuels, c) willingness to pay for different applications of biomethane-based fuels, and d) perceptions on local acceptance of biomethane-producing facilities.

The results of this study will enable the development of policies targeted at the market uptake of bioCH<sub>4</sub> and the creation of tools addressing citizen misconception issues.

**Keywords:** biofuels, biomethane, market uptake, societal aspects, public perceptions, survey

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# THE IMPACT OF ECONOMIC GROWTH AND ENERGY CONSUMPTION ON ENVIRONMENTAL QUALITY

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## **Abstract**

*In recent years, research interest in anthropogenic impacts on the environment has been particularly intense, as evidenced by the range of empirical research related to climate change. Climate change and especially its negative effects is a field of continuous research and study. This research examines how economic growth, consumption of energy resources and population affect the quality of the environment in the case of Greece employing appropriate econometric techniques. Specifically, using an ARDL model, the long- and short-term effects of these variables on environmental quality, measured by carbon dioxide emissions, are examined. Carbon dioxide (CO<sub>2</sub>) is the most important anthropogenic greenhouse gas. The findings reveal that economic growth and energy consumption have a positive and significant impact on environmental degradation. These results underline the urgent need for sustainable development policies that promote economic growth while mitigating environmental damage. These policies should aim to reduce CO<sub>2</sub> emissions and focus on increasing energy efficiency.*

**Key words:** *climate change, energy consumption, environmental quality, ARDL*

## **1. Introduction**

The relationship among economic growth, energy consumption and environmental quality has become increasingly significant in the context of global climate change and sustainable development goals. In recent years climate change poses a significant threat to the ability to maintain economic prosperity. In this context many researchers are seeking evidence on how economic growth impacts environmental quality across different stages of development and what the relationship is between energy consumption patterns and environmental degradation. There is not always a clear path between seemingly opposite directions. Energy consumption is a crucial factor, as it drives economic growth and is a major source of environmental pollution, especially through fossil fuel combustion like coal and oil. Non-renewable energy sources are primarily associated with high greenhouse gas emissions.

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The Greek economy is highly dependent on fossil fuels and therefore highly vulnerable to the risks stemming from it (IEA, 2023). However, we should not lose sight of the fact that significant efforts have been made in recent years to move to more environmentally friendly energy sources. Greece has adopted a national climate law that sets ambitious targets for reducing greenhouse gas emissions. This law aims for climate neutrality by 2050 in accordance with European Green Deal.

The case of Greece is extremely interesting because the Greek economy suffered an unprecedented economic debt crisis for a country in the developed world that set it back several years with very significant repercussions on the productive and social fabric. However, the restoration of normality did not last long, since the Covid 19 pandemic broke out very soon. In this light, the new data allows us to study the correlation between economic growth and environmental quality in abnormal conditions.

## 2. Literature Review

The cornerstone of any new study is the Environmental Kuznets Curve (EKC). The Environmental Kuznets Curve (EKC) hypothesis suggests an inverted U-shaped relationship between economic development and environmental degradation. The main idea is that as economies expand, they typically consume more energy, often leading to increased pollution and resource depletion, especially in early stages and this pattern reverses as income rises, due to adoption of cleaner technologies and stricter regulations, potentially leading to improvements in environmental quality. Initial studies by Grossman and Krueger (1991) found that economic growth initially leads to environmental deterioration, but beyond a certain income threshold, environmental quality begins to improve. Although subsequent research has supported these findings, other results are challenging this hypothesis. Stern (2004) argues that while some pollutants follow the EKC pattern, others, particularly global pollutants like CO<sub>2</sub> emissions, may not demonstrate the same relationship.

Early studies primarily focused on total energy consumption and soon after research interest expanded to include different types of energy, such as electricity, nuclear, and renewable energy, recognizing that not all forms of energy have the same impact on growth (Payne, 2010). Energy consumption plays a very important role in environmental degradation. Evidence from developing countries indicated that rapid economic growth leads to higher energy consumption due to high participation of carbon and oil in the energy mix exacerbating environmental degradation (Kais et al., 2016). Apart from EKC analysis, many research studies have been conducted in related areas, including various aspects forming the energy consumption, CO<sub>2</sub> emissions – growth nexus. Studies employ various methods, including panel data, time series analysis, and econometric techniques like OLS, fixed effects, and ARDL. Acaravsci and Ozturk (2010) by applying an ARDL model on data from 19 European countries, found in many cases significant long-run relationship between real GDP, CO<sub>2</sub> emissions and energy consumption. Similar conclusions were reported by Menyah et al (2010) for Saudi Arabia. Manu et al (2017) using simple OLS analyzed the impact of energy consumption and economic growth on CO<sub>2</sub> emissions. Energy consumption patterns significantly influence environmental quality through various channels like direct emissions from fossil fuel consumption and land use changes for energy infrastructure. Studies by

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Zhang and Cheng (2009) demonstrate strong causal relationships between energy consumption and carbon emissions in developing economies.

Population growth rate is another factor to be considered. The empirical analysis at the aggregate level demonstrates the country-specific impact of population density on CO<sub>2</sub> emissions, emphasizing the need for policies that address the environmental impacts of population growth (Ohlan, 2015). Sulaiman et al (2018) added population growth rate to the equation, but there was no evidence of long-term relationship between population growth and CO<sub>2</sub> emissions. Population density also plays a crucial role in environmental quality. Higher population density can lead to increased demand for resources and energy, resulting in higher emissions and greater environmental degradation. The combined approach to investigate the dynamic relationships among economic growth, environmental degradation, and energy consumption has provided valuable insights. Studies using time series analysis and panel data analysis have explored the relationship between environmental pollutants, renewable and fossil energy consumption, and economic growth (Bölük & Mert, 2015). These analyses are crucial for formulating policies that balance economic development with environmental sustainability.

### 3. Methodology

#### 3.1 Data analysis

Greece’s annual data employed by this study cover the period from 1990 to 2018 and the main source is Energy Institute (2024), Statistical Review of World Energy 2024 and the World Bank. This time period covers a period with extremely interesting features, like the fiscal crisis that the country has experienced since 2010 and the period of Covid 19 lockdown. CO<sub>2</sub> emissions are modeled as a dependent variable, while economic growth, energy consumption and population growth rate as independent. More details on those variables exist in Table 1.

Table 1. Data variables details

| INDICATOR_NAME              | SOURCE NOTE                                                                                                                                                                                                                                                                                                                                                                                       | SOURCE_ORGANIZATION                                                       | Unit                 |
|-----------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------|----------------------|
| GDP (constant 2015<br>US\$) | GDP at purchaser's prices is the sum of gross value added by all resident producers in the economy plus any product taxes and minus any subsidies not included in the value of the products. It is calculated without making deductions for depreciation of fabricated assets or for depletion and degradation of natural resources. Data are in constant 2015 prices, expressed in U.S. dollars. | World Bank national accounts data, and OECD National Accounts data files. | US \$                |
| Population Growth           | Population Growth rate derived from total population                                                                                                                                                                                                                                                                                                                                              | Energy Institute (2024), Statistical Review of World Energy 2024          |                      |
| Consumption per capita      | In this review, primary energy comprises commercially-traded fuels, including modern renewables used to generate electricity. Energy from all sources of non-fossil power generation is accounted for on an input-equivalent basis.                                                                                                                                                               | Energy Institute (2024), Statistical Review of World Energy 2024          | Gigajoule per capita |

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|                                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                  |                                  |
|--------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------|----------------------------------|
| Carbon Dioxide Emissions from Energy | Notes: The carbon emissions above reflect only those through consumption of oil, gas and coal for combustion related activities, and are based on 'Default CO2 Emissions Factors for Combustion' listed by the IPCC in its Guidelines for National Greenhouse Gas Inventories (2006). This does not allow for any carbon that is sequestered, for other sources of carbon emissions, or for emissions of other greenhouse gases. Our data is therefore not comparable to official national emissions data. | Energy Institute (2024), Statistical Review of World Energy 2024 | Million tonnes of carbon dioxide |
|--------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------|----------------------------------|

### 3.2. Empirical model

This study employs an ARDL model. In recent years, ARDL models have gained increasing popularity in econometrics and environmental research due to their flexibility and ability to handle small sample sizes effectively. These models are particularly useful for examining the dynamic relationships between variables over time, allowing for both short-term and long-term analysis. By incorporating lagged variables, ARDL models can disentangle the complex interactions between economic growth, energy consumption, and environmental quality, providing more robust and insightful results. One very important advantage of this model is that the order of integration of the variables is not so important. Variables can be of any order. They can be  $I(0)$ ,  $I(1)$  or mixed. The only restriction is that they cannot be greater than  $I(1)$ . The ARDL( $p, q$ ) model is represented by the following general equation:

$$\ln CO2_t = \alpha_0 + \sum_{i=1}^p \alpha_i \ln CO2_{t-i} + \sum_{j=0}^q \beta_1 \ln GDP_{t-j} + \sum_{j=0}^q \beta_2 \ln ENC_{t-j} + \sum_{j=0}^q \beta_3 \ln POP_{t-j} + \epsilon_t \quad (1)$$

To investigate the long run relationship among the variables we will apply the ARDL bounds test approach to cointegration (Pesaran et al., 2001) and use critical values for small samples (Narayan, 2005). By reparameterization of the ARDL equation into an unrestricted error correction model we have the following equation which enables the analysis of long and short run relationship:

$$\Delta CO2_t = \alpha_0 + \pi_{CO2} CO2_{t-1} + \pi_{GDP} GDP_{t-1} + \pi_{ENC} ENC_{t-1} + \pi_{POP} POP_{t-1} + \sum_{i=1}^{p-1} \phi_i \Delta CO2_{t-i} + \sum_{j=0}^{q_1-1} \beta_j \Delta GDP_{t-j} + \sum_{j=0}^{q_2-1} \gamma_j \Delta ENC_{t-j} + \sum_{j=0}^{q_3-1} \delta_j \Delta POP_{t-j} + \epsilon_t \quad (2)$$

Where,  $\Delta$  is the first difference operator,  $\alpha_0$  is the intercept term,  $\pi_{CO2}, \pi_{GDP}, \pi_{ENC}, \pi_{POP}$  are the long-run multipliers,  $\phi_i, \beta_j, \gamma_j, \delta_j$  are the short-run dynamic coefficients,  $p$  is the lag length for the dependent variable and  $q_1, q_2, q_3$  the lag lengths for the independent variables. The bounds test is based on F-Statistics. The null hypothesis  $H_0 : \pi_{CO2} = \pi_{GDP} = \pi_{ENC} =$

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$\pi_{POP} = 0$  is tested against the alternative. The calculated F-statistic is compared to two sets of critical values, the Lower bound, which assumes all variables are  $I(0)$  and the Upper bound, which assumes all variables are  $I(1)$ . Critical values are provided in tables by Pesaran, Shin, and Smith (2001). There are three possible outcomes, first if F is greater than the upper bound, we reject the null hypothesis, which eventually means that there is evidence of cointegration. If F is lower than the lower bound, we fail to reject the null hypothesis. There is no evidence of cointegration. In case F falls between the two bounds the test is inconclusive.

### 4. Empirical Results

Investigating statistical data through Exploratory Data Analysis (EDA) is a critical preliminary step in econometric analysis that involves summarizing, visualizing, and interpreting the main characteristics of a dataset. The primary objective of EDA is to uncover patterns, detect anomalies, test assumptions, and generate hypotheses about the relationships between variables. In Table 2 we present a descriptive statistics summary for all variables employed in this study. There are no missing values in our dataset.

Figure 1 presents the trends in CO2 emissions, energy consumption, GDP, and population in Greece from 1990 to 2022. It visually illustrates the relationships and changes among these variables over time, highlighting significant economic and environmental events and their impact on each parameter. From the graphic illustration we observe that in 2010, a year that coincides with the beginning of the fiscal crisis in the country, there was a significant decline in carbon dioxide emissions and energy consumption. Greece's GDP follows the same path. The economic turmoil led to reduced industrial activities and energy use, contributing to lower carbon emissions. Greece's GDP mirrors the trend of CO2 emissions and energy consumption. Figure 1 demonstrates the interconnected nature of environmental and economic factors in Greece, highlighting how economic crises can lead to significant reductions in pollution and energy usage.

In Figure 2 a correlation analysis presents the correlation coefficients between variables employed. These figures show the relationship among CO2 emissions, energy consumption, GDP, and population. The correlation coefficients provide insight into the strength and direction of these relationships. There is strong positive correlation between GDP and energy consumption, and as expected energy consumption and CO2 emissions, suggesting that higher economic activity is associated with higher carbon emissions. The first step is to test our data for stationarity using the augment Dickey Fuller test (Dickey & Fuller, 1981).

Although ARDL does not require checking the integration order of variables, the unit root test was conducted to ensure no variable exceeded 1 and to verify the methodology's appropriateness. The presence of stationarity of  $I(2)$  would force us to ender the methodology. Pesaran et al. (2001) developed the ARDL method assuming all variables are  $I(0)$ ,  $I(1)$ , or mixed;  $I(2)$  variables would invalidate it. Therefore, these tests were performed, and the results are in Table 3. Results reveal that only population growth (PG) is stationary at level, that is  $I(0)$  and all the other variables, energy consumption (lnEC), economic growth (lnGDP) and CO2 emissions (lnCO2) are stationary at first difference, that is,  $I(1)$ . Therefore, considering the mix order of integration of the variables, the ARDL approach is the most fitted methodology rather than the standard or conventional cointegration approaches.



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Optimal lag selection is a critical step in time series analysis, particularly when building models like ARDL (Autoregressive Distributed Lag) or VAR (Vector Autoregression). The goal is to determine the appropriate number of lags for the dependent and independent variables to ensure the model is well-specified, avoids overfitting, and captures the true dynamics of the data. Including too many lags can lead to overfitting, where the model captures noise instead of the underlying relationship on the other side, including too few lags can lead to underfitting, where the model fails to capture important dynamics in the data.

The optimal lag length for the dependent and independent variables was selected using the Akaike Information Criterion (AIC), which balances model fit and complexity. A maximum lag order of 3 was chosen based on the frequency of the data and prior studies. The AIC was computed for all possible lag combinations, and the model with the lowest AIC value was selected as the optimal specification, as shown in Table 2. The lag selection process identified an optimal lag of 2 for the dependent variable (lnCO<sub>2</sub>). For the independent variables, the optimal lags were 3 for lnGDP, 2 lags for POP and 0 for lnENC.

Having identified the optimum lag length in the previous section, we will estimate now long-run relationship among the variables by applying OLS. The null hypothesis of no cointegration was tested against the alternative. Pesaran et al., (2001) provide two sets of critical values, which form two bounds. The lower bound assumes that all variables are I(0) and the upper bound that all variables are I(1). If the computed F-statistics are greater than the upper bound, we reject the null hypothesis of no cointegration and if it is below the lower bound, we fail to reject the null hypothesis. Between the bounds, the test is inconclusive. The result of this test is presented in Table 5. As the F-statistics (12,9542) lie above the upper bound at 5% and 10%, these indicate that the null hypothesis could not be accepted. As such, a long-term cointegration relationship exists at all levels. Results for the ARDL model and diagnostic checks are represented in Table 6.

ARDL model's diagnostic tests indicate that all assumptions are statistically significant at level 5%. Favorable results indicate a robust and reliable model. This means that the residuals are free from autocorrelation and heteroscedasticity, are normally distributed, and the model passes stability tests. Consequently, the estimated coefficients, representing both short-run and long-run relationships, can be interpreted with a high degree of confidence, suggesting that the model accurately captures the dynamic interactions between the variables under analysis. The validation of these diagnostic tests is crucial for ensuring the validity of any subsequent inferences or policy recommendations derived from the model.

CUSUM and CUSUMSQ charts are presented in Figures 3 & 4. It is important that the blue line does not cross the 5% critical bounds (red and the green line) in any chart. From the charts we can infer that there is not issue of recursive residuals in terms of mean (CUSUM chart) and in terms of variance (CUSUMSQ chart).

After establishing a cointegration relationship among the variables, the long-run model in Equation 2 is estimated to obtain the long-run coefficients as reported in Table 7. The results reveal that economic growth is positive and significant at 5% level in determining CO<sub>2</sub> emissions. A 1% increase in economic growth will cause a 0.65% increase in CO<sub>2</sub> emissions. Population growth and energy consumption have a positive sign and are statistically significant at 5% level.

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Short run results are reported to table 6. Most coefficients are statistically significant at level 5% except dLNGDP and dPG. GDP exhibits a positive sign but is not statistically significant, energy consumption is positive and statistically significant, population growth and its lag are negative. The error correction term (ECT) which measures the deviation from a long-run equilibrium between variables is negative and significant, which is expected to satisfy econometric requirements.

Table 2. Descriptive Statistics Summary

|          | CO2    | GDP    | ENC    | POP   | lnCO2 | lnGDP | lnENC |
|----------|--------|--------|--------|-------|-------|-------|-------|
| count    | 33     | 33     | 33     | 33    | 33    | 33    | 33    |
| mean     | 88,83  | 204,25 | 114,05 | 10,82 | 4,47  | 26,03 | 4,73  |
| std      | 15,69  | 31,05  | 11,66  | 0,26  | 0,19  | 0,15  | 0,10  |
| min      | 56,27  | 158,31 | 94,85  | 10,30 | 4,03  | 25,79 | 4,55  |
| 25%      | 76,14  | 184,91 | 103,84 | 10,63 | 4,33  | 25,94 | 4,64  |
| 50%      | 89,08  | 200,14 | 109,72 | 10,88 | 4,49  | 26,02 | 4,70  |
| 75%      | 103,38 | 218,00 | 122,26 | 11,06 | 4,64  | 26,11 | 4,81  |
| max      | 112,75 | 265,97 | 136,11 | 11,12 | 4,73  | 26,31 | 4,91  |
| median   | 89,08  | 200,14 | 109,72 | 10,88 | 4,49  | 26,02 | 4,70  |
| kurtosis | -0,85  | -0,57  | -1,11  | -1,05 | -0,32 | -0,72 | -1,16 |
| skewness | -0,34  | 0,50   | 0,40   | -0,53 | -0,65 | 0,23  | 0,28  |

Figure 4 - CO2 emissions, Energy Consumption, GDP and Population, Greece (1990-2022)

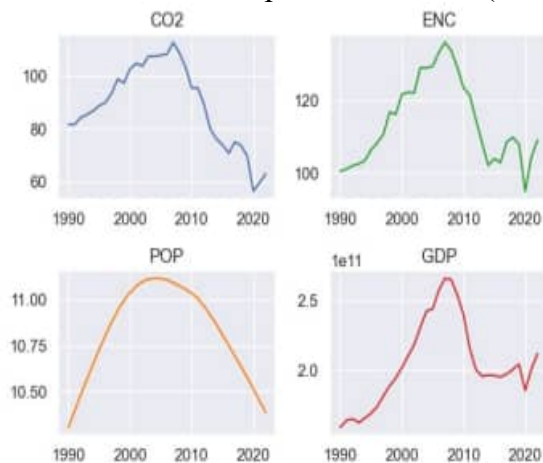
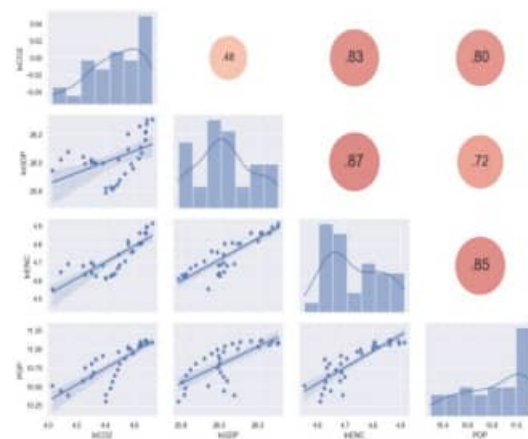


Figure 2 - Correlation analysis



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Figure 3 - Plot of Cumulative Sum of Squares of Recursive Residuals

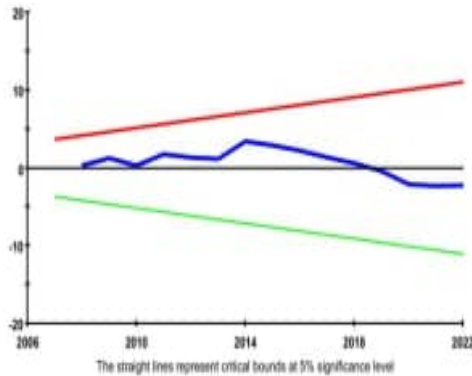


Figure 4 - Plot of Cumulative Sum of Squares of Recursive Residuals

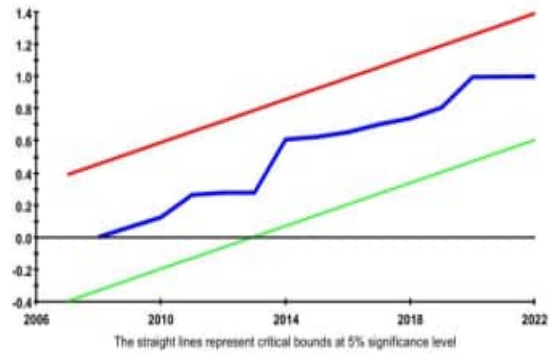


Table 3 - Unit Root Test Using Augmented Dickey Fuller (ADF)

| Var   | Specification                  | Test Statistic | P-value | Stationary at 1% | Stationary at 5% | Stationary at 10% |
|-------|--------------------------------|----------------|---------|------------------|------------------|-------------------|
| POP   | Level - Constant               | -5,5740        | 0,0000  | TRUE             | TRUE             | TRUE              |
|       | Level - Constant & Trend       | -5,6897        | 0,0000  | TRUE             | TRUE             | TRUE              |
|       | First Diff. - Constant         | -4,4961        | 0,0002  | TRUE             | TRUE             | TRUE              |
|       | First Diff. - Constant & Trend | -4,4256        | 0,0020  | TRUE             | TRUE             | TRUE              |
| lnCO2 | Level - Constant               | -2,0572        | 0,2621  | FALSE            | FALSE            | FALSE             |
|       | Level - Constant & Trend       | -2,4139        | 0,3722  | FALSE            | FALSE            | FALSE             |
|       | First Diff. - Constant         | -6,3997        | 0,0000  | TRUE             | TRUE             | TRUE              |
|       | First Diff. - Constant & Trend | -6,2892        | 0,0000  | TRUE             | TRUE             | TRUE              |
| lnGDP | Level - Constant               | -0,6320        | 0,8636  | FALSE            | FALSE            | FALSE             |
|       | Level - Constant & Trend       | 0,0295         | 0,9945  | FALSE            | FALSE            | FALSE             |
|       | First Diff. - Constant         | -5,1253        | 0,0000  | TRUE             | TRUE             | TRUE              |
|       | First Diff. - Constant & Trend | -5,6890        | 0,0000  | TRUE             | TRUE             | TRUE              |
| lnENC | Level - Constant               | -2,0228        | 0,2767  | FALSE            | FALSE            | FALSE             |
|       | Level - Constant & Trend       | -2,5090        | 0,3235  | FALSE            | FALSE            | FALSE             |
|       | First Diff. - Constant         | -5,6013        | 0,0000  | TRUE             | TRUE             | TRUE              |
|       | First Diff. - Constant & Trend | -5,6600        | 0,0000  | TRUE             | TRUE             | TRUE              |

Table 4 - Optimal Lag Length Selection Based on AIC

| AIC      | AIC                                     |
|----------|-----------------------------------------|
| -156,094 | (2, {'lnGDP': 3, 'lnENC': 0, 'POP': 2}) |
| -155,109 | (2, {'lnGDP': 2, 'lnENC': 3, 'POP': 1}) |
| -154,1   | (2, {'lnGDP': 1, 'lnENC': 3, 'POP': 2}) |
| -153,69  | (2, {'lnGDP': 2, 'lnENC': 3, 'POP': 2}) |
| -153,674 | (2, {'lnGDP': 1, 'lnENC': 3, 'POP': 3}) |
| -153,42  | (2, {'lnGDP': 0, 'lnENC': 3, 'POP': 3}) |

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|          |                                         |
|----------|-----------------------------------------|
| -153,113 | (2, {'lnGDP': 3, 'lnENC': 3, 'POP': 1}) |
| -153,033 | (2, {'lnGDP': 0, 'lnENC': 3, 'POP': 1}) |
| -152,734 | (2, {'lnGDP': 0, 'lnENC': 3, 'POP': 2}) |
| -152,721 | (2, {'lnGDP': 3, 'lnENC': 0, 'POP': 1}) |
| -152,103 | (2, {'lnGDP': 2, 'lnENC': 3, 'POP': 3}) |
| -152,079 | (2, {'lnGDP': 2, 'lnENC': 0, 'POP': 2}) |
| -152,03  | (2, {'lnGDP': 3, 'lnENC': 3, 'POP': 2}) |

Table 5 - Bound Test Results

Testing for existence of a level relationship among the variables in the ARDL model  
\*\*\*\*\*

|             |                 |                 |                 |                 |
|-------------|-----------------|-----------------|-----------------|-----------------|
| F-statistic | 95% Lower Bound | 95% Upper Bound | 90% Lower Bound | 90% Upper Bound |
| 12.9542     | 3.8177          | 5.1388          | 3.0558          | 4.2425          |

|             |                 |                 |                 |                 |
|-------------|-----------------|-----------------|-----------------|-----------------|
| W-statistic | 95% Lower Bound | 95% Upper Bound | 90% Lower Bound | 90% Upper Bound |
| 51.8167     | 15.2709         | 20.5552         | 12.2231         | 16.9699         |

\*\*\*\*\*

If the statistic lies between the bounds, the test is inconclusive. If it is above the upper bound, the null hypothesis of no level effect is rejected. If it is below the lower bound, the null hypothesis of no level effect can't be rejected. The critical value bounds are computed by stochastic simulations using 20000 replications.

Table 6 – ARDL estimation

Autoregressive Distributed Lag Estimates  
ARDL(2,3,0,3) selected based on Akaike Information Criterion  
\*\*\*\*\*  
Dependent variable is LNCO2  
25 observations used for estimation from 1994 to 2018  
\*\*\*\*\*

| Regressor | Coefficient | Standard Error | T-Ratio[Prob] |
|-----------|-------------|----------------|---------------|
| LNCO2(-1) | -.31995     | .14406         | -2.2209[.045] |
| LNCO2(-2) | -.44680     | .15557         | -2.8720[.013] |
| LNGDP     | .048835     | .17415         | .28042[.784]  |
| LNGDP(-1) | .74738      | .21023         | 3.5551[.004]  |
| LNGDP(-2) | -.14609     | .18778         | -.77797[.451] |
| LNGDP(-3) | .50494      | .13872         | 3.6400[.003]  |
| LNENC     | .75517      | .16890         | 4.4711[.001]  |
| PG        | -1.5070     | 1.2544         | -1.2014[.251] |
| PG(-1)    | -.68055     | 2.0606         | -.33027[.746] |
| PG(-2)    | -1.5017     | 2.1132         | -.71062[.490] |
| PG(-3)    | 7.4129      | 1.5702         | 4.7209[.000]  |
| C         | -25.7948    | 6.6535         | -3.8769[.002] |

\*\*\*\*\*

|                            |          |                            |                |
|----------------------------|----------|----------------------------|----------------|
| R-Squared                  | .99761   | R-Bar-Squared              | .99560         |
| S.E. of Regression         | .0096234 | F-Stat. F(11,13)           | 494.2483[.000] |
| Mean of Dependent Variable | 4.5337   | S.D. of Dependent Variable | .14501         |
| Residual Sum of Squares    | .0012039 | Equation Log-likelihood    | 88.7896        |
| Akaike Info. Criterion     | 76.7896  | Schwarz Bayesian Criterion | 69.4764        |
| DW-statistic               | 2.1645   |                            |                |

\*\*\*\*\*

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Diagnostic Tests
*****
*      Test Statistics      *      LM Version      *      F Version      *
*****
*
* A:Serial Correlation*CHSQ(1) = .31049[.577]*F(1,12)      = .15091[.704]*
*
* B:Functional Form      *CHSQ(1) = .0079419[.929]*F(1,12)      = .0038133[.952]*
*
* C:Normality            *CHSQ(2) = .71000[.701]*      Not applicable
*
* D:Heteroscedasticity*CHSQ(1) = .24425[.621]*F(1,23)      = .22693[.638]*
*****
A:Lagrange multiplier test of residual serial correlation
B:Ramsey's RESET test using the square of the fitted values
C:Based on a test of skewness and kurtosis of residuals
D:Based on the regression of squared residuals on squared fitted values

```

Table 7 - Estimated Long Run Coefficients

```

Estimated Long Run Coefficients using the ARDL Approach
ARDL(2,3,0,3) selected based on Akaike Information Criterion
*****
Dependent variable is LNCO2
25 observations used for estimation from 1994 to 2018
*****
Regressor      Coefficient      Standard Error      T-Ratio[Prob]
LNGDP          .65378            .097031             6.7379[.000]
LNENC          .42744            .13770             3.1041[.008]
PG             2.1077           .094342            22.3405[.000]
C              -14.6001          1.8855             -7.7433[.000]
*****

Testing for existence of a level relationship among the variables in the ARDL model
*****
F-statistic    95% Lower Bound    95% Upper Bound    90% Lower Bound    90% Upper Bound
12.9542        3.8177              5.1388             3.0558             4.2425

W-statistic    95% Lower Bound    95% Upper Bound    90% Lower Bound    90% Upper Bound
51.8167        15.2709            20.5552            12.2231            16.9699
*****
If the statistic lies between the bounds, the test is inconclusive. If it is
above the upper bound, the null hypothesis of no level effect is rejected. If
it is below the lower bound, the null hypothesis of no level effect can't be
rejected. The critical value bounds are computed by stochastic simulations
using 20000 replications.

```



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Table 8 - Estimated Short Run Coefficients

| Error Correction Representation for the Selected ARDL Model          |             |                            |               |
|----------------------------------------------------------------------|-------------|----------------------------|---------------|
| ARDL(2,3,0,3) selected based on Akaike Information Criterion         |             |                            |               |
| *****                                                                |             |                            |               |
| Dependent variable is dLNCO2                                         |             |                            |               |
| 25 observations used for estimation from 1994 to 2018                |             |                            |               |
| *****                                                                |             |                            |               |
| Regressor                                                            | Coefficient | Standard Error             | T-Ratio[Prob] |
| dLNCO21                                                              | .44680      | .15557                     | 2.8720[.012]  |
| dLNGDP                                                               | .048835     | .17415                     | .28042[.783]  |
| dLNGDP1                                                              | -.35886     | .17232                     | -2.0825[.055] |
| dLNGDP2                                                              | -.50494     | .13872                     | -3.6400[.002] |
| dLNENC                                                               | .75517      | .16890                     | 4.4711[.000]  |
| dPG                                                                  | -1.5070     | 1.2544                     | -1.2014[.248] |
| dPG1                                                                 | -5.9113     | 1.8514                     | -3.1928[.006] |
| dPG2                                                                 | -7.4129     | 1.5702                     | -4.7209[.000] |
| ecm(-1)                                                              | -1.7668     | .25149                     | -7.0252[.000] |
| *****                                                                |             |                            |               |
| List of additional temporary variables created:                      |             |                            |               |
| dLNCO2 = LNCO2-LNCO2(-1)                                             |             |                            |               |
| dLNCO21 = LNCO2(-1)-LNCO2(-2)                                        |             |                            |               |
| dLNGDP = LNGDP-LNGDP(-1)                                             |             |                            |               |
| dLNGDP1 = LNGDP(-1)-LNGDP(-2)                                        |             |                            |               |
| dLNGDP2 = LNGDP(-2)-LNGDP(-3)                                        |             |                            |               |
| dLNENC = LNENC-LNENC(-1)                                             |             |                            |               |
| dPG = PG-PG(-1)                                                      |             |                            |               |
| dPG1 = PG(-1)-PG(-2)                                                 |             |                            |               |
| dPG2 = PG(-2)-PG(-3)                                                 |             |                            |               |
| ecm = LNCO2 -.65378*LNGDP -.42744*LNENC -2.1077*PG + 14.6001*C       |             |                            |               |
| *****                                                                |             |                            |               |
| R-Squared                                                            | .97445      | R-Bar-Squared              | .95283        |
| S.E. of Regression                                                   | .0096234    | F-Stat. F(9,15)            | 55.0919[.000] |
| Mean of Dependent Variable                                           | -.0059236   | S.D. of Dependent Variable | .044310       |
| Residual Sum of Squares                                              | .0012039    | Equation Log-likelihood    | 88.7896       |
| Akaike Info. Criterion                                               | 76.7896     | Schwarz Bayesian Criterion | 69.4764       |
| DW-statistic                                                         | 2.1645      |                            |               |
| *****                                                                |             |                            |               |
| R-Squared and R-Bar-Squared measures refer to the dependent variable |             |                            |               |
| dLNCO2 and in cases where the error correction model is highly       |             |                            |               |
| restricted, these measures could become negative.                    |             |                            |               |

## 5. Conclusions

This study investigates the impact of economic growth, energy resource consumption, and population on environmental quality in Greece using appropriate econometric methods. Specifically, an ARDL model is employed to analyze the long- and short-term effects of these variables on environmental quality, as indicated by carbon dioxide emissions. Carbon dioxide (CO<sub>2</sub>) is the most significant anthropogenic greenhouse gas. The results demonstrate that all variables under consideration economic growth, energy consumption and population growth have a positive and substantial effect on environmental degradation in the long run. In the short run only energy consumption seems to explain CO<sub>2</sub> emissions. These findings highlight the imperative need for sustainable development policies that foster economic growth while mitigating environmental damage. Such policies should aim to reduce CO<sub>2</sub> emissions and prioritize enhancing energy efficiency.

## Acknowledgements

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# QUANTILE CONNECTEDNESS IN RENEWABLE ENERGY COMPANIES AND RELATED COMMODITIES DURING COVID-19 OUTBREAK

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## Abstract

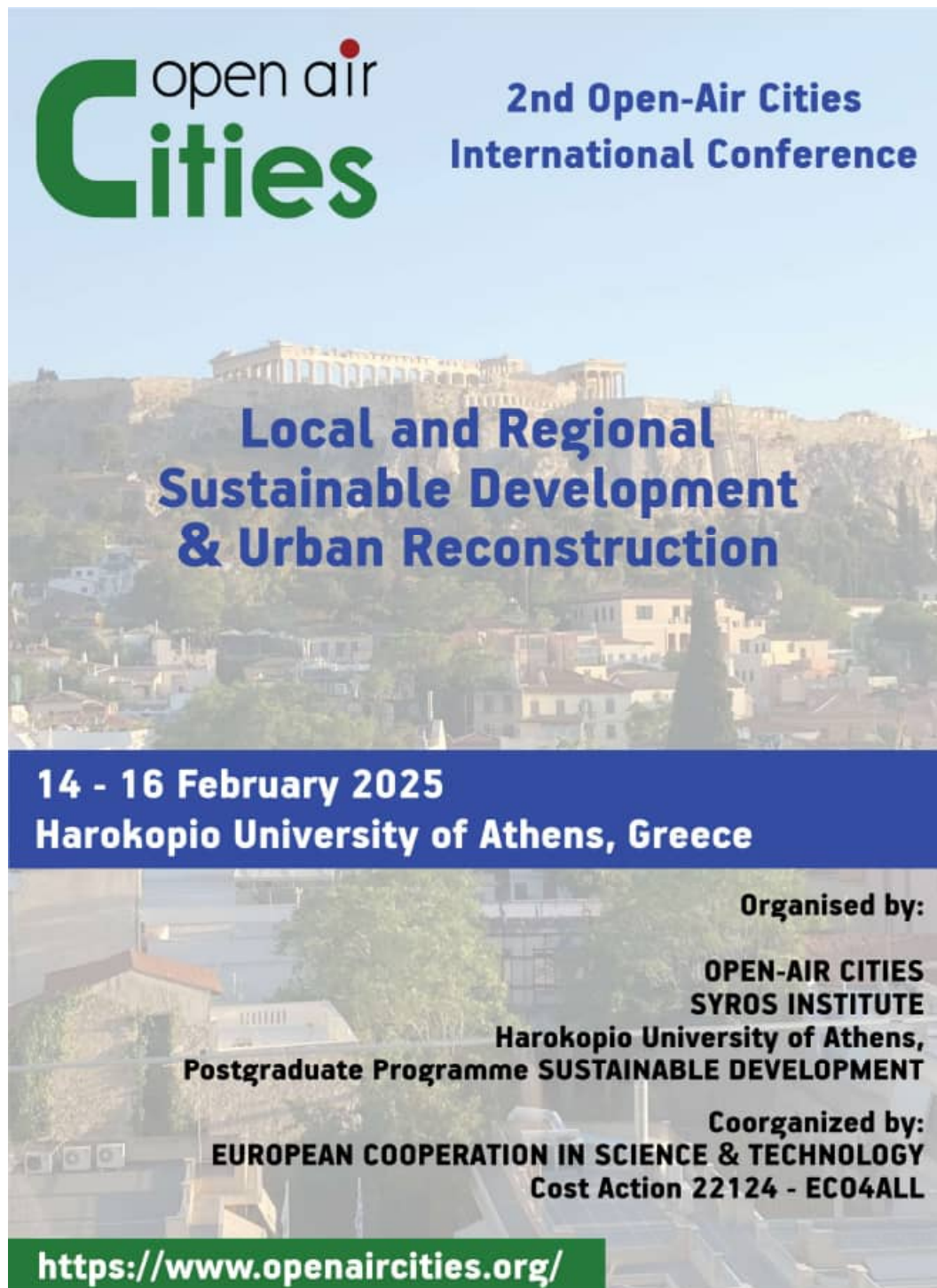
IMF indicated soaring metal prices, as cleantech firms are witnessing a meteoric rise in demand, and even dirty energy firms are changing their stance towards clean energy. Shock transmission (both positive and negative) is plausible as the world is chasing a net-zero emissions scenario. Therefore, we have investigated the top nine renewable energy companies globally with related metals (Nickel, Copper, Cobalt) from 3rd January 2017 to 3rd January 2022. This period also involves pre-Covid, Covid 1st Wave, Delta and Omicron. Our approach was QVAR, as suggested recently by Gabauer (2021), which is a logical extension of the initial connectedness approach proposed by Diebold and Yilmaz (2014). We found several outcomes. Shock transmission is happening from both cleantech and dirty energy firms to metals. Connectedness (shock transmission) is increasing in tails. Moreover, connectedness in the lower upper quantiles is asymmetric, with clean energy companies tending to transmit positive shocks to metals. Therefore, mean-based connectedness could be ruled out. Metals such as Nickel, Cobalt, and Copper emerged as the net receivers of shocks. The firms with higher market capitalization producing clean energy emerged as significant net transmitters of shocks (Enphase, Orsted and VWS). The total Connectedness Indices (TCIs) are heterogeneous over time. TCI sharply increased immediately after Covid-19 fallout and remained at a relatively higher zone than pre-Covid levels. Wind energy firms (SSE and Orsted) emerged as the net transmitter among all pairwise directional connectedness; furthestmost wind energy firms (SSE, ED and EDP) emerged as the moderate net receiver of shocks. This research provides many inputs towards the wind energy sector for researchers, practitioners and policymakers.

**Keywords:** Renewable energy, Commodities, Covid -10, Quantile connectedness

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# URBAN ENERGY TRANSITION AND BUILDING INTEGRATED PHOTOVOLTAICS

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## Abstract

Urban energy transition is a critical response to the urgent challenges of climate change and urbanization. Building-Integrated Photovoltaics (BIPV) emerge as a transformative solution, integrating solar energy generation into the buildings and urban infrastructure of cities. BIPV systems not only provide renewable energy but also enhance the functional aspects of buildings, making them a key component in sustainable urban development.

BIPV technology enables the integration of photovoltaic materials into building elements, such as roofs, façades, windows, and shading devices. This integration allows buildings to generate their own electricity while serving essential structural functions, such as weather protection and thermal insulation. By utilizing available surfaces without requiring additional land, BIPV maximizes space efficiency, which is particularly crucial in densely populated urban environments. The dual functionality of BIPV systems contributes to reducing overall energy consumption and greenhouse gas emissions, aligning with global sustainability goals. The potential of BIPV is significant; in Europe, 36% of energy-related greenhouse gas (GHG) emissions and around 40% of energy use are attributable to buildings. In response to climate change there is an urgent need to curb emissions and mitigate their environmental impact. By harnessing solar energy on-site, BIPV can significantly mitigate this impact. Moreover, BIPV can enhance energy independence for urban dwellings by reducing reliance on traditional power grids and enhancing clean air and urban resilience.

Technological advancements in BIPV have led to improved efficiency and design flexibility. The development of new materials and designs has made BIPV systems lighter and more adaptable to various architectural styles, facilitating broader adoption across diverse urban contexts. Regulatory frameworks are less advancing, and further evolution is needed to support the integration of BIPV in urban planning, supported by policies promoting energy efficiency and renewable energy adoption. With the increasingly recognition of the role of BIPV as a viable solution for achieving net-zero buildings and positive energy districts, initiatives such as the European Union’s Renewable Energy Directive encourage Member States to facilitate local renewable energy projects, including BIPV installations. As cities strive to reduce their carbon footprints and enhance resilience against climate change, the

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widespread adoption of BIPV will be essential. In this context, BIPV's efficiency and longevity are two critical parameters in the wider BIPV deployment and will be discussed synergistically to greenery and towards urban decarbonization.

**Key words:** Building Integrated Photovoltaics (BIPV), BIPV Longevity, Urban environments, Energy transition

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**COGNITIVE BACKGROUND OF THE RELATIONSHIP BETWEEN  
AUTONOMOUS VEHICLES AND SUSTAINABLE MOBILITY: A CASE  
STUDY OF GREEK DRIVERS**

DOI: 10.26341/issn.2241-4010-2025-9a-5-K02059

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***Abstract***

*The research that is presented concerns the investigation of the background of the cognitive familiarity, regarding the matter of the relationship between autonomous vehicles and Sustainable Mobility. Both the existing background knowledge and the gaps of knowledge are approached in detail, concerning the sustainable side of the future use of autonomous driving of vehicles.*

*More specifically, research which targets the group of Greek drivers is used as a case study. Within the initial theoretical part of this research, the necessary review of related studies and methods as well, is conducted, so as to link this research topic with the much wider, existing body of research of the international scientific community. Moreover, on its main theoretical part, the conceptual definition of autonomous vehicles and sustainable mobility, as well as other relative terms that lay the initial foundations for understanding, are mentioned for deeper understanding.*

*Furthermore, the past and current development of some relevant proposals and applications is presented with the purpose of making the suggestions for their future use more understandable. The following case study is specialized in the statistical population of car drivers in the country of Greece, who are approached by a representative sample of some statistical units in the context of primary data collection.*

*Subsequently, based on their answers and thoughts about the topic in question, the cognitive background regarding the contribution of autonomous vehicles to sustainable mobility is delineated. Finally, specific helpful conclusions are drawn regarding the potential inclusion of autonomous vehicles, related to sustainability, in real road networks, as well as suggestions that have to do with future research work on the topic.*

***Key words:*** *autonomous vehicles, sustainable mobility, sustainable development.*

**Introduction**

Nowadays, there has been an increasing number of research and applications that has to do with the utilization of advanced digital technologies towards the technical enhancement of diverse types of vehicles, based on the principles, ideas, and practices of Sustainable Development. Relative practices are aligned with the universal shift on behalf of governments, the car industry and other stakeholders towards the protection of humanity's resources for the

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future and indeed on a global level. This is an essential core element that is highlighted on the Sustainable Development agenda, which was redefined with the publication of the "Our Common Future" in the year 1987, a significant publication with regards to environmental thinking in general. Funded by the United Nations, the World Commission on Environment and Development, led by Brundtland H. G., called for the reorganization of institutional stakeholders at a global, national, and local level to promote a type of economic development that would guarantee the safety, well-being, and strong survival of the planet (WCED, 1987, as cited in Sneddon, 2006). At that point, it was emphasized that the strategies of economic development derived from countries and regions should align with a well-organized systematic approach based on specific principles. These principles should ensure the preservation of both good survival conditions on the planet as well as a better quality of life. It is also worth noting that the publication in question was not based on a local or a national institutional level, but on the foundations of an international discussion among governance representatives. Its global character highlights the significance of the strong need for a wide constructive collaboration among different stakeholders and their efforts from different areas, fields and perspectives. From the above, we can clearly understand the mixed nature of Sustainable Development as a matter that should be approached in a multi-disciplinary manner and not just from its environmental side, as in the "green" strategies of sustainability. Its various perspectives involve different aspects and strategies that are synergistically related to the defense of our resources, but it should be noted that its spectrum is not limited to the natural resources. Specifically, as one of the most accepted definitions of Sustainable Development presents: it is a "... development that meets the needs of the present without compromising the ability of future generations to meet their own needs" (WCED, 1987, as cited in Halkos & Gkampoura, 2021, p.94).

In the more targeted area of the car development sector, both research and practical approaches are being promoted, integrating concepts and incorporating methods with the overall aim of making mobility more sustainable than it used to be in previous years. Most of these strategies focus on decreasing the negative environmental impact of vehicles, like CO<sub>2</sub> emissions in a much "greener" modification of the conventional manufacturing approaches. A representative example of this approach with which people have recently become more acquainted is the massive breakthrough of electric vehicles, which is becoming more and more an object of discussion. Using electric vehicles instead of the conventional ones can potentially lead to a more sustainable mobility model with an abundance of benefits related to different goals of the Sustainable Development agenda, rather than only "greening" the mobility network. Apart from electric vehicles, mobility-oriented sustainable approaches can also be supported by smart technologies and, in particular, in the urban transport systems, and therefore contributing to Sustainable Mobility and specifically to that of Smart Mobility, which is an essential element in Smart Cities. According to a well-known definition: "A smart city brings together technology, government, and society to enable the following characteristics: a smart economy, smart mobility, a smart environment, smart people, smart living, and smart governance" (IEEE Smart Cities Technical Community, n.d., as cited in Faria, 2017, p. 2). This definition includes the factor of Smart Mobility which describes: "... the use of Information and Communication Technologies in modern transport technologies to improve urban traffic" (Albino et al., 2015, p.11) or alternatively refers to a: "... local and

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supra-local accessibility, availability of Information and Communication Technologies, modern, sustainable, and safe transport systems” (Vanolo, 2013, p.887). In this conceptual framework, autonomous vehicles are included, which appear to be the most groundbreaking part of research and approaches in the scientific area of Smart Mobility, which should not be regarded as an independent technological achievement or even as a high-level product of the car industry, but as a means for achieving certain goals of Sustainable Development agenda at a universal level.

In this context, an innovative driving model has been created, which is autonomous driving, where, at a partial or total level, human-user control becomes to some extent unnecessary. This new way, beyond road comfort, can also lead to benefits related to the principles of sustainability. Therefore, the present research thematically concerns the conceptual connection of autonomous mobility and sustainability. More specifically, it concerns the understanding of the positive relationship between these two factors by citizens since they are the potential future users and thus it must be as clarified as possible for them. Subsequently, a primary level study is being conducted to determine actual perceptions about the relationship between autonomous vehicles and Sustainable Development. These perceptions are extremely important since they will shape the background towards the arrival of such vehicles in future adaptations. More specifically, this work is based on securing a body of arguments on specific issues. For this purpose, focused primary research has been carried out on a sample of drivers, in the country of Greece, regarding the above fertile correlation. Based on this research, supplemental suggestions were drawn concerning future work regarding the matter that will be outlined.

### **Theoretical background**

To provide the initial theoretical foundations for the targeted field in question, in this section an introductory presentation will be provided, about several research examples and findings that are thematically associated with the aim of the present research material. These are studies that primarily focus on the beneficial dimension of the integrations of autonomous vehicles in road environments, particularly from the side of Sustainable Mobility. In the previous decade Malik (2017) highlighted the correlation between autonomous driving and sustainability, with classifications that aimed to illustrate the contribution of the autonomous vehicles to the latter. These categories were about: 1) Social level, like through their potential use by social groups, such as the elderly, the disabled and individuals with disorders. 2) Environmental level, emphasized by the increased capacity, reduced traffic congestion, reduction in greenhouse gas emissions etc. Furthermore, the use of their platooning is noted, where in such a scenario air resistance primarily affects the lead-driven vehicle, which appears as a shield for the others of the group. Moreover, elimination of unnecessary accelerations but also decelerations, and the matter of aggressive driving that consumes more fuel, is also mentioned. 3) Economic level describes matters as savings through engagement with other activities, as for instance, work during transport time. Additionally, a broader reduction in costs linked to transportation is also identified, due to the naturally reduced travel time.

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Another study of the following year from Bahamonde-Birke (2018) categorized their effects into direct and indirect impacts. The first group included outcomes such as the reduction of costs that are -generally- economically related to transportation, like fuel usage efficiency. Also, the reduction in expenses related to parking services due to the autonomous function of parking of the specific vehicles, is mentioned. Additionally, this study appears to trigger a discussion about a new model of public transportation that is mainly based on the use of smaller vehicles that operate in a denser network. This unfamiliar approach could enhance the appeal to public transport in citizens' preferences as more attractive. Rather than their beneficial effect associated with transportation, positive environmental aspects are noted as well. For instance, matters such as the reduction in a negative environmental footprint, the decrease in the level of exhaust emissions both on a local and global level, and improved safety in road environments. In particular, road safety can positively be assisted by minimizing risks related to human factor behaviors like interactions between drivers (e.g. hostile gestures that can escalate tension and lead to dangerous situations). Lastly, the fact that they can be potentially used by unlicensed drivers or individuals unable to drive (e.g. children, the elderly) is also highlighted in the study.

In addition, in a relative study Williams et al. (2020) presented issues such as the improved efficiency of autonomous vehicles due to reduced congestion, vehicle platooning, smoother driving, and consequently decreased fuel consumption. Moreover, about their economic dimension, their research pointed out some potentially derived changes like their use in the tourist industry for recreational travel, a more convenient delivery of goods and meals, and cheaper freight transportation which leads to lowering prices of goods, among others. The social dimension is seen as a perspective of increased safety due to the disassociation of driving from drawbacks related to human error, such as distraction, and non-immediate reaction. They can also provide new opportunities for people from low-income backgrounds, for example through ride-sharing systems that can serve as an innovative form of public transport.

Beyond the previous overview, an initial clarification in accordance with the different types of autonomous vehicles, will be provided below, based on their distinct levels. According to SAE International, the driving automation levels are defined as follows: Level 0: No Automation, Level 1: Driver Assistance, Level 2: Partial Automation, Level 3: Conditional Automation, Level 4: High Automation, Level 5: Full Automation. More analytically, Level 0: refers to a state without any automation, where the driver is fully responsible for driving. Level 1: refers to vehicles that integrate basic autonomous functions. These can assist the driver with specific controls, but drivers still have a significant operating role. Level 2: introduces a wider range of autonomous functions and therefore leads to automation in a partial manner. In this level, the vehicle can operate steering, acceleration, and braking, but it needs the driver's supervision for intervention when necessary. Level 3: signifies the start of conditional automation, where the autonomous vehicle can deal on its own functions of driving while monitoring the external environment. Level 4: represents a high-level of autonomous driving and its vehicles can operate independently on some occasions or within specific spaces, without the driver's intervention. Level 5: the ultimate type, where vehicles can deal with all aspects of driving without any involvement on behalf of human factor (SAE, 2016, as cited in Malozzi et al., 2019).

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In this direction, the company of Roborace designed autonomous vehicles (Robocars) of the fifth level which were battery-electric vehicles powered by 62kWh lithium-polymer batteries and had specialized sensors to perceive conditions of external environmental factors and other systems of localization and for spatial awareness. They also had peripheral cameras, lidar systems, radars both at the front and rear, seventeen ultrasonic sensors, among other essential technical equipment as well as hardware (Betz et al., 2018). The use of such a vehicle in the context of a Roborace, appears as a representative example of a vehicle's ability to operate under the fifth level's autonomous driving with specific spatial limitations under technically defined circumstances (car race). These limitations primarily concern: 1) The vehicle remaining within a defined spatial entity for their entire performance. 2) The complete disassociation from conventional vehicles, with intelligent interaction occurring only with vehicles of the same type.

A notable related example is the one of the Mercedes-Benz research program for the autonomous F015, emphasizing on the significance of exchanging information with other vehicles, the external environment, as well as passengers. This model is equipped with laser and light projections for visual interactions with pedestrians and other vehicles. Some of its various features are adaptive cruise control and lane keeping. Some of its drawbacks are about braking and self-steering functions which are not yet at an efficient level (Yaqoob, 2019). Several depictions of the F015 show an impressive function of rotating seats so the driver can actively socialize with all the passengers during the entire route. Another case with significance for the Greek road environment was showcased in the city of Trikala, which participated in a program named CityMobil2 that introduced buses without the need for drivers and were integrated into an existing network of transportation. Their route stretched 2.4-kilometers in length, with the aim of presenting the city's landmarks for touristic purposes (Kalliaras, 2018, as cited in Papadima et al., 2020). Specifically, six autonomous buses were launched in October of 2015, with a capacity for eleven passengers (six seated, four standing, and one spot for a wheelchair user). Until 2016, the buses completed 1,490 trips in a total distance of 4,030 kilometers, and in total they transported 12,138 passengers (Portouli et al., 2017). The afore-mentioned program offers important input as an initial foundation for familiarization with autonomous vehicle performance, within a place of technical supervision and support from the relevant local authorities regarding safety issues. Secondly, to understand the positive impact of such a smart application to promote both cultural heritage and urban scenery.

Projects like the previously mentioned can provide a preparatory background for understanding towards their mass utilization on real road networks. Such an alteration can lead to the redefining of lifestyle and city planning across different sectors. Duarte and Ratti (2018) placed these changes in five fundamental areas: 1) Morphology, as today's vehicles have a specific morphology that derives from their functions and as it will change in the case of autonomous models, the morphology of road scenery will alter as well. 2) Number of vehicles on the roads, because autonomous mobility promotes car-sharing ideas for the simultaneous transportation of multiple passengers. 3) Parking spaces that could be reduced due to the reduction in the number of vehicles that will free up space occupied by conventional cars as parking spots. 4) Relieving travel-related burdens, as they will encourage people to consider living in other areas apart from cities, which will lead to less congestion. 5)



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Potential lightening of road infrastructures, due to the data exchange between these vehicles and infrastructures, so fewer road systems may be needed to accommodate the same number of people.

In another recent study of Seuwou et al. (2019) other points according to sustainability are summarized into six classes: 1) reduction in pollution, 2) reduction in traffic congestion, 3) increase in citizen's safety, 4) reduction in noise pollution, 5) improvement in travel speed, 6) reduction in transportation costs. The last point is also correlated with car-sharing mode associated with a popular factor found in literature that is MaaS (Mobility as a Service) which essentially, has to do with a model of mobility services delivered from a provider. Such a model could free drivers from owning a vehicle and the costs that are associated with it (Coppola & Silvestri, 2019). Apart from the simpler MaaS an increasing interest is presented related to the more complex MaaS Ecosystem, that includes transportation experts, researchers, and MaaS providers and it can also be related to infrastructure, transportation services and information and payment services (Hietanen, 2014, as cited in Reyes García et al., 2019). In the case of a synergistic scenario that will involve both the concept of MaaS and autonomous vehicles, a system of ASaaS (Autonomous Shuttle as a Service) can be also formed for further extensions, with possibilities like: 1) customization to the needs of users, 2) serving areas with a lack of infrastructure, 3) reduction in noise pollution, 4) enhancement of the existing network of public and private urban mobility services (Bucchiarone et al., 2020).

Regarding the above theoretical overview, it becomes clear that the use of autonomous vehicles can modify or replace the current mobility model to a more sustainable one, indeed towards different axes of sustainability principles. It should also be noted that the introductory understanding provided of such arousing possibilities can only be roughly outlined as autonomous mobility concerns state-of-the-art research of the car industry, with a small body of representative examples and therefore it cannot be strictly specified. Yet, people already form strong opinions upon the existing scenarios and in most of the cases these are mainly associated with the aspects of the user's experience (e.g. road comfort) rather than the ones linked to sustainability, which should be kept in mind for the defense of their future integration in the road environments.

## Methodology

The methodological tool selected is of primary level research (data collection) which was carried out on a statistical sample of Greek Drivers (163 people), via an online electronic survey with a questionnaire (form in Google Forms and distributed in June of 2024) upon specific points that need to be checked. These points are based on the research axes, which concern both the corresponding positive outcomes and the concerns that contribute to a partially flawed knowledge regarding the role of autonomous vehicles in sustainable mobility.

## Results

The specific section presents the results of the survey and more specifically statistics that illustrate the findings. Apart from the table presented below regarding the first twelve



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questions, further down four subsequent questions that needed a short-written answer in a more free-thinking manner will be given.

**Table 1: Primary level research results linked to the given questionnaire**

| Questions                                                                                                                                                                                | Answers                                                                     |                                           |                                                              |                          |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------|-------------------------------------------|--------------------------------------------------------------|--------------------------|
| 1. Are you familiar with the term Sustainable Development?                                                                                                                               | No                                                                          |                                           | Yes                                                          |                          |
|                                                                                                                                                                                          | 44,8%                                                                       |                                           | 55,2%                                                        |                          |
| 2. Given that Sustainable Development focuses on preserving resources for future generations, with which field do you consider it is inseparably linked?                                 | Society                                                                     | Economy                                   | Environment                                                  | All the mentioned points |
|                                                                                                                                                                                          | 9,8%                                                                        | 12,9%                                     | 31,9%                                                        | 45,4%                    |
| 3. Sustainable Development constitutes a national "bet" for each state independently of the others and therefore strategic transnational synergies are not required for its achievement. | False                                                                       |                                           | Correct                                                      |                          |
|                                                                                                                                                                                          | 49,7%                                                                       |                                           | 50,3%                                                        |                          |
| 4. The achievement of the Sustainable Development Goals is exclusively related to smart systems, technologies (e.g. software, artificial intelligence functions)                         | False                                                                       |                                           | Correct                                                      |                          |
|                                                                                                                                                                                          | 44,2%                                                                       |                                           | 55,8%                                                        |                          |
| 5. What factors do you believe Sustainable Development is inseparably linked to?                                                                                                         | Road user safety                                                            | Reducing negative environmental footprint | Promotion of active mobility (e.g. walking, cycling)         | All the mentioned points |
|                                                                                                                                                                                          | 6,7%                                                                        | 28,8%                                     | 16,6%                                                        | 47,9%                    |
| 6. The achievement of Sustainable Mobility is inseparably related to smart systems, technologies (e.g. software, artificial intelligence functions).                                     | False                                                                       |                                           | Correct                                                      |                          |
|                                                                                                                                                                                          | 58,3%                                                                       |                                           | 41,7%                                                        |                          |
| 7. Which aspect do you think Sustainable Mobility is most ideal to be based on?                                                                                                          | Increasing the network of sustainable private vehicles (e.g. electric cars) |                                           | Increasing the network of sustainable public urban transport |                          |
|                                                                                                                                                                                          | 44,8%                                                                       |                                           | 55,2%                                                        |                          |
| 8. Projects that promote Sustainable Urban Mobility are not implemented within the framework of local government but only on larger administrative urban scales.                         | False                                                                       |                                           | Correct                                                      |                          |
|                                                                                                                                                                                          | 40,5%                                                                       |                                           | 59,5%                                                        |                          |

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|                                                                                                                                                                                                                   |       |       |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|-------|
| 9. Are you aware of the existence of research and implementations on vehicles capable of navigating without significant or complete human intervention?                                                           | No    | Yes   |
|                                                                                                                                                                                                                   | 32,5% | 67,5% |
| 10. Have you ever driven a vehicle that operates without any human intervention (e.g. steering wheel operation)?                                                                                                  | No    | Yes   |
|                                                                                                                                                                                                                   | 65%   | 35%   |
| 11. Are you positive about the total or partial replacement of specific functions of conventional vehicles, which you use as a driver, by autonomous functions (e.g. autopilot mode on straight routes for rest)? | No    | Yes   |
|                                                                                                                                                                                                                   | 34,4% | 65,6% |
| 12. Are you positive about the total or partial replacement of conventional vehicles by autonomous vehicles (e.g. in specific spatial units, such as cultural routes and for designated uses, tracks)?            | No    | Yes   |
|                                                                                                                                                                                                                   | 25,8% | 74,2% |

From the 13<sup>th</sup> question: “Provide an example of identifying the contribution of autonomous vehicles to Sustainability from an environmental perspective (2 to 3 lines).” and onward, a significant degree of freedom was given as short written responses were requested. The overall responses of the 13<sup>th</sup> question were grouped into the following categories:

- 1) Group A: Reduction of environmental pollution.
- 2) Group B: Conversion of occupied stopping and parking spaces into green areas.

Below there are some characteristic responses from each group, which stood out:

- 1) “Low pollutant emissions into the environment,” “Precision on handling to reduce emissions,” “Fewer emissions from the vehicle manufacturing stage, as fewer vehicles will be produced.”
- 2) “Promotes prosperity without the simultaneous abuse of land and the squandering of resources,” “Reduction of road network sections for cars and their conversion into areas for planting trees and plants.”

Regarding the first category, an important finding emerges about the understanding of the variety of polluting functions associated with the traditional vehicles with which these drivers are more familiar. In particular, the first answer is quite common, referring to the direct environmental impact of the car itself, but in addition, the polluting stage prior to its operation -manufacturing- is correctly mentioned, as it has a significant impact on the increase in carbon footprint among other negative aspects. Secondly, there are some references made to address the squandering of valuable spatial units that could be reclaimed by citizens as green spaces.

In the 14<sup>th</sup> question: “Provide an example of identifying the contribution of autonomous vehicles to Sustainability in terms of the economy (2 to 3 lines)”, responses were likewise categorized into the following groups:

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- 1) Group A: Saving money through reduced fuel consumption etc.
- 2) Group B: Saving money due to a decreased need for private vehicle ownership per individual or family.
- 3) Group C: Creation of new opportunities and job positions.
- 4) Group D: Reduction or complete avoidance of taxes related to private vehicles.

The new representative responses from each group were as follows:

- 1) “Reduction of fuel expenses,” “Less fuel due to improved driving behavior,” “Lower servicing needs due to fewer accidents.”
- 2) “No need for each family to purchase a car (often more than one vehicle per family),” “Reduction in private cars.”
- 3) “Creation of new jobs,” “New synergies with more technologically skilled staff; knowledgeable in modern technologies.”
- 4) “If we use autonomous public transport, we won’t be burdened with related taxes,” “An end to costly taxes on private vehicles.”

This set of responses is especially interesting from the perspective outlined in the first category, as Greek drivers appeared to be positive towards saving on fuel, an issue that has consistently burdened households, particularly in the modern era where costs are becoming higher and there is an increasing interest in exploring alternative, more economical energy sources. At the same time, extra money savings are approached from the side of the reduced necessity in buying a private vehicle. This is a benefit of high importance in the country of Greece, where it is very common for a family to own more than one car, which in many cases is extremely expensive both in terms of purchasing it but also its maintenance, service etc. In the third category of responses, there appears to be a significant interest, as it is shown that Greek drivers do not oppose autonomous vehicles with the typical hostile argument according to which there would be less job positions. On the contrary, they are of the opinion that new jobs will be created, which in many cases might be ideal for technologically skilled individuals. Finally, taxes are also considered, which is logical as the tax system heavily burdens citizens who should be relieved.

In the 15<sup>th</sup> question: “Provide an example of identifying the contribution of autonomous vehicles to Sustainability from a societal perspective (2 to 3 lines)”, the most relevant responses were grouped as follows:

- 1) Group A: Equal opportunities for access to transport for all.
- 2) Group B: Protection of public health and well-being through safer road networks.
- 3) Group C: Releasing occupied urban spaces for other uses.
- 4) Group D: Ease, comfort, and social interaction.

The most characteristic responses about the above question from each group included:

- 1) “Easy access for everyone,” “Easier vehicle uses for every person.”
- 2) “Fewer accidents,” “Compliance with traffic laws.”
- 3) “Bike lanes / walking paths,” “Liberation of spaces and their conversion into cultural and recreational areas, etc.”
- 4) “Social well-being,” “Ease of driving,” “Reduction in traffic congestion and time that individuals spend on the road.”

In this group of responses, it appears that individuals have efficiently understood the distinction of the positive social impact of autonomous vehicles compared to other categories

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of advantages. As it is also derived from many literature sources, many responses refer to the immediate benefit of reducing traffic accidents and the ease of use. Furthermore, a significant number raised the question of the inclusion of individuals who, in this innovative scenario, would be able to enjoy equal transport opportunities. The spatial impact on the urban environment is also emphasized, particularly the freeing up of spaces that can be reclaimed and repurposed for public use. The specific beneficial aspect strongly underlines the significant social dimension of such a shift in mobility models.

The responses of the final 16<sup>th</sup> question: “Give an example of identifying the contribution of autonomous vehicles to environmental, economic and social sustainability (2 to 3 lines)”, due to its complexity as it requires thinking about a combination of the three axes of Sustainable Development, could not be grouped. Therefore, just two responses are presented which are worth noting since they address all of the main concepts successfully:

“Easier parking, therefore less fuel consumption, pollution, and better mental health.”

“Fleets of such vehicles on small Greek islands for tourist routes, as tourists often get into accidents due to intoxication.”

The above responses show a fairly good understanding on behalf of Greek drivers regarding the potential different side of benefits that can simultaneously contribute to the essential factors of sustainability, that also lay the foundations for an interesting discussion on future mixed sustainable applications of the specific type.

## Conclusions

This research regarding an examination towards the cognitive relationship between autonomous mobility and sustainability, provided representative findings from a sample of Greek drivers. The Greek respondents can be characterized as efficiently being familiar with the given concept and that appears as a positive sign for their transition to the new models of sustainable autonomous mobility. Regarding their current knowledge about the wider nature of sustainability sectors, they recognized it correctly as a matter with several dimensions and not strictly based on the more familiar environmental dimension. Yet, it is not a positive reflection of their understanding that a significant number of participants did not agree on Sustainable Development as a global “bet” that needs international attention and collaboration as well. Moreover, most of the respondents consider Sustainable Development Goals potentially achievable through smart technology rather than without it, which may serve as one of its key elements, but it is not inseparably connected with it. Similarly, it appears that a significant percentage of Greek drivers also consider Sustainable Mobility as a matter that is exclusively associated to smart technology, which is a common misconception most likely associated to the general approach of cars as technological products and not as tools to shape wider sustainable strategies. Via the questions of the most practical section of the questionnaire, it was noted that the majority of the respondents are aware of the partial or total replacement of vehicle functions with autonomous ones, but without hands-on experience. However, it was shown that they are generally not opposed to the idea of partial or full autonomous mobility, which can possibly lead to fertile grounds for future implementations such as the ones that had been mentioned. Finally, as concerns their specific examples about their contribution to sustainability, they emphasized on the reduction of pollution, advantages

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related to land use, money saving, new jobs, inclusivity and accessibility, road safety, increased social interaction due to the diminished or eliminated role of driving among others. As regards their suggestion about a triple contribution, unfortunately groups of similar answers could not be formed to provide secure conclusions on the matter. Overall, it appears that they have a respectable degree of awareness regarding the principles of Sustainable Development and Sustainable Mobility, but further education on the matter is necessary for a thorough understanding. On the other hand, they seem more theoretically familiar with autonomous vehicles than with their practical use, yet concerning their connection to Sustainable Mobility their knowledge is at a relatively satisfactory level that creates a positive climate for such a potential future shift. Future research axes were shaped to explore more specific attitudes of Greek drivers towards related applications that have been -successfully or unsuccessfully- implemented in foreign cities for a better understanding via detailed scenarios. Such supplementary research can investigate their views in more detail towards establishing potential Greek versions of autonomous mobility applications based on the former, which will serve as preparatory background towards the more specific applications in Greek road networks, with a focus on the most crucial problems that should be addressed related to the targeted drawbacks in the country of Greece.

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### **ANALYZING ENERGY POVERTY IN SOUTHERN EUROPE: A DESCRIPTIVE ANALYSIS USING SUBJECTIVE INDICATORS**

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#### **Abstract**

Access to sustainable and affordable energy is the fundamental principle of the 7<sup>th</sup> Sustainable Development Goal (SDG), highlighting the pivotal role of energy in driving global development. The European Union (EU) recognizes energy as an essential right for everyone, as emphasized in its energy policies. Nevertheless, despite these initiatives, energy poverty significantly impacts the EU population, hindering equal societal progress and prosperity. Although the EU focuses on cohesion among its member states, Southern European countries experience more severe energy poverty despite having milder winter conditions. Aiming to capture energy poverty occurrence in Southern European countries, this study employs statistical analysis focusing on Greece, Italy, Spain, and Portugal for 2012-2022. The outcomes reveal that Southern European countries bear a disproportionate burden, highlighting the region's vulnerability. Furthermore, significant disparities within South European countries are evident since some countries bear a disproportionate burden, highlighting regional vulnerability.

**Keywords:** Energy poverty; Descriptive analysis; Southern Europe; Vulnerability



This project is carried out within the framework of the National Recovery and Resilience Plan Greece 2.0, funded by the European Union – NextGenerationEU (Implementation body: HFRI).

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Pre-organised Special Session:

**“Culture and Sustainable Development”**

*Organized by*

***Assoc Prof Maria Manola***

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### **MONASTERIES AS ELEMENTS OF CULTURE AND SUSTAINABLE DEVELOPMENT. FROM TRAVEL TEXTS TO ENTREPRENEURSHIP.**

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#### **Abstract**

The texts of travelers, such as the descriptions of monasteries by Cristoforo Buondelmonti in the 15th century or Tournefort in the 17th century, contain valuable information about the architecture, the daily life of monks, and the spiritual role of monasteries. Travelers from Europe were often impressed by the location of the buildings, the natural beauty of the landscapes surrounding them, and the monastic life. The architecture also aroused their interest, such as Gerola, who was fascinated by the monasteries of Tzagarolon, Arcadi, Preveli, or Toplou. But the descriptions also give us information about a different aspect of the life of the monasteries, that of the development of some early form of economic activity.

This activity continues today in many of them and is an example that blends tradition with modern business strategy, which is now becoming necessary for their survival. The economic activities of the monasteries have important social implications as they contribute to sustainability by creating jobs, especially in rural and isolated areas, and often support, as their ‘raison d’être’ requires, charitable projects. Now days they are important tourist destinations, attracting visitors interested in history, nature, art and organic products and enhancing the economic sustainability of a place. The business initiatives of the monasteries serve as models of sustainable development.

The article presents Holy Monasteries through the writings of travelers and, with the help of a survey of a sample of 113 people, tries to approach the way in which Holy Monasteries bridge the past with the present and the innovative practices they engage in order to maintain a unique role in contemporary society by combining culture and economy.

**Key Words:** travel texts, travelers, monasteries, entrepreneurship, sustainability, tourism

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### **An introduction to the Sustainability**

Sustainability is a central issue in global discussions, as environmental degradation threatens humanity's viability. The United Nations defines sustainability as balanced development that considers both economic growth and respect for the environment and society. The Brundtland Report (1987) highlighted the need to address the environmental crisis, emphasizing that meeting present needs should not compromise the ability of future generations to meet their own. This led to reforms and policies for environmental protection, while the Rio Summit (1992) reinforced the connection between development and environmental conservation, establishing institutions such as the Commission on Sustainable Development.

The concept of sustainability is based on three pillars:

- Social dimension: Promoting well-being and social cohesion for both present and future generations.
- Environmental dimension: Protecting and preserving natural resources.
- Economic dimension: Ensuring long-term economic growth while respecting society and the environment.

In 2015, the 2030 Agenda for Sustainable Development reaffirmed the fundamental role of sustainability in creating a fairer world.

### **Sustainable Tourism**

In the tourism sector, sustainable development is considered crucial, with Goals 4.7 and 11.4 emphasizing the importance of cultural heritage. According to researchers, tourism should adapt to local social, cultural, and environmental structures, especially as issues such as over-tourism and rural depopulation present challenges (Kokkosis & Tsartas, 2019; Kizos, 2018). Sustainable tourism promotes a balance between societies and the natural environment, while alternative tourism offers solutions that integrate environmental responsibility and local development (Kokkosis et al., 2011). At the same time, travelers seek authentic experiences, making strategic planning and the implementation of sustainable practices essential. The relationship between culture and tourism is considered significant for preserving traditions and ensuring the sector's long-term sustainability (Terkenli & Georgoula, 2022).

One form of alternative tourism is literary tourism, which provides a sustainable and authentic solution by promoting culture through literature.

### **Literature as a form of sustainable Tourism**

Culture serves as a mirror of human creativity throughout time and space, expressed through social activities and the production of material and intellectual values. Many tourists choose destinations based on their cultural significance. According to McKercher and Du Cros (2015), cultural tourism offers visitors the opportunity to engage with a place's cultural heritage, combining entertainment, education, and a more immersive experience. Literature, as one of the primary forms of cultural expression, plays a central role in this process.

Literary tourism is an emerging sector that merges a passion for books with exploration. Visitors seek locations associated with literary works, whether due to the presence of authors

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or the fictional worlds created in stories (Fawcett & Cormack, 2001). Manola (2019) notes that readers aspire to experience the world depicted in a book in a tangible way. This form of tourism enhances a place's uniqueness and promotes sustainable development. As highlighted by Della Spina & Giorno (2021), an interdisciplinary approach can offer new ways of understanding cultural landscapes and enhance their sustainability.

Literature has the potential to increase a location's touristic appeal, adding a new dimension to its cultural interest. Many areas have gained tourism popularity due to literary works (Manola, 2019; Tsatalbassoglou, 2019; Manola & Tsatalbassoglou, 2021; Manola et al., 2021). Literary routes facilitate the understanding of cultural heritage by connecting places with historical events and landmarks (Mitoula et al., 2008). Simultaneously, they enhance the attractiveness of destinations and contribute to their sustainability (Mitoula & Kaldis, 2018).

Additionally, literary works, including travel writings, offer an interactive experience, allowing travelers to follow in the footsteps of authors and literary characters, explore landscapes, and participate in activities while maintaining respect for the environment. Technological innovations, such as virtual reality, open new possibilities for enhancing these experiences (Tsatalbassoglou et al., 2024). Travel literature is a distinct form of literary expression with a direct connection to tourism.

### **A special form of literature: “Travel texts”**

Greece's geographical location at the heart of the Mediterranean has established it as a crucial hub for commercial and religious journeys, particularly towards the East and the Holy Lands. Recognizing its significance, the Venetians and Genoese set up supply stations in Greek ports to facilitate travelers. Many of these travelers wished to document their experiences, producing detailed narratives that evolved into early travel guides. According to Viggopoulou (2005), these texts blend personal impressions with practical information, serving as important historical sources despite containing subjective elements (Tsatalbasoglou & Manola, 2024a). Simopoulos (1999) highlights that these narratives preserve invaluable details that might otherwise have been lost, offering insights into the past of Greek society.

Greece's strategic position at the crossroads of three continents makes it a convergence point of diverse cultural influences, shaping its image both in the West and the East (Manola & Tsatalbassoglou, 2020). During the Crusades, Crete functioned as a supply station but gradually emerged as a tourist destination. Under Venetian rule, interest in the island increased, with travelers recording their experiences and others sending reports to their superiors. These historical narratives contribute to shaping modern tourism by promoting sustainable routes and incorporating lesser-known sites into tourism planning (Tsatalmbasoglou & al., 2024b). The use of new technologies allows for the development of strong and balanced experiences that benefit local communities while addressing issues of overtourism, particularly in northern Crete.

Beyond their artistic value, travel narratives provide valuable insights across various academic disciplines. In an era of information overload, studying these texts can inspire sustainable tourism practices and support the development of strategic approaches for the future.

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### Travelers and Sacred Monasteries of Crete

Sacred monasteries serve as focal points for travel, primarily due to their connection to religious sentiment. Pilgrimage is a way for individuals to seek a closer relationship with the divine, combining travel to a sacred place with a deeper spiritual experience. Through this process, the pilgrim distances themselves from material needs and daily life, striving for spiritual fulfillment. Thus, it is not merely a journey to a specific location but also an internal quest that often leads to travel-related activities (Timothy, 2002; Moira, 2003; Laclali & al, 2019). Religion and tourism are distinct concepts: pilgrimage focuses on religious experience and faith, whereas religious tourism perceives sacred sites as cultural monuments (Timothy, 2002). Although separate phenomena, both relate to human spirituality.

Significant interest has been shown in the sacred monasteries of Crete, which have played a major role in the cultural and daily life of local society. Travel writings also contain descriptions of these monastic sites. Some of the following are from the site “travelogue.gr” of the Aikaterinis Laskaridis Foundation:

- the drow of Pashley for the Tzagarolon Abbey

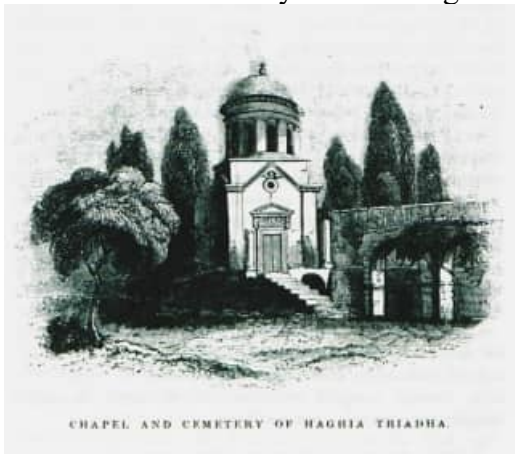


*Figure nr 1: Pashleys' Moni Tzagarolon, Resource: travelogue.gr*

- William Stewart, in his work published in 1867, highlights that "Arcadi has been a symbol of the resilience and self-sacrifice of the Cretans; this monastery is not only a religious monument but also a symbol of Cretan freedom".



*Figure nr 2: Arcadi Monastery Resource: arcadimonastery.gr*



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- Toplou monastery was mentioned by many travelers as for example De la Croix, who in 1806 reports it “as a strong refuge, which has the capacity to withstand even the most severe attack”



Figure nr 3: “Toplou”, Resource: [ikivotos.gr](http://ikivotos.gr)

- As seen in Boissonnas’ photographs, activities to ensure self-sufficiency and support their social and charitable missions. He made many photos with the activities of the Monasteries and the villagers that they used to work at them



Figure nr 4: Olive harvest at Moni Prevelis by Boissonnas  
Resource: [travelogues.gr](http://travelogues.gr) /Baud-Bovy, D., Boissonas, F.

Historically, monasteries have functioned as centers of economic activity, managing assets and engaging in productive activities to ensure their self-sufficiency and support charitable initiatives (Kavvadias, 2024) by developing an early form of entrepreneurship.

### Entrepreneurship and Holy Monasteries

Entrepreneurship is defined as the process of identifying, developing, and leveraging opportunities to create value through innovation and resource organization, with the aim of establishing or expanding business activities (Spiliotis, 2017). Within the context of monasteries, entrepreneurship acquires unique characteristics, combining economic activity with a spiritual mission. In the modern era, monasteries continue to contribute to the economy through activities such as agricultural production, hospitality for pilgrims, and the publication of religious texts. Entrepreneurship within monasteries constitutes a complex phenomenon

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that integrates economic activity with spiritual and social missions, offering valuable insights for contemporary business practices.

Here is important to highlight that according to the Greek Orthodox religion it is necessary to maintain a balance between economic development and their spiritual mission, monasteries follow certain fundamental principles. First, their business activities are based on ethical values, avoiding practices that contradict Church teachings. Second, they strive for economic independence without seeking wealth accumulation, instead allocating their revenues to community needs and charitable efforts. Additionally, monasteries maintain strong ties to tradition by engaging in activities such as agriculture, beekeeping, handicrafts, and the publication of religious texts. At the same time, they operate with transparency to ensure the trust of the faithful. A significant portion of their profits is dedicated to social welfare, supporting vulnerable groups through charitable initiatives, education, and healthcare. Finally, labor within monasteries is considered an integral part of daily life, harmonized with prayer to avoid distracting monks from their spiritual path. (Ware 1993; Giovanoglou, 2020). So in some of the above points the Holy Monasteries seems to have a very modern prospective similar to the Corporate Social Responsibility because they can positively influence job creation and contribute to the overall well-being of local communities. Research indicates that corporate CSR activities add value to public and tertiary sector tools, strengthening their capacity to support economic and social development (Mitoula and Astara, 2012).

## Research and Results

A total of 113 individuals were surveyed, all participants were adults and took part voluntarily and anonymously between July 13th and 20th of 2024.

The research employed a purpose sampling method, which was chosen because of the small sample with a mainly informative character with comparable characteristics [Durbarray, 2020] from the city of SITIA, the nearest town to Toplou Monastery, one of the most famous of Crete. A structured questionnaire with closed-ended questions was used, and respondents were independent travelers, not part of an organized tour.

Sitia was chosen due to the fact that it is the closest city to the historic Holy Monastery of Toplou, which due to its religious and cultural importance, and the development of a particular business activity, indicates that the monastery is a multidimensional attraction. This means that the promotion of the Holy Monastery of Toplou can target different audiences, enhancing the attractiveness of the area for cultural, religious and gastronomic tourism, which makes it an ideal location for this preliminary research.

The study focused on exploring factors that shape tourists' perspectives on:

- The role of literature through travelers texts in promoting tourism in the Sitia region.
- Tourists' reflections on previous literary tourism initiatives.
- The possibility of achieving sustainable cultural growth in the area.
- The visitors' opinions regarding the development of entrepreneurship by monasteries, focusing on their perception of the role of monasteries in the local economy

### Demographic data

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- SEX: Regarding demographic data, from the sample 45 people has choosen male, 63 female and 5 chose ‘Other’.
- AGE: At the ages of 12 they belonged to the 18-25 group, 22 to the 26-40 group, 27 declared themselves to be in the 41-60 group and 52 people declared themselves to be over sixty years old.
- EDUCATION: The largest percentage completed secondary education, specifically 49 people. 13 lower secondary, as well as 13 Trainning Institute, 25 university, 12 master and 1 PHD.

Below are some of the research questions of the descriptive statistic:

Question nr 6: Could the following reasons affect literary tourism?

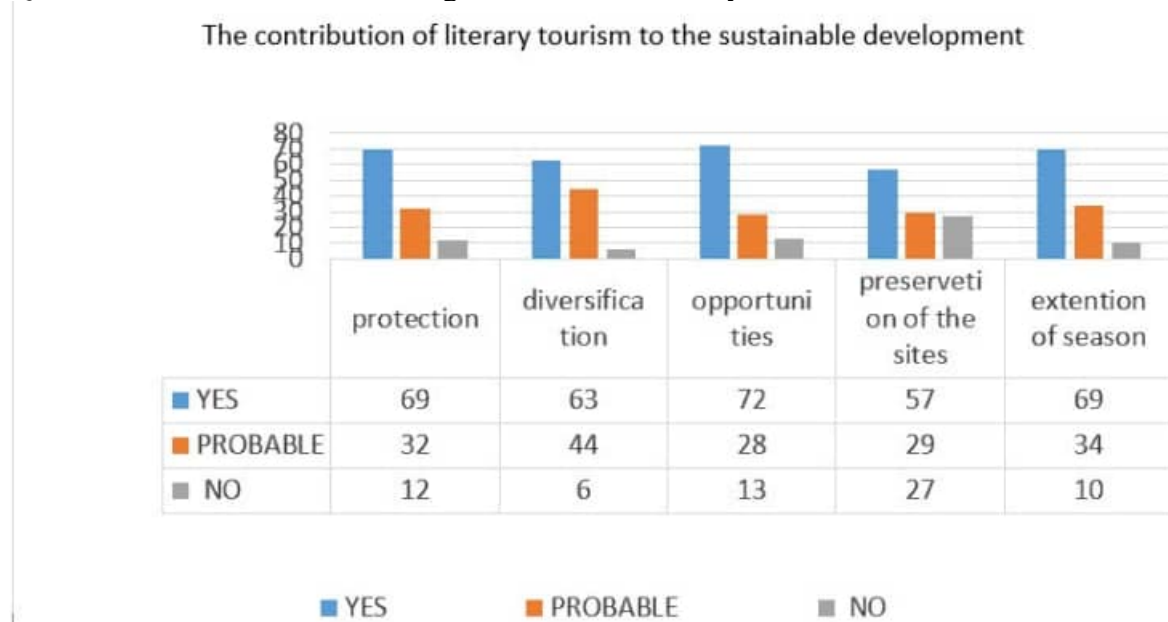


*Figure nr 5: Chart 1- Literary tourism as a factor*

The contribution of literature to the sustainable development of a place, according to the interviewees, depends largely on the opportunity given to differentiate a place from others, a choice chosen by 63 individuals. The development of new initiatives is chosen by 72 individuals, the protection of the environment (69), as well as of cultural heritage (57 persons), and the expansion of seasonality (69 persons)

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Question nr 7: “How likely are you to follow travel texts from earlier centuries as a guide on your journey?”

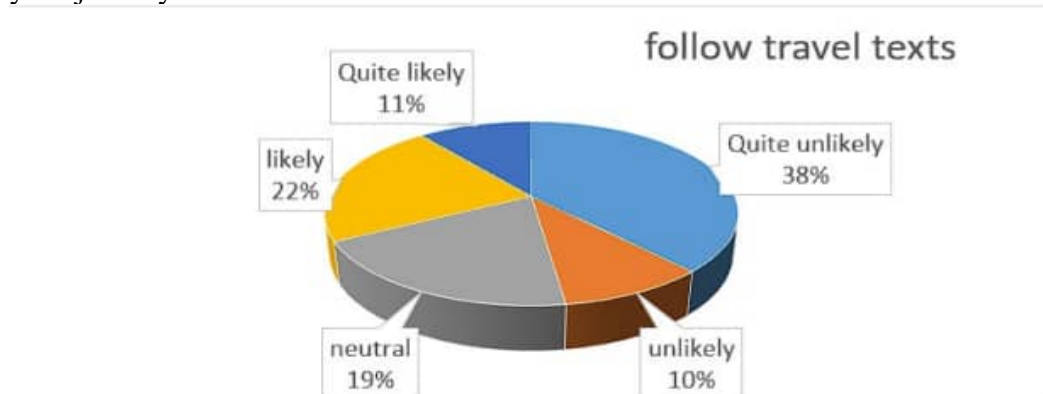


Figure nr 6: Chart 2- travel texts and selection of a place

Regarding the question about the possibility that the interviewee would show interest in following the travel texts, as can be seen from the diagram, a total percentage of around 33% (37 persons) responded positively, 19% (22 pax) is neutral, and a percentage of 38% (which is 43 persons) responded negatively.

Question nr 8: “What is the main reason you would probably not follow old travelogues on your travels?”



Figure nr 7: Chart 3- follow a travelogue

The next question concerns the reasons why interviewees would not follow a travelogue from another era. It is particularly interesting that most people consider as an important reason, as can be seen from the graphic, the fact that they prefer an "easy and fast" presentation from modern websites at a rate of 59% (51 individuals), followed by the lack of interest in historical data at 18% (22), the difficulty in studying the language of another era, “never thought” was chosen from 27 persons and finally the lack of digital applications at a rate of 9% (8).

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Question nr 9: “What is your opinion on the involvement of Holy Monasteries in business activities?”

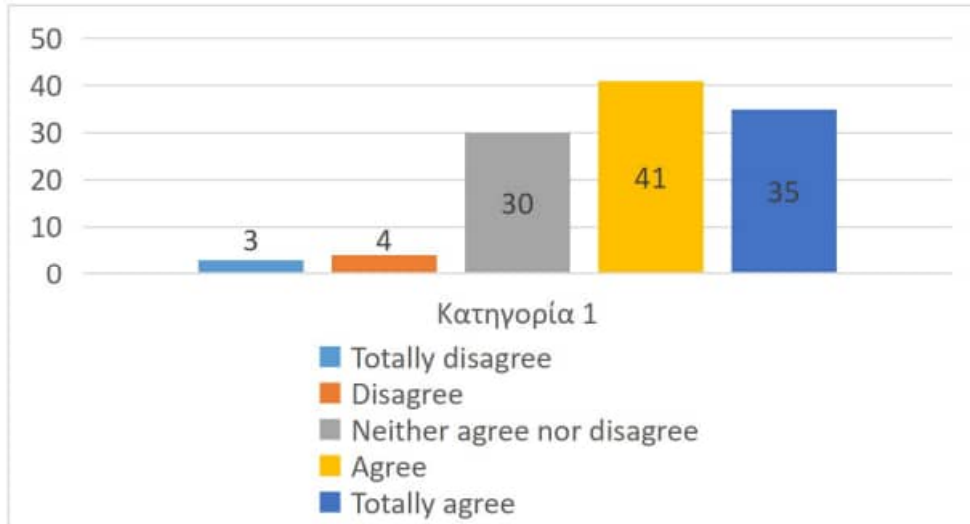


Figure nr 8: Chart 4- Monasteries & entrepreneurship

As can be seen from the chart, the option that wins the largest percentage is "agree" as it gathers 41 people. “Totally agree” was chosen by 35 interviewees, 30 people chose “rather”, 4 “disagree” and 3 “totally disagree”.

Question nr 10: In your opinion, what is the role of monasteries in the economic development of local communities?

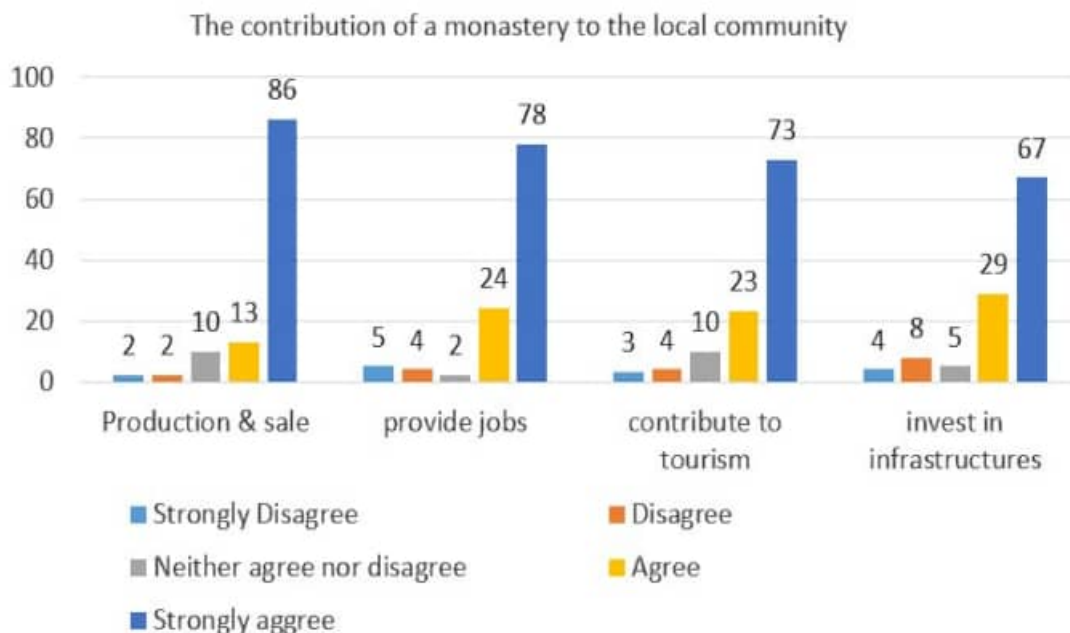


Figure nr 9: Chart 5- Monasteries & local community

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As shown from the chart, for the answer “strongly agree” we have 86 persons for “Monasteries strengthen the local economy through the production and sale of monastic products (e.g. honey, wine, cheese) . The second choice with 78 answers is “ They provide jobs either directly or indirectly through cooperation with local producers” , then 73 person has given “They contribute to tourism, as they attract visitors who strengthen the hospitality and catering industry” and the fourth answer was chosen by 67 person “They invest in infrastructure and maintain traditional buildings, upgrading the area”.

Question nr 11: To what extent does monastic activity contribute to the preservation of cultural heritage and local traditions?

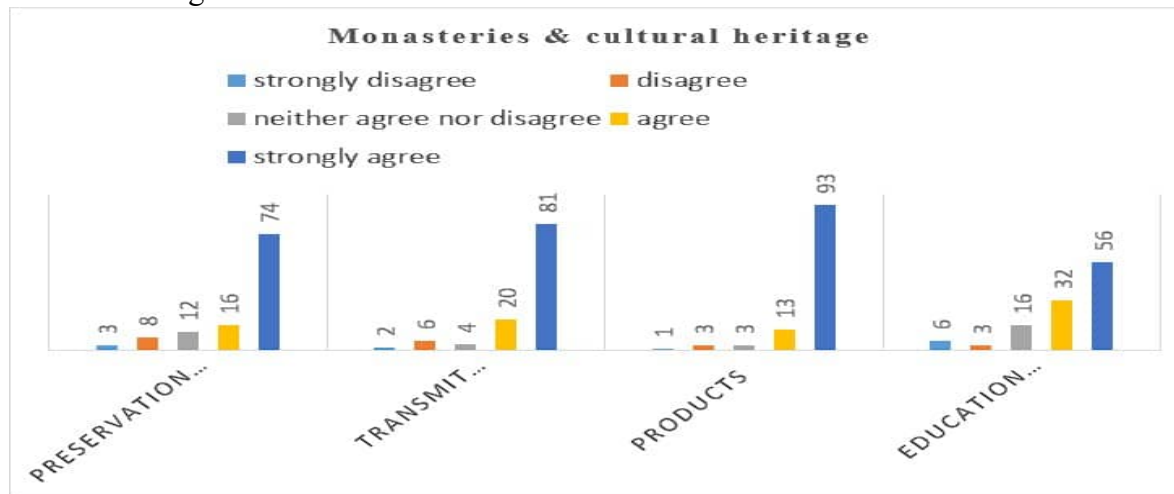


Figure nr 10: Chart 6- Monasteries & heritage

As shown from the chart the answer “strongly agree” was given for 93 persons for the choice “They support the preservation of traditional gastronomy through the products they produce”. The second place is taken by They transmit local tradition through iconography, music and handicraft” with 81 answers. As third choice given is with 74 persons “They preserve and restore historical buildings, archival material and relics” and with 56 answers “They function as cultural education centers, hosting seminars and events”



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Question nr. 12: Are there opportunities to expand the business activity of monasteries beyond religious tourism? If so, what are they?

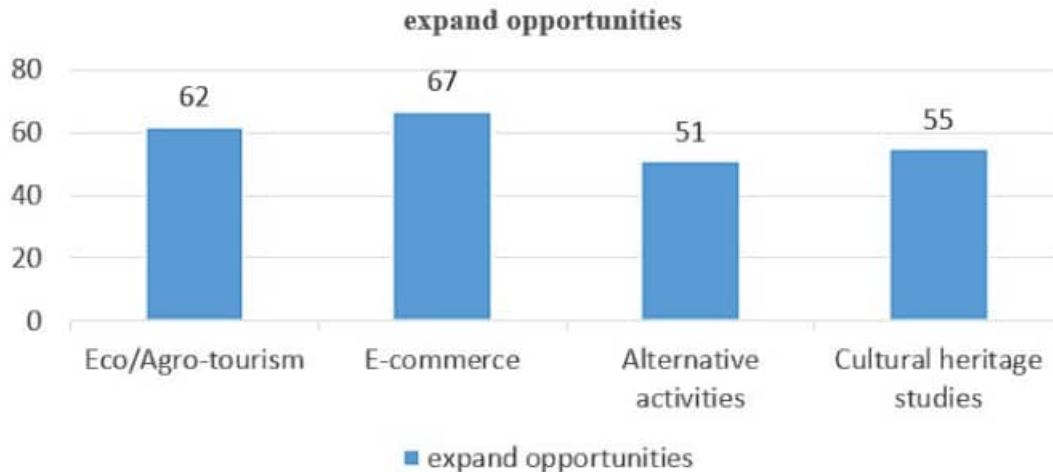


Figure nr 11: Chart 7- expand activities- The answer “strongly agree”

“Development of eco- and agro-tourism through organic farming and hosting visitors in traditional cells”, gave as an answer 62 persons. The “Creation of e-commerce” in order to to sell monastic products internationally gave 67 person. The answer “Development of alternative activities, such as handicraft workshops, botany and hagiography seminars” was the first choice of 51 person while “Cooperation with educational institutions for cultural heritage studies” was chosen from 55 person

Question nr. 13: «What are the factors that could influence your choice to buy a product from a Monastery?»

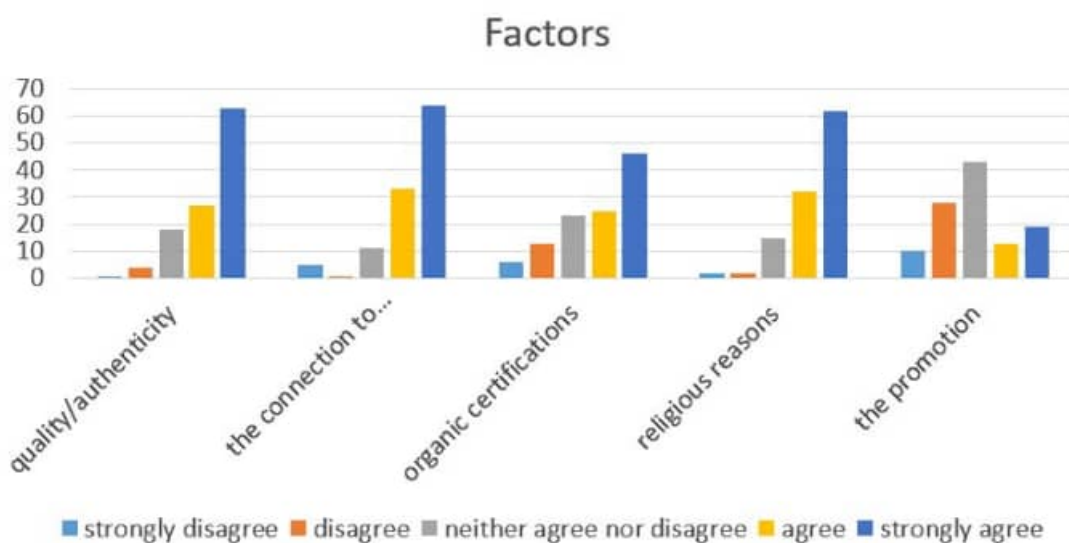


Figure nr 12: Chart 8- factors that could influence

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The quality and authenticity of the products is a strong motivation, since 63 people from the sample answered “strongly agree”. The connection of the products with the tradition and history of the monastery is important enough, and we have 64 “strongly agree” and 33 “agree”. Ecological and biological certifications are a condition that should now be taken seriously by the authorities as it is also a guarantee for the quality of the products. “Strongly agree” was chosen by 46 people as a prerequisite. Emotional and religious reasons, as many products have been blessed is a “strongly agree” answer for 62 people while “agree” was given from 32 people, so it is a very strong motivation. The ‘Proper promotion and positioning’ is a strongly motivation for only 19 people.

### Discussion

The research findings indicate that the majority of respondents agree that monasteries play a crucial role in preserving cultural identity. This is because monastic activities contribute to the preservation of traditional arts, architectural monuments, and cultural practices, rendering monasteries vibrant centers of cultural heritage. Moreover, respondents expressed a willingness to engage in alternative forms of tourism, such as literary tourism, particularly in relation to travel literature, provided they were more familiar with these texts. It is important to consider the dynamic potential of travel literature when properly highlighted, as there is a lack of awareness regarding their existence and insufficient utilization through new technologies.

The responses further reveal that a significant proportion of participants recognize the positive contribution of monasteries to the local economy. This occurs through activities such as the production and promotion of local products, the attraction of tourists throughout the year, and the creation of employment opportunities.

Based on the findings, there appears to be considerable potential for expanding monastic activities into areas such as agritourism, sustainable production on a larger scale, and new initiatives like education in traditional arts. The positive reception from respondents suggests that the public is open to innovative approaches that maintain the monastic character while enhancing its economic dimension. However, this expansion must be grounded in authenticity, quality, and a strong connection to tradition, as these are key factors influencing consumer behavior. The findings indicate that consumers appreciate monastic products not only for their religious significance but also for their high quality and local character.

### Conclusion

The travel text could create new paths for an alternative form of tourism, even more so if combined with other practices such as the development of soft form of entrepreneurship. The utilization of monastic products in the tourism sector has the potential to yield significant benefits and strengthen the local economy. Through the implementation of processes such as certification, branding can be enhanced—an essential factor in the promotion of monastic products—as it contributes to the establishment of a strong identity and the strategic positioning of these products in the market. The fact that a large proportion of respondents consider branding important underscores the significance of storytelling and authenticity in

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shaping consumer perceptions. Entrepreneurship within monasteries represents a unique model of economic activity that integrates financial sustainability with spiritual and social missions. Developing a structured promotional strategy that highlights monastic production can increase brand recognition and attract a broader audience, thereby enhancing the competitiveness of these products.

Furthermore, strengthening monastic entrepreneurship requires the adoption of policies and strategies that support sustainable development and the outward orientation of monasteries. The positive stance of respondents confirms the necessity of state or private initiatives aimed at enhancing funding, visibility, and networking for monastic enterprises. The implementation of such policies, informed by further research, could contribute to the preservation of monastic tradition while simultaneously reinforcing the role of monasteries in both the local and national economy.

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- <https://www.culture.gov.gr/el/ministry/SitePages/viewyphresia.aspx?iID=1328>
- <https://spinalonga-island.gr/%CF%83%C%CE%B1/giuseppe-gerola/>
- <https://www.imis.gr/el/%CE%B9%CE%B5%CF%81%CE%AC-%CE%BC%CE%B7%CF%84%CF%81%CF%8C%CF%80%CE%BF%CE%BB%CE%B9%CF%82-E%B1%CF%82-54/-7039>
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- <https://www.sitia.gr/>
- <https://ikivotos.gr/post/226/monh-toploy-h-ploysia-monh-se-istoria-kai-perioysia/>
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### CULTURAL ENTREPRENEURSHIP AND SUSTAINABLE DEVELOPMENT IN LEMNOS

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#### **Abstract**

Lemnos, one of the outlying islands of Greece, occupies a special place in the national and cultural map of the country. Its geographical location in the northeastern Aegean Sea and its proximity to the border with Turkey give it strategic importance, while its rich history and cultural heritage make it an important hub between the ancient and modern world.

The present study aims to highlight the tangible and intangible cultural heritage of Lemnos, while examining the potential for enhancing cultural entrepreneurship as a key driver of sustainable development for the island. The themes explored include the importance of religious monuments, gastronomy, cultural events - such as music and dance festivals - the management of archaeological sites and the contribution of literature, through the works of Yannis Ritsos and other authors inspired by Lemnos.

As part of the study, a quantitative analysis was carried out using questionnaires distributed exclusively to residents of Lemnos. Data collection focused on recording and analyzing the views of local people on the potential and opportunities that cultural entrepreneurship provides for the sustainable development of the island. The results of the survey aim to formulate recommendations for linking local cultural heritage with economic, social and environmental sustainability, enhancing local identity and development.

**Key words:** Cultural entrepreneurship, sustainable development, Lemnos



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### **DAFNI MONASTERY: PILLAR OF SUSTAINABLE DEVELOPMENT AND CULTURAL ENTREPRENEURSHIP. ARE THERE POSSIBILITIES?**

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#### **Abstract**

Daphni is an eleventh-century monastery on the outskirts of Athens. It is considered a superb example of Middle Byzantine architecture, with sublime mosaics representing the visualisation of the Christian cosmos. The monastery is inscribed on the UNESCO World Heritage Sites list and has attracted significant scholarly attention. The ravages of time and a destructive earthquake in 1999 triggered an extensive, multi-million-dollar restoration project funded by the Greek state and the European Union to preserve the building and the mosaics for future generations.

The popularity of neoclassicism in the 19th century condemned many remnants of Byzantine architectural heritage to oblivion. However, the concerted efforts of European artists, architects, and archaeologists eventually contributed to the study, rescue, and conservation of the most prominent religious buildings. In the 1870s, the historian Konstantinos Paparrigopoulos integrated the Byzantine Empire into Greek history. Preserving Byzantine and medieval monuments became necessary to serve the broader goals of the Great Idea.

Contemporary attitudes toward Byzantine monuments are less ideologically charged, but the meaning and significance of the monuments to the public continue to evolve. Cultural heritage has become a cornerstone of sustainable development at a local level, which raises

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interesting questions regarding the enhancement of the Daphni Monastery's tourist potential. Is the monastery's value known to the general public? What elements impress its visitors? Is public transport accessibility satisfactory? Finally, what cultural entrepreneurship opportunities does the monastery offer to assist local development?

As part of the study, Daphni Monastery visitors received questionnaires to explore their attitudes towards the monument. The survey will underpin efforts to develop the area's cultural entrepreneurship potential and to enhance Daphni Monastery's visibility and popularity as a tourist destination. The proposals include improving access, strengthening cooperation with local businesses, and promoting Daphni Monastery as an essential cultural destination.

**Keywords:** Daphni Monastery, UNESCO World Heritage Site, Byzantine Empire, Education, Tourism, Sustainability

### 1. INTRODUCTION

Daphni is an eleventh-century monastery on the outskirts of Athens. It is considered a superb example of Middle Byzantine architecture, with sublime mosaics representing the visualisation of the Christian cosmos. The popularity of neoclassicism in the 19th century condemned many remnants of Byzantine architectural heritage to oblivion. However, the concerted efforts of European artists, architects, and archaeologists eventually contributed to the study, rescue, and conservation of the most prominent religious buildings. Preserving Byzantine and medieval monuments became necessary to serve the broader goals of the Great Idea. Contemporary attitudes toward Byzantine monuments are less ideologically charged, but the meaning and significance of the monuments to the public continue to evolve. Cultural heritage has become a cornerstone of sustainable development at a local level, which raises interesting questions regarding the enhancement of the Daphni Monastery's tourist potential.

### 2. THE HISTORY OF DAPHNI MONASTERY

The Daphni Monastery was built in the sixth century on the side of the famous Sacred Way, leading from Athens to Eleusis. A sanctuary of Apollo stood on the site for centuries. According to the ancient traveller and geographer Pausanias, who visited the area in the second century AD, the sanctuary consisted of a wall enclosing a large temple and another building with columns. These buildings provided the material for the monastery's construction after numerous imperial edicts against the pagan religion completed the sanctuary's abandonment that had begun with the destructive raid of the Goths in 395. The first Christians erected a basilica using many ancient columns and capitals. Emperor Justinian I (527-565) repaired the fortifications protecting the church and added battlements and towers to secure the strategic pass through the mountains connecting Athens and the plain of Eleusis. At some point between the 7th and the 9th century, the basilica was abandoned [Lazarides, 1977].

In the eleventh century (around 1080), a new church was built using the cross-in-square church of the octagonal type, which became popular throughout Greece. It was dedicated to the Dormition of the Virgin and served as the *katholikon* of the monastery. A massive dome

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(eight meters in diameter) covered the central square nave and the short arms on each side, which formed a Greek cross. The quality of craftsmanship suggests the employment of workers from Constantinople. It was a time of relative stability and prosperity, so the restored monastery thrived. A refectory to the north of the katholikon and rows of cells served the needs of the monks. A smaller chapel was attached to the cemetery within the enclosure [Lazarides, 1977].

Gradually, the katholikon expanded with the addition of an exonarthex (approximately thirty years after the completion of the main church). In 1207, after the Frankish conquest of Attica, Othon de la Roche, the first Frankish Lord of Athens, offered Daphni Monastery to a group of Cistercian monks from Bellevaux who left their indelible imprint on the building. They gave the arched openings in the western façade of the exonarthex a distinctive Gothic look and remodelled the second floor above the narthex and the exonarthex into defensive battlements [Kyriacopoulou, 1956].

The Daphni Monastery is also renowned for the quality and splendour of its mosaics. An impressive and well-preserved cycle of gold mosaics adorns the interior of the katholikon. The depiction of Christ Pantokrator (Ruler of All Things) holding a book within a rainbow almond-shaped aureole of light in the central dome is paradigmatic. It has frequently been used in books dedicated to Byzantine art [Westcoat *et al.* 2014]. Initially, the mosaics covered the upper surfaces of the walls. However, the ravages of time and frequent earthquakes caused significant damage to the mosaics. The surviving segments are scattered in the nave, the exonarthex, and the dome. They illustrate the dogmatic teachings of the Greek Orthodox Church as they were formulated during the Comnenian dynasty in the late 11th and early 12th centuries [Connor, 2016].

There are nineteen narrative scenes dedicated to the lives of Christ and the Virgin Mary, as well as isolated figures depicting archangels, prophets, saints, and martyrs (approximately 107 figures). The artists who created the katholikon mosaics attempted to produce naturalistic figures and focused on the narrative of the stories from the Gospels rather than the dogma. Interestingly enough, there seems to be a progression of emotion from the dome to the lower walls. Christ Pantokrator is severe and almost intimidating to those looking at him from the floor, while the figures closer to them on the walls have a softer, more compassionate expression. There are various interpretations for this difference in style, ranging from a long period of construction (Byzantine artists typically began working on the higher parts of the church and gradually lowered the scaffolding) or a conscious decision to adjust their style to elicit different responses from the faithful in the various parts of the iconographic program [Cormack, 2018].

Irrespective of the motives guiding the execution of the artistic plan, the mosaics are evidence of the Byzantine Empire's ability to fund expensive building and creative projects in faraway corners. Eleventh-century Athens was almost an imperial backwater; nevertheless, the unknown patron or patrons who decided to finance the construction of the katholikon and its decoration with expensive, high-quality mosaics could marshal the materials, money, and artistic skill to produce a masterful work of art [James, 2017].

The Cistercian monks abandoned the monastery after the abolition of the Duchy of Athens following the city's conquest by the Ottomans in the late 1450s. Over the following centuries, the monastery served various functions. The Ottomans returned it to the hands of

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Greek Orthodox monks for long periods, but the monastery was abandoned in the 18th century [Cormack, ]. Still, the complex also played a military role during the Greek War of Independence in the 1820s and the early years of the independent Greek kingdom in the 1830s when it hosted garrisons of Greek and Bavarian troops. From 1883 to 1885, the monastery became a public mental hospital.

Wars and neglect were constant threats to the monastery's survival. However, earthquakes were equally dangerous. The monastery was built on a Neogene graben between Egaleo and Korydallos, an area considered tectonically active [Miltiadou-Fezans et al., 2003]. As a result, the katholikon and the surrounding buildings suffered significant damage during a series of earthquakes in the late 19th century (most notably in 1886, 1889 and 1894). However, on September 7, 1999, an earthquake in Athens severely damaged the load-bearing structures of the katholikon and the mosaics. The vertical walls, piers, arches, and vaults had cracks, and the vault's structural condition was extremely critical. A strong aftershock (or another earthquake) could collapse the dome, a fate shared by numerous octagonal Byzantine churches that survive without the original dome [Miltiadou-Fezans *et al.*, 2003].

The Hellenic Ministry of Culture formed a multidisciplinary scientific group to create a comprehensive plan for the protection, conservation, and restoration of Daphni Monastery. European Funding Programs and the Greek State financed the multi-year restoration project (1999-2016). It included extensive laboratory investigations and structural interventions to preserve the Katholikon and improve its seismic behaviour. The experience and knowledge acquired during the restoration also provided an educational opportunity that may prove invaluable in similar structural restoration projects concerning other World Heritage monuments [Miltiadou-Fezans and Delinikolas, 2019].

### 3. DEALING WITH THE BYZANTINE PAST

The katholikon of the Daphni monastery is a fine example of the so-called “Helladic School” of Middle Byzantine architecture. Because of its outstanding significance, it has been on UNESCO's World Heritage List since 1990, alongside the monasteries of Hosios Loukas in Boeotia and Nea Moni in Chios. It is one of Greece's nineteen properties on the List. It is currently an archaeological site under the jurisdiction of the Greek Ministry of Culture and Sports (Ephorate of Antiquities of West Attica).

However, recognising the church's cultural significance was not always so evident. The autocratic rule of Byzantine emperors and the dominant role of the Church in state affairs offended the enlightened sensitivities of intellectuals in the late eighteenth and early nineteenth century. They considered Byzantium ridiculous and underdeveloped, an opinion crystallised in Edward Gibbon's monumental *Decline and Fall of the Roman Empire*. The English historian described the millennium of Byzantine rule as the triumph of barbarism and religion [Runciman, 1976]. He refused to acknowledge even a single positive contribution of the Byzantines to the happiness of mankind. Such harsh criticism shaped the view of the Byzantine culture for many generations. Modern Greeks were often considered the descendants of their ancient forefathers without any connection to the generations that inhabited the same lands during the Middle Ages [Stathakopoulos, 2023].

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The modern Greek state was correspondingly hostile to its medieval inheritance. Numerous Byzantine churches in Athens were demolished in the nineteenth century to facilitate archaeological excavations, to “liberate” classical monuments from the evidence of foreign domination or medieval ignorance, to make room for the construction of roads, or to provide building material for neoclassical mansions and public buildings [Tziovas, 2014]. However, as popular opinion seemed determined to condemn the Byzantine Empire to oblivion, new scholarly attitudes emerged and revisited all aspects of medieval Greece. The Greek historian Constantine Paparrigopoulos laboured for decades to integrate Byzantium into the continuum of Greek history from antiquity to the present day. His seminal and multi-volume *History of the Greek Nation* provided readers with a substantive and detailed narrative of the Byzantine state, to which he attributed the survival of the Greek language, religion, and national identity [Ricks and Magdalino, 1998].

These new attitudes encouraged a new look towards at least the most important extant Byzantine monuments. In the late nineteenth century, European Byzantinists and Greek scholars started publishing scholarly articles and monographs about churches and monasteries. Foreign visitors also turned their attention to these long-neglected remnants of medieval Greece. They provided detailed descriptions in travel accounts that aroused considerable interest and encouraged the authorities to start restoring them [Kourkoutidou-Nikolaïdou, 1998]. The Greek state entrusted the French architect Eugène Troump with repairing the damage caused to Daphni monastery by the earthquakes in the late nineteenth century. Troump reconstructed the narthex, the walls of the upper floor, and the dome according to the original plans in a multi-year project that was completed in 1907 [Chlepa, E. 2024, and Troump, 1896]. At the same time, Byzantine history and culture began to be accepted as essential elements of Greek national identity and narrative with their inclusion in schoolbooks. The Byzantine and Christian Museum was established in Athens in 1914, followed four years later by the establishment of the Association for Byzantine Studies. The first professor of Byzantine history and art was appointed at the University of Athens in 1921, the same year the government enacted the first legislation to protect Byzantine churches and castles [Liakos, 2009].

The transformation of attitudes towards the Byzantine Empire was influenced by romanticism towards a past deemed more intimately associated with the “authentic Greek soul”. Early-twentieth-century intellectuals embraced the country’s perceived medieval past and proclaimed their affinity for its material remains. The influential politician and writer Ion Dragoumis exalted in his ability to visit what he described as “the Byzantine cities” of Macedonia, walk their old streets, and visit their old houses. They were “Byzantine and lordly” [Dragoumis, 1927]. Nostalgia, romanticism, questions of continuity, antagonism with other Balkan states over the heritage of the Byzantine Empire, and a sense of responsibility towards the past encouraged Greek intellectuals and the state to preserve the monuments and assemble collections to underpin and embellish the national narrative of Hellenism’s uninterrupted continuity over the millennia [Bounia, 2020].



#### **4. UNESCO WORLD HERITAGE SITES AND SUSTAINABLE DEVELOPMENT**

UNESCO World Heritage Sites are often listed among the most popular tourist destinations. The transformation of local places of interest into sites of universal significance has an immense effect on local economies and cultures. In less than half a century since the convention guiding the work of the World Heritage Committee, a small cluster of twelve Western sites has become a global network of more than 1200 properties of cultural and natural importance spread over 168 countries. Tourism is the largest and fastest-growing global industry, and World Heritage Sites attract millions of tourists annually [Bourdeau *et al.*, 2017]. Visitor numbers for Daphni Monastery are not readily available. However, according to surveys of World Heritage travellers, as of January 2025, the site ranks approximately in the 704th spot among 1223 monuments. [<https://www.worldheritagesite.org>, accessed 15 January 2025].

There is no scarcity of definitions of tourism. Still, Gaburn’s idea of tourism as a sacred journey undertaken to experience a formative change from the mundane nature of everyday life seems pertinent to monuments of a religious nature like Daphni Monastery [Gaburn, 1989]. Equally applicable appears to be a classic definition of tourism as an activity demanding geographic change and mobility [Noronha, 1979]. Combining both concepts in the person who decides to abandon their routine and visit a monument as part of a broader embrace of leisure proved immensely profitable for states and local stakeholders. Tourism at World Heritage Sites was relatively inexpensive to utilise as a resource. It delivered immediate short-term cash flows to communities that often had little recourse to alternative sources of income. Many monuments were located in remote areas, requiring infrastructure development to access. Since the concept of the World Heritage List seems to emphasise tradition and preserving a “genuine” image of the past, the underdevelopment of sites and regions seemed a benefit rather than a drawback. Direct and indirect employment empowered local communities and alleviated poverty [Bourdeau *et al.*, 2017].

The concept of World Heritage Sites tourism was not despite its drawbacks and problems. The paradigm of UNESCO’s World Heritage Sites program as a getaway for the betterment of local communities often fails to consider the exclusion of local stakeholders from tourist interactions. A superficial approach to cultural monuments can mutate them into resources to be economically exploited to the maximum with total disregard for local sensitivities or the associated environmental impact. What was long considered a tool employed by society to endow their world with meaning can become a meal ticket for outside actors keen to benefit from a resource that does not properly belong to them [Di Giovine, 2010].

The environmental impact of global tourism is significant. Aeroplanes and automobiles allow millions of people to travel, but both modes of transportation are energy-intensive and contribute approximately five per cent of the total global carbon emissions. Although it may appear that the number is not exceptionally high, reports suggest that within the next quarter of the century, emissions from tourism will more than double. Unplanned or poorly managed development seriously imperils World Heritage monuments and the local communities around them. Climate change poses a whole array of threats to cultural and natural heritage. Extreme weather events can become more frequent and destructive, leading to damage or irreparable loss of attractions and infrastructure. Rising insurance costs, environmental degradation, water



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shortages, dangerous fires, or oppressive heat waves reduce destinations' attractiveness and jeopardise stakeholders' livelihoods. As economic opportunities dwindle, there is less enthusiasm or motivation to protect heritage sites, a process that has often been repeated in the past and which (ironically) has usually determined the nature and current levels of preservation of numerous World Heritage assets [Markham, 2016].

An unexpected downside of heritage conservation, exemplified by the UNESCO list, is the discontinuity between the monuments and the people in the associated communities. The fundamental objective of heritage conservation is to protect the building or natural setting from degradation and/or irreparable loss. There is a noticeable emphasis on the past and an implied assumption that the authenticity of the tangible remains cannot be renewed. Heritage conservation practices emphasise the preservation of the original, the avoidance of falsification, the compatibility of restoration materials, and the need to distinguish between original and new materials. Since the past and the present are considered discontinuous, preservation usually selects a frozen “glorious” past phase of the monument and removes evidence of previous or subsequent (less desirable) phases [Poulios, 2014]. Life on the site stops in an attempt to preserve the landscape or the monument's desired features. This quest for authenticity has been denounced as an illusion [Lowenthal, 1985], but such criticism has failed to encourage the adoption of a different approach.

There is also a noticeable absence of meaningful engagement with communities and the public since no official World Heritage mechanism exists to ensure local input in the nomination and inscription process. A survey of nomination dossiers revealed that the local community is usually considered a threat to the site's survival, and the participation of local stakeholders in the identification and management of the heritage site is not deemed essential or even desirable [Tarvinga and Ndoro, 2003]. The result of this ambivalence is evident. Heritage authorities are keen to identify a local community that will derive concrete and substantial benefits from the designation of a monument as a World Heritage site while avoiding establishing a mechanism to ensure the community's involvement in site management [Poulios, 2014].

Cultural heritage faces more threats from its use as an economic resource. Affluent societies can often afford the cost of protecting and restoring monuments. Less affluent societies cannot afford similar levels of investment. It is frequently difficult or unethical to support heavy expenditures on preserving buildings or sites when local communities suffer from poverty. Cultural heritage is usually considered a non-renewable resource, bankable, and a development asset that could alleviate poverty and address the needs of destitute communities. This is the so-called “economy of heritage,” best exemplified in a slogan in the UK in the 1980s that proudly declared, “Preservation pays” [Ost, 2014]. However, economic opportunities and heritage conservation are not always compatible. Income from the growth of tourism can provide resources to assist in safeguarding and restoring monuments. After all, tourism is a significant source of income (and employment) in many countries. An adequately managed tourist strategy can provide local communities employment, income, and a sense of pride that will encourage them to continue protecting their cultural assets, generating all these benefits [Korka, 2014].

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### 5. CULTURAL ENTREPRENEURSHIP AND MONASTERIES

Cultural entrepreneurship refers to creating cultural businesses and promoting products and services with artistic value, simultaneously bringing economic benefits [Maniou et al., 2024]. An example of this entrepreneurship is the organisation of thematic routes starting from monasteries that connect cultural points of a city or region, attracting visitors, enhancing local development and promoting sustainability. The advantages of these initiatives include the promotion of cultural heritage, stimulating the local economy and creating new jobs [Maniou, 2024]. In Greece, religious tourism also significantly contributes to the economy and society. Visitors, whether pilgrims or tourists, support the local economy through accommodation, catering and the purchase of local products. In addition, the preservation and restoration of religious monuments creates new employment opportunities and enhances sustainable development [Maniou, 2023; Manola, & Papagrigoriou, 2020]. Greece provides a unique religious tourism experience, combining spiritual quest with cultural exploration. Through its religious monuments, traditions, and cultural wealth, it invites visitors to live a comprehensive experience [Tsatalbasoglou & Koltsikoglou, 2021]. Religious tourism not only contributes to the economic well-being of the local community, but also helps preserve each place's cultural heritage. Developing business activities around monasteries can strengthen the local economy, with visitors buying souvenirs, dining in local restaurants, and participating in cultural events. Tourism-related businesses, such as hotels, cafes, local product shops, and tourist offices, benefit from the proximity to monasteries. (Manola et al., 2023; Trikalitis & Manola, 2024)

Some of the businesses operating around monasteries include:

- ✓ Souvenir and local product shops: An everyday business activity around monasteries is shops selling souvenirs and local products. “Magnets” are a classic souvenir [Manola, 2020]. Shops operating near or inside monasteries often offer religious items, such as icons, prayer beads and candles, and local products, such as honey, herbs or wine. According to Shackley [2001], visitors prefer buying items representing their visit experience.
- ✓ Accommodation and restaurants: Another form of business activity around monasteries is the creation of accommodation. Traditional or modern accommodation can serve visitors' needs. In addition, local cuisine, primarily based on monastic recipes or regional ingredients, can attract tourists.

Cultural entrepreneurship in monasteries is a modern model of sustainable development, integrating cultural heritage and religious tradition with economic activities. With the development of religious tourism, monasteries are no longer limited to their spiritual mission but become pillars of local development, attracting visitors from all over the world while revitalising the local economy. (Maniou et al., 2024a ;Maniou et al., 2024b; Maniou et al., 2025).

### 6. CULTURAL ENTREPRENEURSHIP ACTIVITIES

**Organisation of thematic routes:** Monasteries are often the center of thematic routes that connect cultural monuments, religious sites, and natural landscapes. These routes attract visitors, promoting the local cultural heritage. For example, the route that includes the

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Monastery of Saint Raphael in Lesbos can be combined with visits to local archaeological sites and museums, attracting pilgrims and tourists with a cultural interest [Maniou et al., 2024; Manola & Trikalitis, 2022; Papaioannou et al., 2024)

**Conservation and restoration of monuments:** The restoration of historical monuments is another focal point of cultural entrepreneurship. Monasteries often receive funding to conserve their buildings, which creates new jobs and strengthens the local economy [Maniou, 2023]. Restoration contributes not only to the preservation of cultural heritage but also to the promotion of monasteries as tourist destinations.

**Production of local products:** Monasteries rely on the traditional production of local products, such as honey, wine, herbs, and soaps. These products are the result of centuries-old knowledge transmitted within the monastic communities. They are a source of income for the monasteries while contributing to the preservation of tradition and cultural identity of the region [Georgiou, 2017]. By purchasing these products, visitors support the monastic communities and participate in a circular economy based on sustainability.

**Promoting religious tourism:** Monasteries are a magnet for pilgrims and tourists from all over the world. Visitors either come for spiritual pursuits or to admire the architecture and art housed in monasteries [Tsatalbasoglou & Koltsikoglou, 2021]. Religious tourism is an essential source of income for local communities, as visitors stay in local accommodations, eat in restaurants, and purchase local products, enhancing the region's sustainable development.

## 7. BUSINESS ACTIVITIES AROUND MONASTERIES

**Souvenir and local product shops:** Visitors to monasteries often seek out items that will remind them of their experience. Shops operating near monasteries typically offer religious items, such as icons, candles, and prayer beads, as well as local products, such as honey, herbs, and wine, produced either by the monasteries or local producers [Shackley, 2001]. These businesses enhance visitors' connection to local tradition and heritage while financially supporting monastic communities and the local economy. (Manola & Balermipas, 2020)

**Accommodation and restaurants:** Visitors who come to worship or admire the monasteries need accommodation. This has led to the development of local accommodation that offers traditional and modern hospitality experiences. In many cases, the monasteries offer visitors hospitality, thus creating new business opportunities. At the same time, restaurants that offer local dishes based on traditional monastic recipes attract tourists who want to enjoy authentic gastronomic tradition [Manola, 2020].

Cultural entrepreneurship around monasteries benefits local communities in multiple ways. Beyond economic support, monasteries promote preserving cultural heritage and regional identity. Through these activities, visitors gain a deeper connection with the region's culture while contributing to the development of the local economy.

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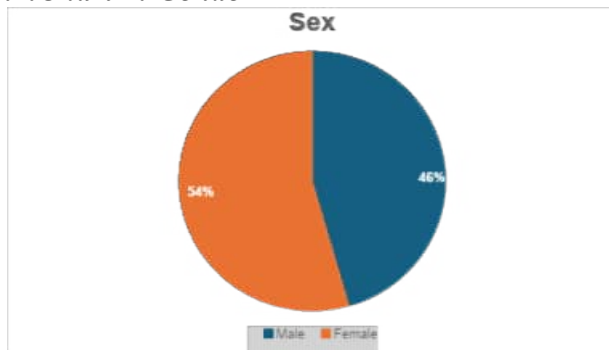
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### 8.RESEARCH RESULTS

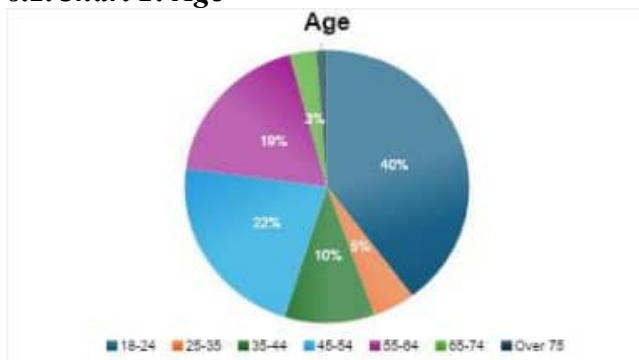
One hundred ninety-one questionnaires were correctly completed. The answers came from students, secondary school teachers, and the students' families and friends. The participants' results are initially presented by gender, age group, educational background, and place of residence. Most participants (54%) were men, and women accounted for 46% of the respondents.

#### 8.1.Chart 1: Gender



There was a considerable spread in the age of participants. The largest percentage of them belonged to the 18-24 age group (40%), followed by the 45-54 age group (22%), 55-64 age group (19%), and 35-44 age group (which accounted for ten per cent of respondents). The smallest age group was 51-60, making up approximately 4% of the respondents. Very few participants were from the older demographic groups (people over 65) or young adults aged 25-34.

#### 8.2.Chart 2: Age



Regarding the participants' level of education, half of them were university or Technological Educational Institute students. The second largest group were Middle School students (19%), while postgraduates and high-school students each accounted for approximately 15% (with postgraduates being marginally more numerous). Barely one per cent of participants were still in primary school, which seems pretty reasonable since visitors

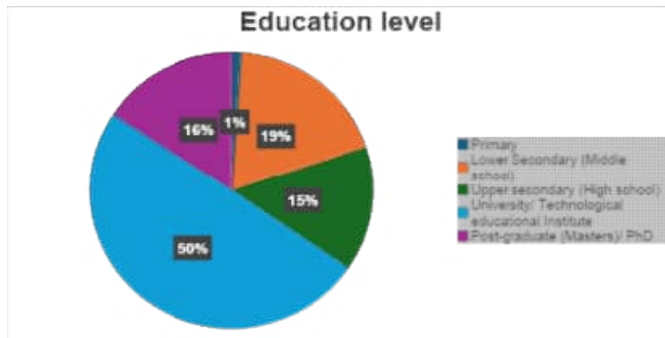
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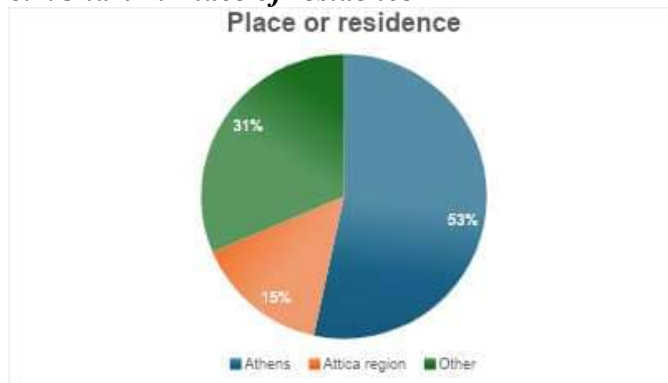
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who are so young would be rather unlikely to be interested in filling out a questionnaire about a cultural heritage monument.

### 8.3. Chart 3: Educational Level

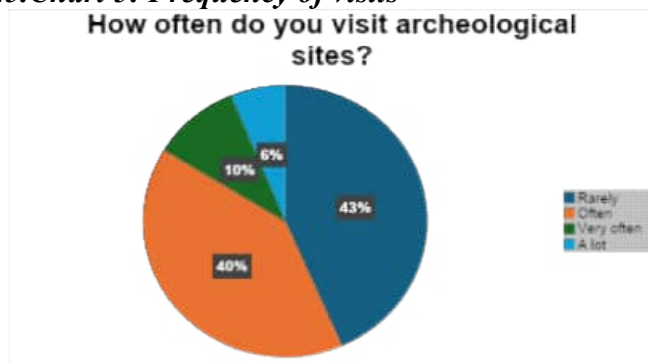


### 8.4. Chart 4: Place of residence



Most participants (68%) were residents of Athens or the wider Attica region. There is some ambivalence about whether this reflects the international popularity of Daphni Monastery as a heritage destination or simply the low number of foreign visitors to Athens at the time of the survey. Only a third of the participants resided somewhere outside Attica.

### 8.5. Chart 5: Frequency of visits



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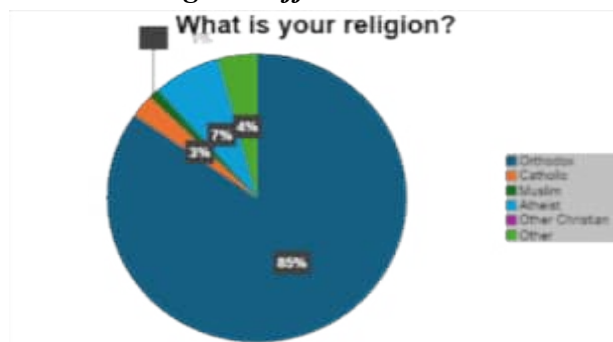
Regarding the frequency of visits to archaeological sites, 43% of participants responded that they rarely visit them, while forty per cent described themselves as frequent visitors. A small percentage (approximately sixteen per cent) declared a very high rate of archaeological site frequency. Overall, it seems that the Daphni Monastery can attract the interest and attention of people who consider cultural heritage a potential leisure destination and include it in their touring schedules.

### 8.6. Chart 6: Frequency of visits to monasteries



Although technically not a monastery, since no monks reside within its walls, Daphni Monastery is widely regarded as an archaeological site with a prominent religious aspect, so it would be interesting to explore whether religious tourism or religious faith and practices affect the number of visitors. According to the survey, it seems not to be a crucial factor. Almost six in ten participants said they rarely visit monasteries, while 29% said they often frequent such sites. A small percentage (4%) appear to be very passionate about monasteries and see them “a lot”.

### 8.7. Chart 7: Religious Affiliation



The religious affiliation of survey participants indicates that visitors of many denominations and religions chose to explore the Daphni Monastery. However, their numbers were relatively low, and the overall results are heavily skewed towards Greek Orthodox visitors (accounting for 85% of the survey participants), which seems consistent with visitors' place of origin. Most of them were from the wider Attica region. Despite the lack of quantitative data and the debate about the levels of secularisation in modern urban centres [Beaumont and Baker, 2011],



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the Greek Orthodox church still claims that most Attica residents are faithful to the doctrines of Eastern Christianity.

### 8.8. Chart 8: Sources of information

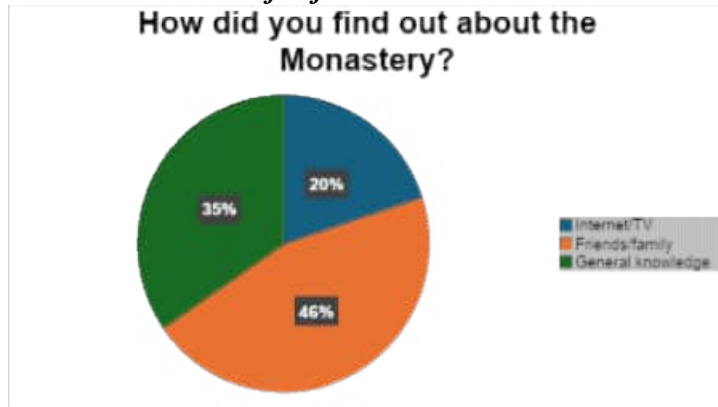
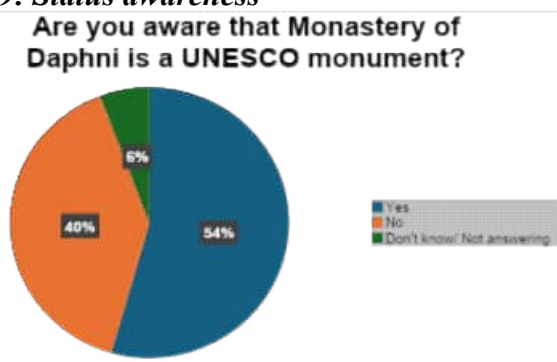


Chart 8 indicates that despite the Daphni Monastery's status as a UNESCO World Heritage site, almost half the participants claim they learned about it through family and friends (46%). The internet or television accounted for another fifth of the responses, with the rest falling into a broad category of unspecified sources of information. This is an area where more work could be done to expand knowledge about the monastery in Greece and perhaps overseas. Word of mouth is an important source of information. Still, it can hardly be considered an effective or efficient method to increase the monument's visibility and ensure wider benefits for the local community [Keller and Berry, 2003]. Chart 9 suggests that over half of the participants knew the monastery's status as a UNESCO World Heritage site (54%). Nevertheless, this number still implies that many visitors were unaware of the Daphni Monastery's cultural, archaeological, and historical significance before their visit.

### 8.9. Chart 9: Status awareness



Accessibility is a crucial factor determining the sustainable development and use of cultural heritage sites. Physical accessibility to remote sites can often be a serious challenge, but even access to urban monuments can be equally difficult or challenging for numerous reasons. Suitable transport to and from the site is essential but not always readily available [Adie, 2019]. The Daphni Monastery, although by no means remote, is situated in a somewhat

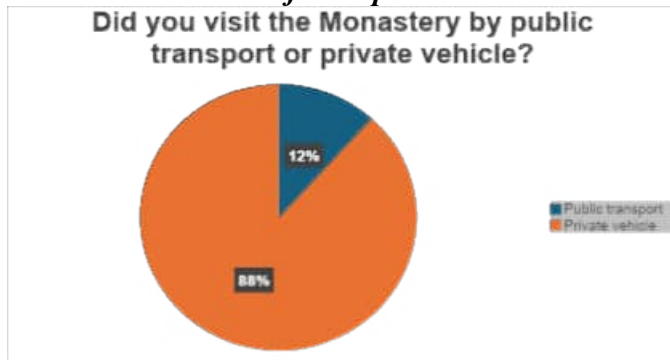
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awkward area, just outside the urban core and on the side of a major national road leading from Athens to the Peloponnese. Chart 10 reflects this difficulty. The vast majority of visitors used private vehicles to reach the site. Barely twelve per cent used public transport, which means a bus or taxi, since these are the only options available to potential visitors.

### 8.10. Chart 10: Mode of transportation

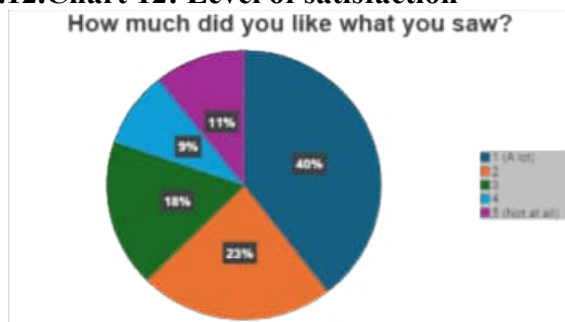


### 8.11. Chart 11: Ease of access



Considering the previous points, it is not surprising to discover that most people who chose to use public transportation to visit the Daphni Monastery encountered various levels of difficulty in accessing the site. A quarter of the participants claimed that access was difficult or demanding. Nevertheless, another substantial percentage (39%) seemed to have encountered almost no obstacles or complications and described access as easy.

### 8.12. Chart 12: Level of satisfaction



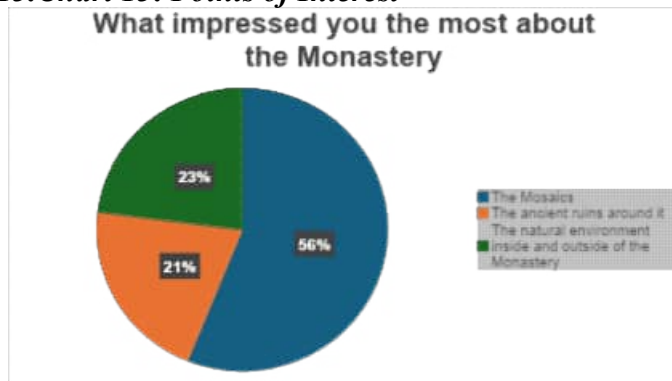
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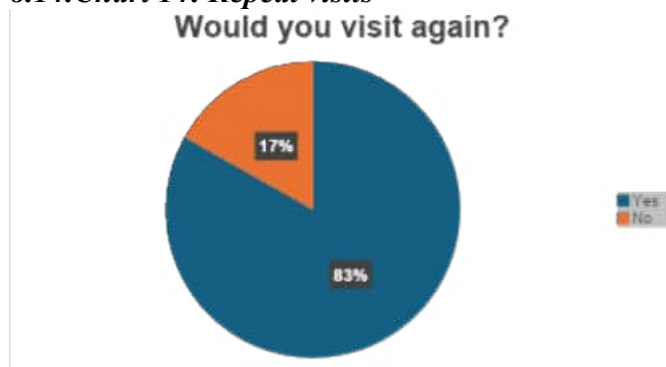
Visitors' satisfaction levels with what they encountered while at the Daphni Monastery varied but were generally positive. Forty per cent declared they liked what they saw a lot, while another 23% seemed equally pleased. Approximately a fifth of the visitors did not like what they saw. Still, the numbers were lower than those of people who never visit archaeological sites or monasteries, which could be considered at least favourable.

### 8.13. Chart 13: Points of Interest



Not surprisingly, the mosaics attracted most visitors' attention and are clearly listed as the most impressive element of their stay at the heritage site. Almost six in ten participants identified the mosaics as the main attraction (56%). The others focused more on the surrounding landscape (the monastery was built in a valley between two verdant mountains) and the ruins of the monastery's other buildings (the refectory, etc.).

### 8.14. Chart 14: Repeat visits



Irrespective of what particular point of interest attracted their attention, the participants' determination to revisit the Daphni Monastery in the future seems overwhelming. Four in five (80%) expressed a desire to return to the archaeological site at some point.

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### 8.15. Chart 15: Recommendations

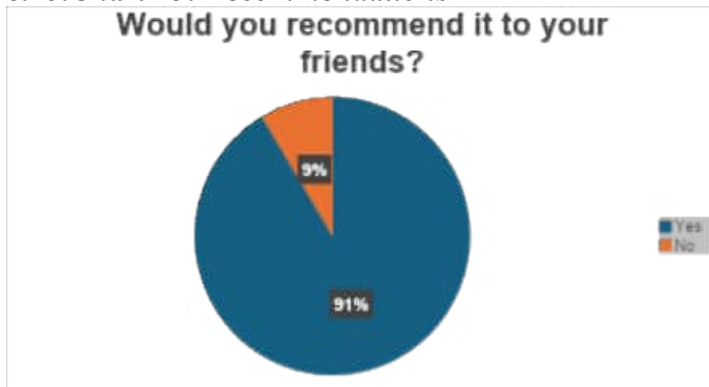


Chart 8 demonstrated the importance of word-of-mouth as a determinant of visitor numbers. Almost half the survey participants said they heard about the Daphni Monastery from family and friends. Chart 15 reinforces the point by showing an overwhelming desire to recommend the site to their family and friends. Less than one in ten seemed unwilling to suggest a visit to the monastery.

### 8.16. Chart 16: Guided tour availability



There is currently no guided tour offered at the Daphni Monastery. Visitors can explore the site independently and read about its history and significance on the available information panels. However, the survey suggests a strong desire for guided tours. Almost nine out of ten participants answered positively about the desirability of guided tours. There has been extensive research on the role of tour guides and a broad recognition of the multifaceted nature of their work. Scholars attribute pathfinding and mentoring roles to tour guides, who are often invited to supply traditional geographic way-finding information and logistical arrangements while acting as educators and spiritual advisers [Weiler and Black, 2014]. Since tour guides serve a crucial role as representatives of local people and cultures to visitors [Nelson, 2017], guided tours in Daphni Monastery would add value to a cultural product already recognised as important globally.

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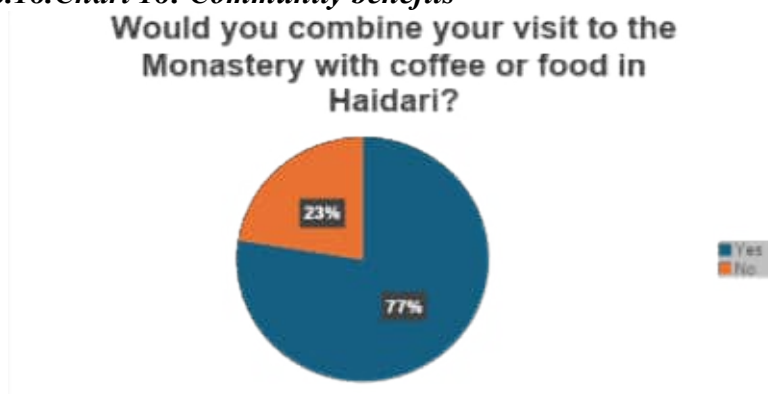
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### 8.17. Chart 17: Paying for guided tours



Chart 17 also reflects the strong demand for guided tours at Daphni Monastery. Although the survey did not consider cost, four out of five respondents (eighty per cent) expressed a willingness to pay for a guided tour.

### 8.18. Chart 18: Community benefits



Haidari is a suburban town west of Athens city centre. The municipality has a population of approximately 47,000. The Daphni Monastery is the oldest and most significant point of interest within its boundaries and the only UNESCO World Heritage Site in Attica (other than the Acropolis of Athens). Due to the monastery's location, Haidari is the closest area that provides amenities to visitors, with numerous coffee shops, restaurants, hotels, retail stores, etc. Therefore, the residents of Haidari can be considered the local community that would stand to benefit or suffer the most from the proper or improper development of the Daphni Monastery. Fortunately, there seems to be a corresponding willingness among visitors to the heritage site to take advantage of whatever opportunities are available in Haidari. Almost four out of five participants said they would combine their visit to the Daphni Monastery with food and/or coffee in Haidari.

## 9. CONCLUSION

The sustainable development of the Daphni Monastery requires the adoption of specific measures to improve accessibility, overall cleanliness, and visitor experience, always with

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respect for the historical and religious character of the monastery. It is essential to revamp public access by establishing a new and safe bus stop right in front of the monastery so that visitors are not forced to cross the busy highway, thus ensuring their safety and convenience. In addition, the recruitment of permanent cleaning and/or gardening staff will contribute to a permanent, thorough, and effective maintenance of the buildings and the surrounding area (including the gardens). The amelioration of common areas, such as paths and courtyards, is equally crucial, with regular maintenance and cleaning that will make them more welcoming for visitors.

At the same time, cultural and religious events in the monastery's courtyard can offer visitors a unique experience, provided they are held with absolute respect for the monastery's sanctity and historical value. Another helpful measure is the establishment of a kiosk near the entrance to the monastery, where visitors can purchase souvenirs and enjoy refreshments in a small cafeteria, enhancing the heritage site's sustainability.

Finally, improving signage and access to the café-restaurant next to the monastery will facilitate more visitors' visits. Proper landscaping will make the café more visible, and clear signs will make it more accessible and enhance the visitor experience. Through these measures, the Daphni Monastery can evolve into a model of sustainable development, combining the care of the historical site with modern visitor service.

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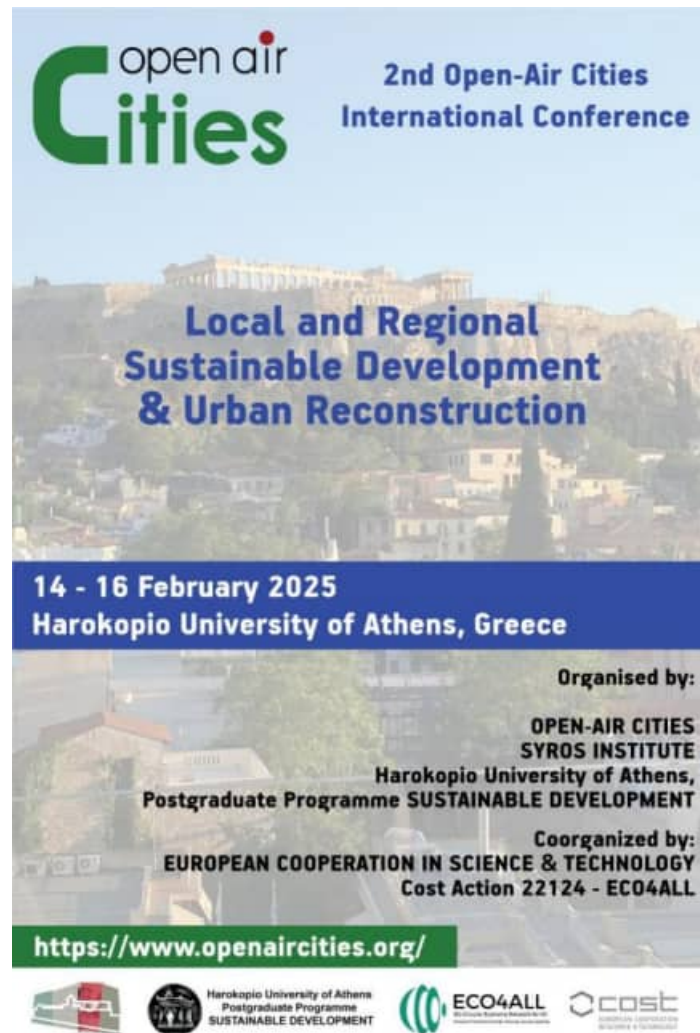
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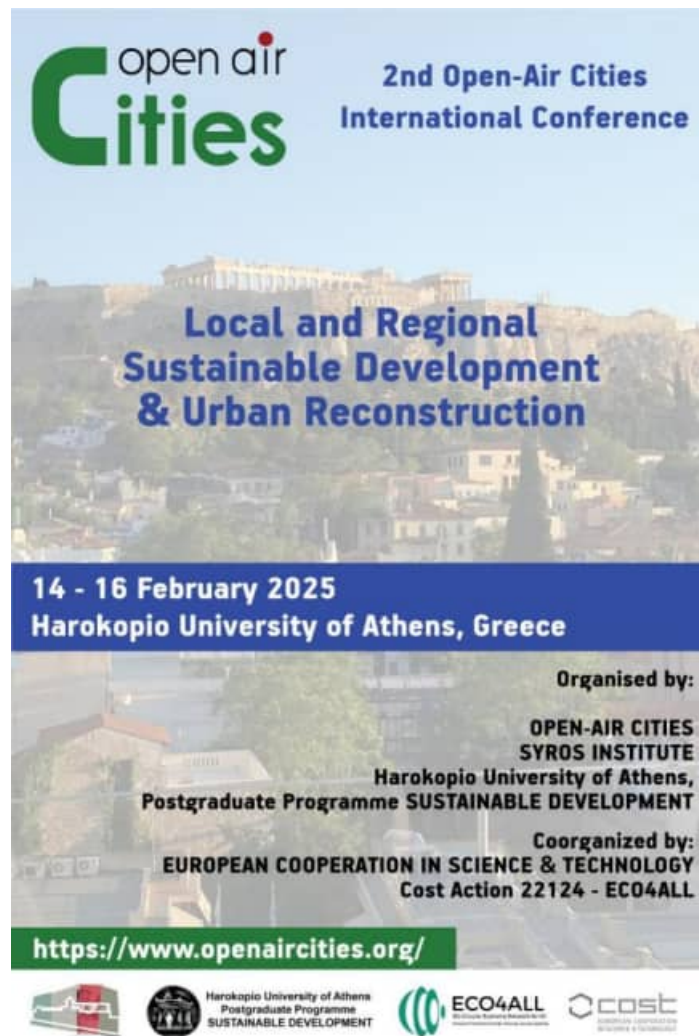
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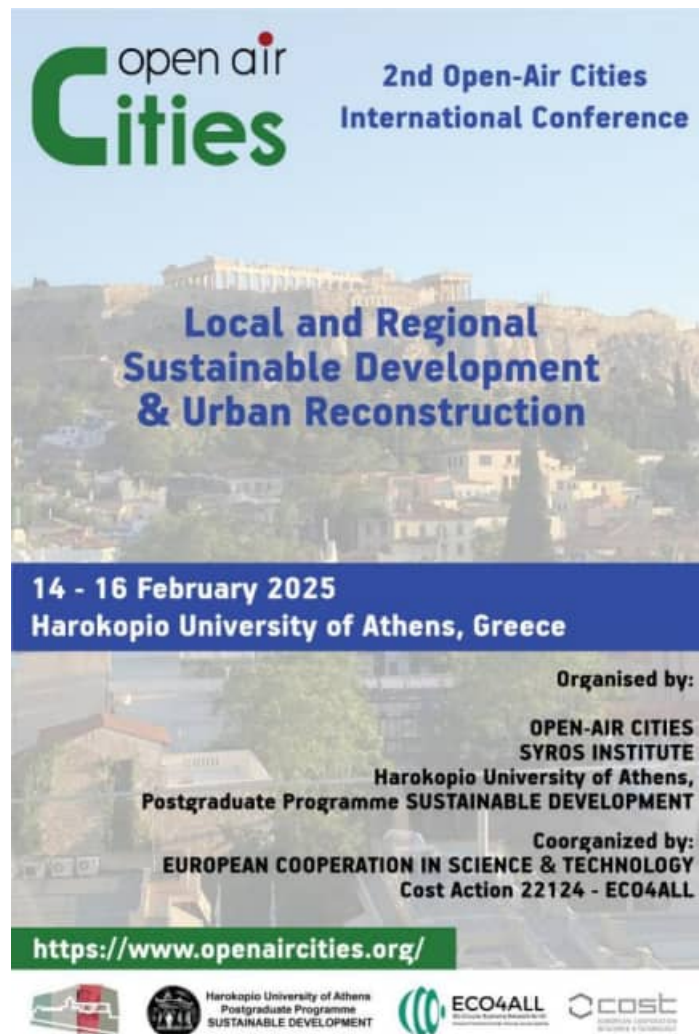




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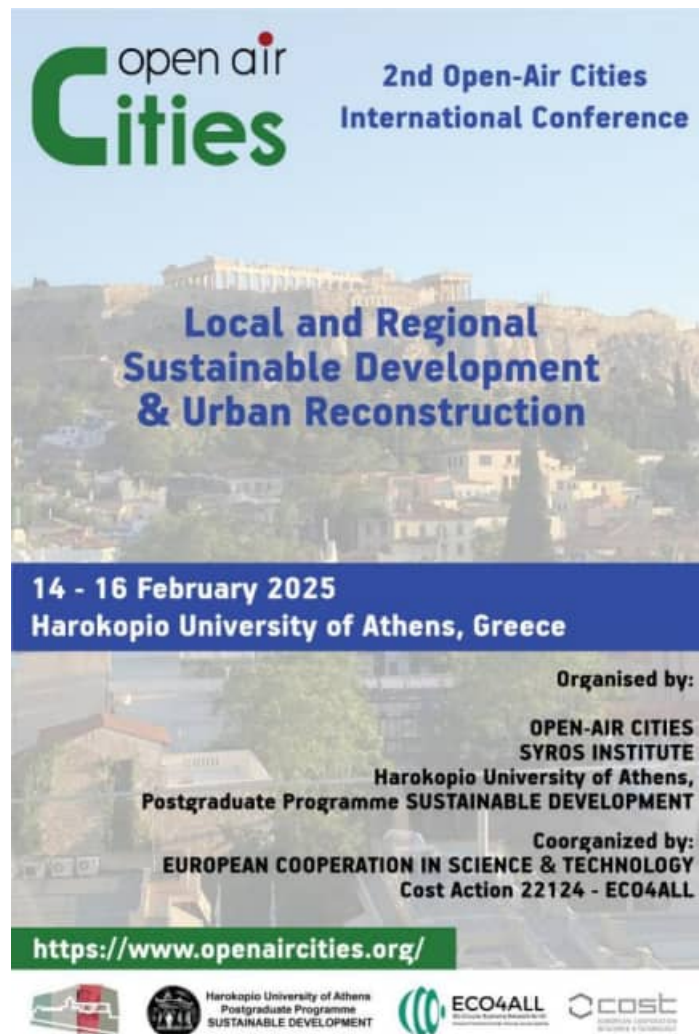
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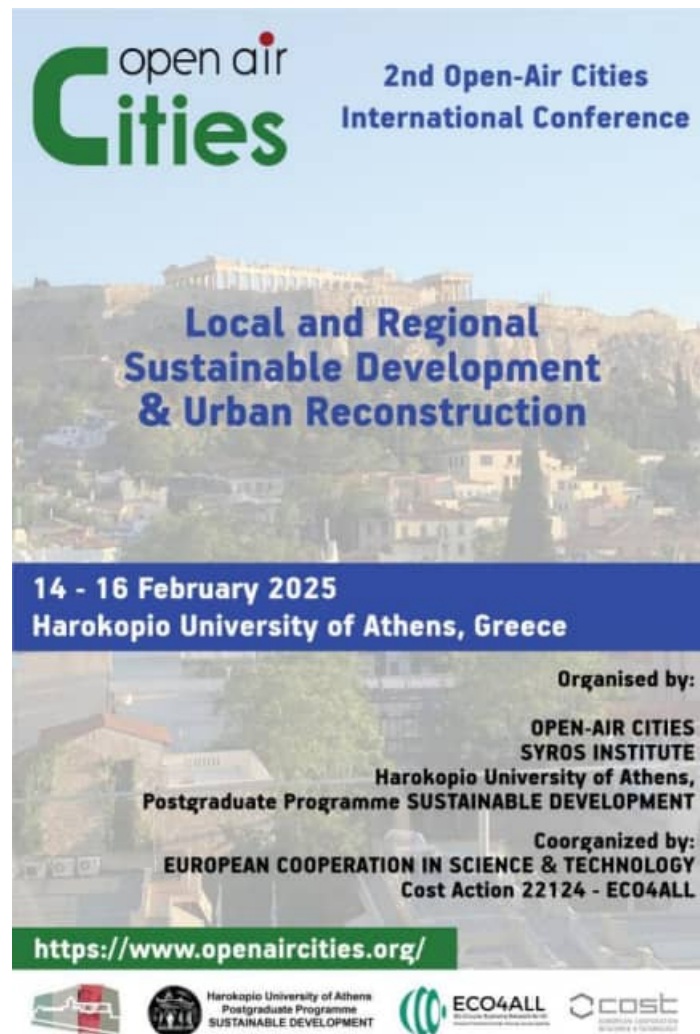
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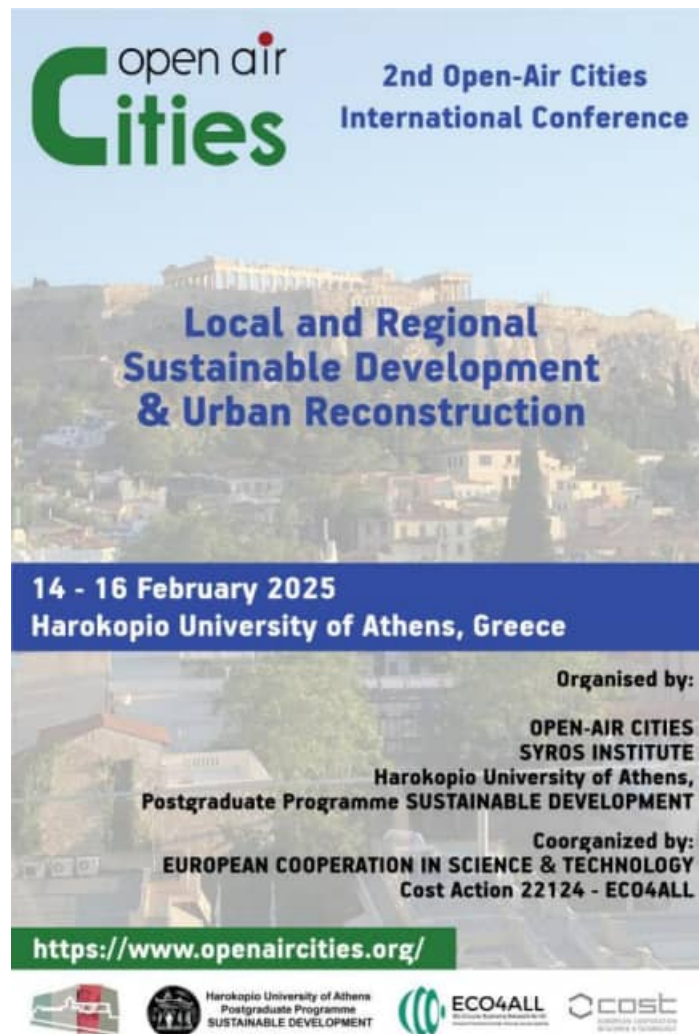
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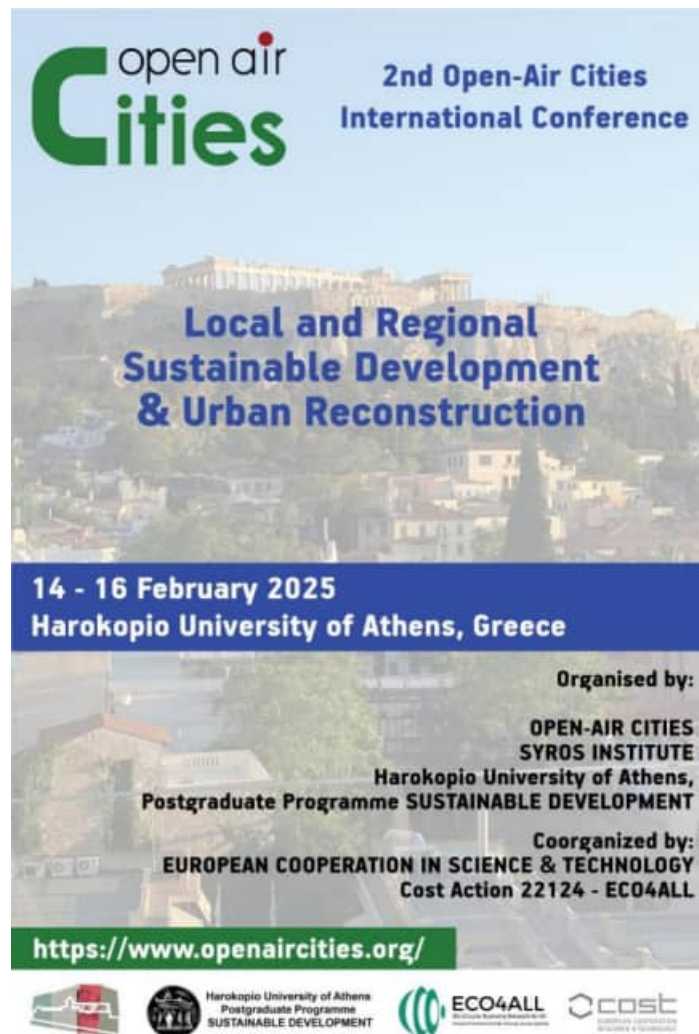
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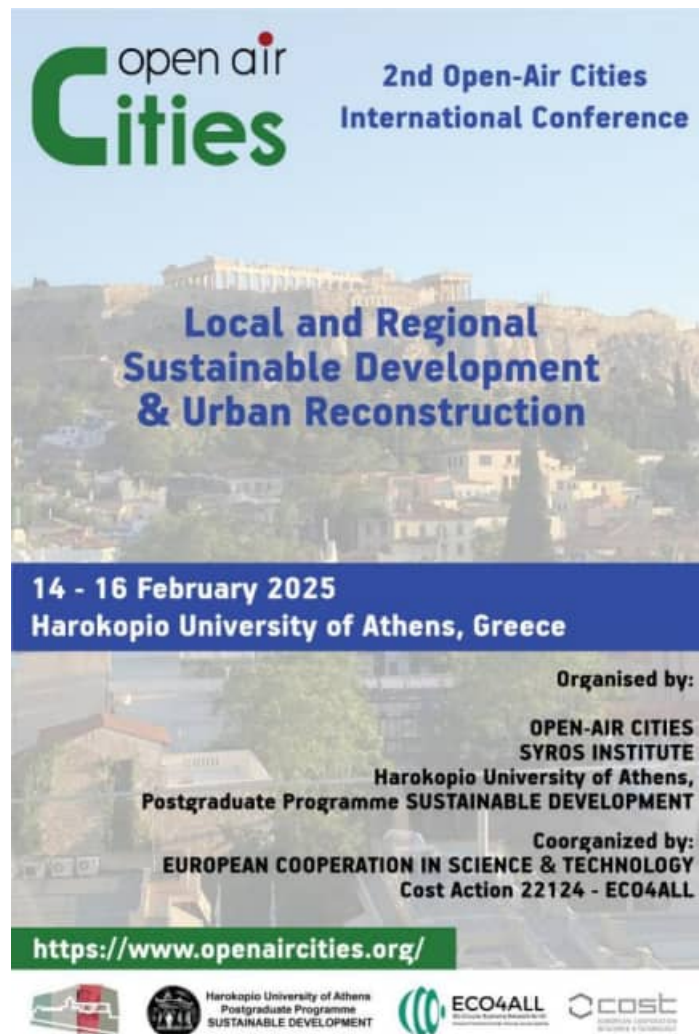
  



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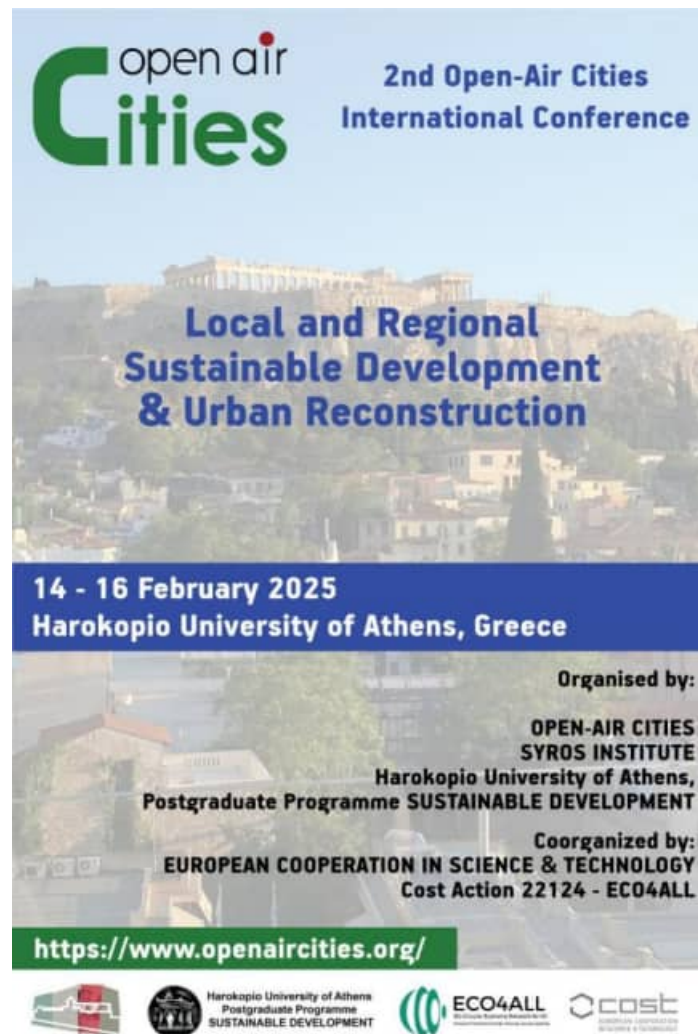
  



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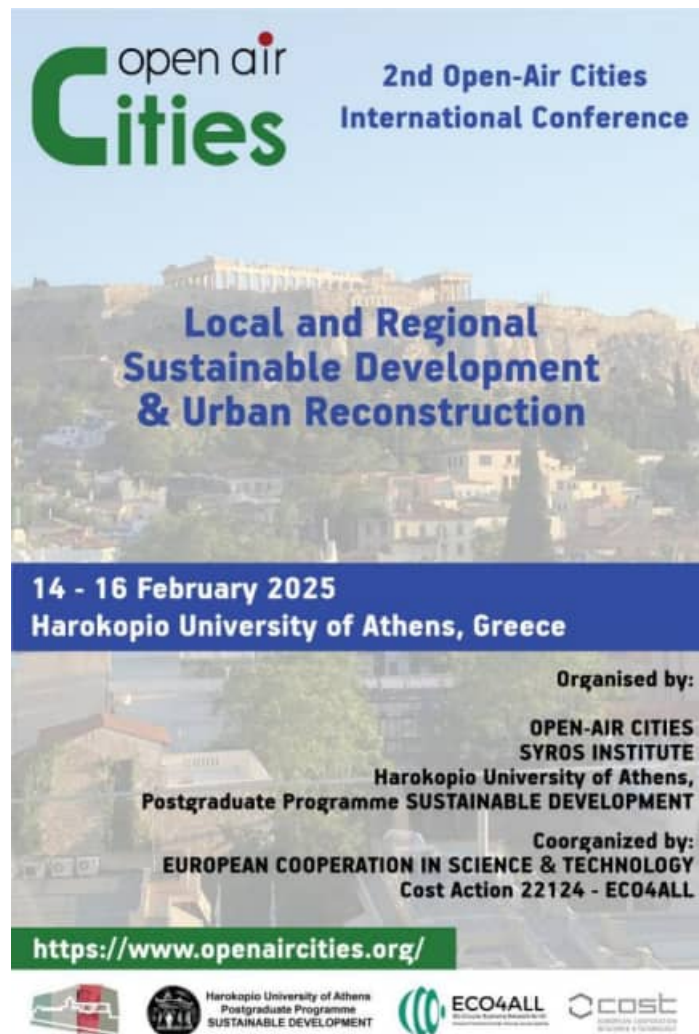
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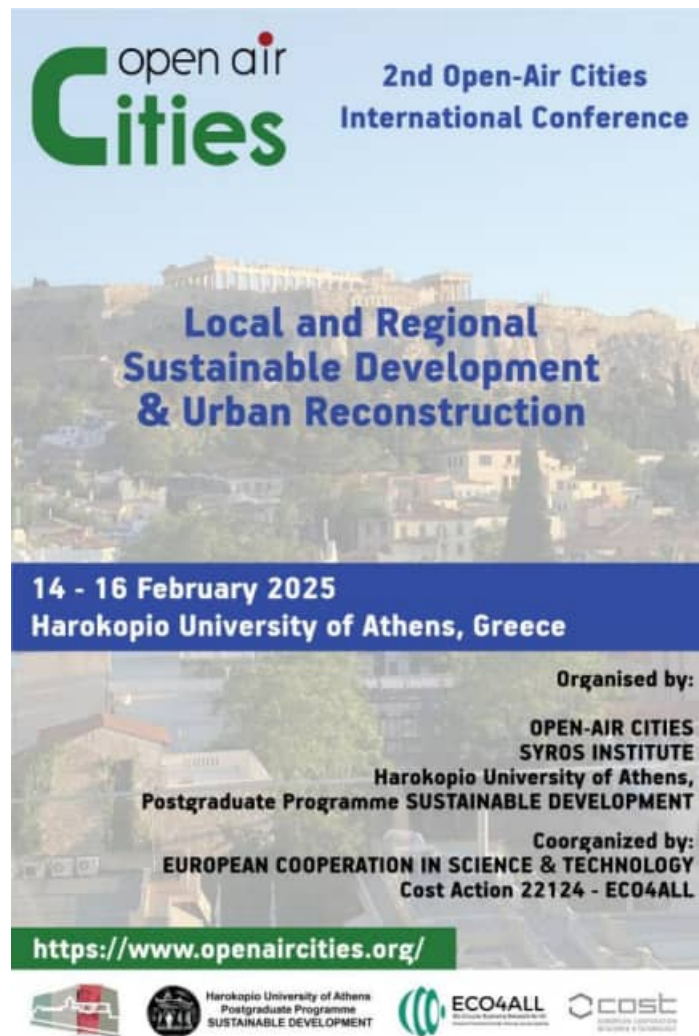
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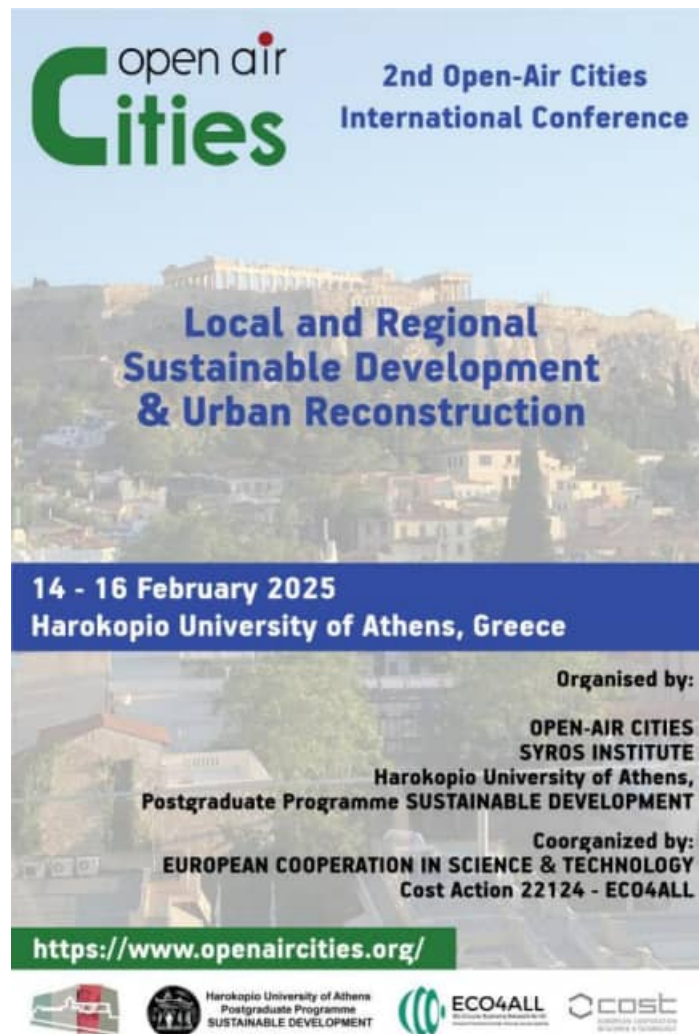
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### ART IN EDUCATION AND LANGUAGE AS FUNDAMENTAL TOOLS OF CULTURE AND TOURISM

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#### **Abstract**

Art in Education and Language as Fundamental Tools of Culture and Tourism Art in Education and Language are two essential means of expression and communication closely linked to culture and tourism. The integration of these elements can generate unique experiences that enhance both cultural understanding and tourist attraction.

Art in Education serves as a medium for cultivating creativity, imagination, and social interaction. Through its application, myths, historical events, and folkloric traditions can be represented, fostering a deeper understanding of the culture and identity of a region or community. This approach enables participants to actively engage with cultural elements such as language, customs, and traditions through an immersive, experiential process.

Language, as a core element of communication, adds another layer to Art in Education, allowing participants to connect with the linguistic heritage of a place and understand its importance in shaping cultural identity.

The connection between Art in Education, language, and tourism is particularly significant. Tourist destinations that incorporate local theatrical performances, language workshops, or dramatic reenactments provide visitors with opportunities to actively engage with the cultural heritage of a region. Through such initiatives, tourists transition from being mere spectators to active participants, experiencing culture through activities that blend play with education.

Furthermore, art and language initiatives in tourism can contribute to the preservation and revitalization of endangered traditions and dialects. These programs not only raise awareness among visitors but also provide economic and social benefits to local communities.

By integrating art and language into educational tourism strategies, regions can foster meaningful connections between people and place, creating memorable experiences that emphasize cultural authenticity.



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The interdisciplinary approach of combining Art in Education and Language highlights the importance of creativity and communication in shaping sustainable tourism practices. Such initiatives support cultural preservation while promoting global cultural exchange.

Ultimately, the synergy between Art in Education, Language, and Tourism offers a dynamic framework for celebrating and sharing the unique heritage of communities worldwide.

This study explores how integrating art and language in education enhances cultural appreciation, creativity, and social interaction while also contributing to the development of cultural tourism. A quantitative analysis involving 120 participants was conducted to examine perceptions of art and language as tools for cultural preservation and tourism growth. Statistical methods, including ANOVA and Pearson correlation, were employed to assess variations in perspectives based on demographic factors. Results indicate a strong consensus on the role of art in fostering creativity and engagement, whereas views on language preservation are more varied. The study highlights that integrating art and language into tourism experiences through theatrical performances, language workshops, and immersive cultural events transforms visitors from passive observers into active participants. Furthermore, these initiatives support the revitalization of endangered traditions and dialects while providing economic and social benefits to local communities. By adopting educational strategies that merge art and language, cultural tourism can create meaningful, authentic experiences that promote heritage sustainability.

**Keywords:** Art in Education, Cultural Heritage, Language Preservation, Tourism Engagement, Experiential Learning, Sustainable Tourism

## 1.INTRODUCTION

Art and language play a crucial role in shaping cultural identity and promoting tourism. They serve as essential tools for understanding, expressing, and preserving cultural heritage. Education, when infused with artistic expression and language studies, fosters a deeper appreciation of different cultures, making it a significant driver of cultural tourism. This paper explores how art in education and language function as fundamental pillars of culture and tourism. Additionally, it examines statistical evidence through empirical research to highlight the significance of these factors in educational and tourism sectors.

## 2.ART IN EDUCATION

Art in education plays a significant role in the development of both learning and social skills, promoting creativity, critical thinking, cultural understanding, and emotional intelligence. The contribution of art to the educational process is multidimensional, positively influencing students' personal and social growth, while enhancing the educational experience in innovative ways. Art in education offers students the opportunity to express their imagination and creativity through various mediums, such as painting, theater, music, and literature. This enhances their ability to think outside conventional frameworks and develop innovative



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solutions to problems (Eisner, 2002). Students learn to explore new ideas and develop a creative mindset that can benefit them in all areas of life.

Through art, students develop critical thinking skills, as they are called upon to analyze works of art, understand the intentions of the creators, and interpret the messages conveyed. This process encourages them to form their own opinions and support them with arguments, thus enhancing their critical abilities and self-confidence (Winner, 2007). Art provides students with the opportunity to express their emotions in ways that cannot be achieved through traditional teaching methods. Through visual expression, music, and theater, students develop their emotional intelligence, learning to recognize, express, and manage their emotions. This ability is crucial for the development of empathy and social awareness (Goleman, 1995).

Art is a tool that facilitates understanding and respect for different cultures and traditions. Through exposure to different artistic forms and cultural elements, students develop a broader view of the world and a deeper understanding of cultural diversity. This helps them become more tolerant and respectful toward other cultures, enhancing their social sensitivity (Dewey, 1934). Participation in artistic activities, such as teamwork in theatrical performances or collaboration on artistic projects, fosters the development of important social skills, such as communication, cooperation, and conflict resolution. Students learn to collaborate, exchange ideas, and resolve disagreements creatively, while developing skills that are useful in their future lives (Hetland et al., 2007).

Art in education is often associated with improving students' academic performance in other subjects. Studies have shown that students who actively participate in artistic activities exhibit increased problem-solving abilities, improved language skills, and better performance in mathematics and science (Rabkin & Redmond, 2006). The multifaceted nature of art gives students the opportunity to develop a wide range of skills that support them academically. Art provides students with a means of expressing their personality and ideas, which strengthens their self-confidence. As students create and present their own artistic works, they learn to appreciate their abilities and feel proud of their achievements. This process is particularly important for their personal development and boosting their self-esteem (Burton, Horowitz & Abeles, 1999).

Incorporating art into the educational process also contributes to the preservation of cultural heritage and local traditions. Through engagement with traditional art and local dialects, students learn to appreciate the value of their cultural identity and develop a sense of responsibility for preserving their cultural roots. Art, therefore, becomes a tool for the sustainable development of cultural heritage (Freedman, 2003).

### **3.ART - LANGUAGE - TOURISM**

Art, language, and tourism are three fields that, when combined, can significantly contribute to the preservation of cultural heritage, the strengthening of local identity, and the promotion of sustainable tourism practices. Art and language serve as means of communication and creation, while tourism provides the platform to showcase these elements to a wider audience. The synergy of these three factors leads to a comprehensive approach to highlighting and

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sustainably utilizing cultural heritage.(Manola& Papani, 2020 ;Manola, & Tsatambassoglou, 2021 ;Tsatalmpasoglou et al.,2024)

Art, whether through painting, theater, music, or other forms, has the ability to convey messages and cultural values without the use of verbal language. This allows visitors, regardless of their linguistic identity, to understand and appreciate the local cultural heritage. Through art, local characteristics and traditions can be showcased in a unique way, making them accessible to a global audience (Richards & Wilson, 2006). The integration of art into tourism initiatives, such as festivals, art exhibitions, and performances, creates a multisensory experience for visitors, enhancing their connection to the place and encouraging them to explore local traditions further (Donnelly, 2014). These experiences can transform the tourist from a passive observer into an active participant, increasing the sense of authentic and sustainable tourism.( Ikonomou et al.,2024 ;Tsatalbassoglou & Manola, 2024 ;Trikalitis, & Manola, 2024)

Language is a critical element of cultural identity and often reflects the unique traits of a local community. Through tourism activities that promote language, such as workshops on local dialects, thematic tours with a linguistic focus, or traditional storytelling, visitors can deepen their understanding of the linguistic and cultural heritage of a place (Smith, 2009). The preservation of endangered languages and dialects through tourism is not just an act of cultural conservation but also a means of promoting the local economy and cultural sustainability. Visitors, especially those seeking authentic experiences, tend to value interaction with the language, whether through learning basic phrases or understanding linguistic peculiarities that reflect the local culture (Crystal, 2000). Thus, language not only serves as a means of communication but also as a tool that strengthens visitors' connection to the local culture.

The combined use of art and language in tourism activities enhances the authenticity and sustainability of experiences. The visual arts utilize and expand students' imagination, inventiveness, and creativity (Galanos, 2011). Through visual expression and the use of language, visitors gain a more holistic understanding of the local culture, while also being encouraged to actively participate in the process of cultural revival (MacCannell, 1999). Local communities, through these initiatives, benefit both culturally and economically, as they create new job opportunities and support the sustainable development of the tourism sector. Art and language are not merely tools for tourism promotion but also means of cultural resistance and revival. Especially in regions where traditions and languages are under threat, these initiatives can be key drivers for their preservation and sustainable utilization (UNESCO, 2010).

Art and language in tourism, therefore, can play a decisive role in the long-term preservation of cultural identity. In various regions of the world, the integration of art and language into tourism activities has proven effective. For example, in Ireland, initiatives for preserving the Gaelic language through tourism include language lessons for visitors and theatrical performances that highlight local cultural heritage (O’Leary, 2007). Similarly, in Spain, visitors can participate in flamenco workshops, where they learn both about the art of dance and the local language and traditions (Selwyn, 1996; Maniou et al., 2024;Manola, 2022).

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### 4.METHODOLOGY

A quantitative study was conducted with a sample of 120 participants from diverse backgrounds, that is educators, students, and cultural professionals. A structured questionnaire was distributed to assess perceptions of art in education and language learning in relation to cultural identity and tourism. The study aimed to answer the following research questions:

1. How does art education influence creativity and social interaction?
2. To what extent does learning local dialects or languages contribute to cultural preservation?
3. Is there a significant difference in perceptions of art and language based on demographic factors (age, education, profession)?
4. What is the correlation between support for art in education and language preservation?

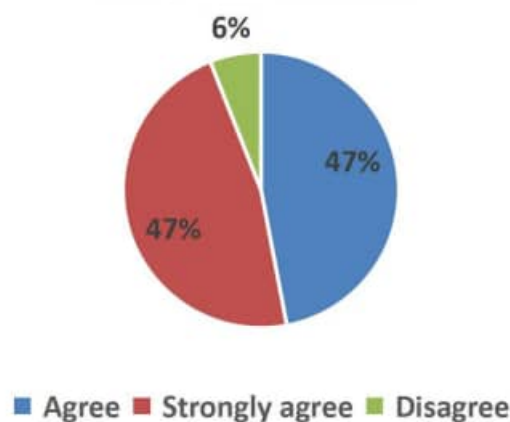
The independent variables included demographic factors such as age, education level, and professional background. The dependent variables were perceptions of art in education and language preservation. The responses were analyzed using statistical methods, including ANOVA and Pearson correlation, to determine significant patterns and relationships.

#### *4.1.Statistical Data & Results-Descriptive Statistics*

When participants were asked, "To what extent do you agree that art in education can enhance creativity and social interaction?", the majority expressed a positive stance. Specifically, 47% of respondents strongly agreed, while an additional 47% agreed, indicating a broad consensus on the significance of art in fostering creativity and social engagement. In contrast, only 6% of participants disagreed with this statement.

Similarly, in response to the question, "To what extent do you believe that learning local dialects or languages helps preserve cultural identity?", opinions were more varied. While 36% of respondents agreed and 18% strongly agreed with the statement, a notable 35% remained neutral. Meanwhile, 6% of participants disagreed, and 5% strongly disagreed, reflecting a broader spectrum of perspectives on the role of language in cultural preservation.

To what extent do you agree that art in education can enhance creativity and social interaction?

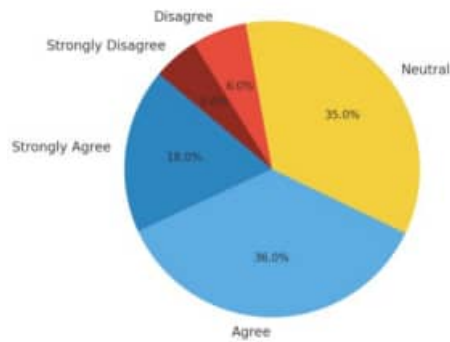


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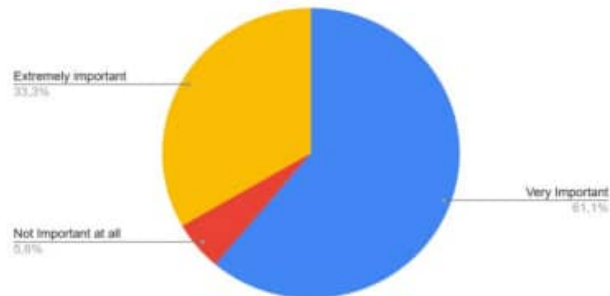
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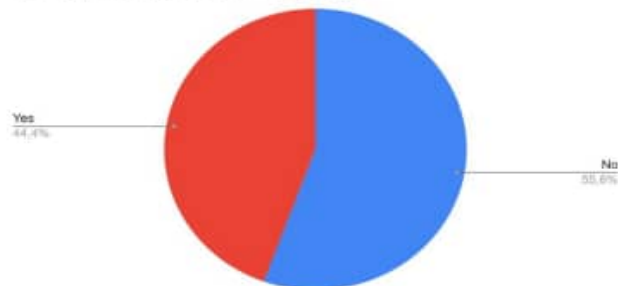
To what extent do you believe that learning local dialects or languages helps preserve cultural identity?



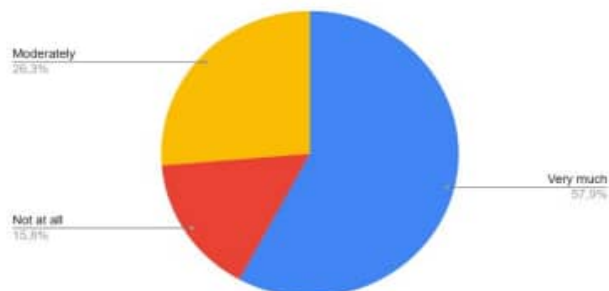
How important do you consider the integration of local stories, myths, or traditions into the educational process?



Have you ever participated in language workshops or dramatizations of cultural narratives?



If yes, how interesting was this for you?



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These findings underscore the strong endorsement of art as a means of enhancing creativity and social interaction, while also highlighting the diversity of opinions regarding the impact of local dialects and languages on cultural identity.

### **4.2. ANOVA Analysis**

To further analyze the data, an ANOVA test was conducted to examine potential differences in perceptions of art in education across various demographic groups. Specifically, the analysis considered participants' education level, categorized as High School, Bachelor, Master, and PhD, as well as their age group, divided into the ranges of 18–25, 26–35, 36–50, and 51 years and above. The results indicated no statistically significant differences between education groups, with a p-value of 0.87, and no significant differences between age groups, with a p-value of 0.79. These findings suggest that support for art in education remains consistent regardless of educational background or age.

Furthermore, an ANOVA test was conducted to explore variations in responses regarding the role of language in cultural preservation. Participants were grouped based on their level of agreement with the statement, ranging from *Strongly Disagree* to *Strongly Agree*. While the results showed slight variations among these groups, no statistically significant differences were observed, as indicated by a p-value of 0.64.

### **4.3. Correlation Analysis**

A Pearson correlation analysis was performed between responses on art in education and language preservation. The results indicated a weak negative correlation ( $r = -0.125$ ,  $p = 0.17$ ), suggesting that while both aspects are valued, individuals who strongly support one may not necessarily prioritize the other at the same level.

### **4.4. Analysis**

The data suggests a high level of agreement regarding the importance of art in education for fostering creativity and social interaction. However, opinions on language preservation are more varied. While a majority believe in its significance, a substantial portion of respondents remained neutral, which may indicate a lack of awareness or direct experience with language preservation efforts.

The absence of statistically significant differences among demographic groups suggests that the appreciation for art in education transcends age and educational background. This reinforces the notion that art is universally perceived as beneficial in education.

Moreover, the weak negative correlation between support for art in education and language preservation may indicate differing priorities among respondents. Those who emphasize the role of art may see it as a standalone tool for cultural preservation, while others may prioritize linguistic elements.

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## 5.CONCLUSION

Art in education is not merely a tool for enhancing creativity, but it is a significant factor in the holistic development of students. Its contribution is multidimensional, enhancing learning, cultural understanding, emotional intelligence, and social responsibility. Therefore, the integration of art into the educational process is crucial for shaping sustainable and socially aware societies.

Art, language, and tourism are three fields that, when combined, can significantly contribute to the preservation of cultural heritage, the strengthening of local identity, and the promotion of sustainable tourism practices. Art and language serve as means of communication and creation, while tourism provides the platform to showcase these elements to a wider audience. The synergy of these three factors leads to a comprehensive approach to highlighting and sustainably utilizing cultural heritage.

When art and language are combined in tourism, they offer not only unique experiences for visitors but also a means of preserving and promoting local cultural heritage. These initiatives enhance the sustainability of the tourism sector, providing long-term benefits for both local communities and their cultural heritage.

Art and language in education are indispensable tools for cultural preservation and tourism development. Art fosters creative engagement with culture, while language facilitates communication and transmission of traditions. Together, they enhance cultural tourism by making cultural expressions more accessible and comprehensible to global audiences. Governments and educational institutions should continue to support art and language education to sustain cultural heritage and drive tourism growth. Future research should explore qualitative aspects of cultural engagement through art and language, including case studies and in-depth interviews.

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# THE ITALIAN MONUMENTS IN LEROS AS HISTORICAL RELICS OR LIVING PARTS OF MODERN ECONOMIC LIFE

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## **Abstract**

*The Italian monuments in the Dodecanese, particularly on the island of Leros, are an important part of the region's cultural heritage, reflecting a unique blend of Greek and Italian history. Leros, shaped by thirty-one years of Italian rule, became a center of architectural and urban interventions. The Italian administration not only modernized the island but also left behind timeless cultural monuments that reflect the values of the era. These monuments, combined with the natural beauty of Leros, form a cultural bridge between Greece and Italy. By incorporating these monuments into cultural routes, their potential as tools for sustainable tourism and cultural exchange can be harnessed, enhancing appreciation for their historical significance.*

**Keywords:** cultural heritage, cultural routes, Leros, Dodecanese, Greece, Italy

## **1/INTRODUCTION**

Cultural and economic tourism are key pillars for the sustainable development of a destination, and Leros is a prime example of this dynamic. The island's historical and architectural heritage, with an emphasis on Italian monuments, acts as a magnet for visitors seeking authenticity, a connection to the past and the uniqueness of the place (Papageorgiou, 2019; Kostopoulos, 2015). At the same time, the economic tourism that stems from the increased tourist traffic strengthens local entrepreneurship, creates new jobs and contributes to the wider development of the region (Zannas, 2003). This coexistence of cultural experience and

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economic activity makes Leros an emerging destination that combines the preservation of cultural heritage with modern tourist demand (Manola, M. 2019).

The Italian monuments in Leros constitute a unique chapter in the history and cultural identity of the island. However, their role is not limited exclusively to their historical value (Manola, M. 2024) . On the contrary, these monuments have been integrated into modern economic and social life, functioning both as a reminder of the past and as a driving force for the development of the island. This dual dimension enhances their cultural, touristic and economic importance (Aegean Islands Portal. (n.d.).

## 2/HISTORICAL HERITAGE AND ARCHITECTURAL SIGNIFICANCE OF MONUMENTS

Leros, this small island in the Aegean Sea, bears the imprint of the Italian occupation (1912-1943), with the monuments of this period constituting a living chapter of its cultural and historical identity (Kolonas, 2002). The Italians designed and constructed a multitude of monuments and buildings, trying to transform the island into an important military and administrative center. Important works of the period include the Old War Hospital, the war installations, the settlements of Lakki, as well as public buildings, schools and churches (Venturini, 1988; Karnava, 2011).

The architecture of these monuments reflects the fascist modernism of the era, with a clear emphasis on geometric lines, functional constructions and the use of materials that were resistant to local climatic conditions (Ferrari, 1990). The Italians also tried to incorporate certain elements of the local architectural tradition, creating a unique composition that continues to impress both locals and visitors (Hellenic Ministry of Culture, 2015).

The following is a detailed list of all the Italian monuments built on Leros during the Italian occupation, as well as their importance as an integral part of modern life (Manola, M. 2024).

## 3/ITALIAN MONUMENTS IN LEROS

### *3.1. The Settlement of Lakki (Porto Lago)*

The settlement of Lakki is the most characteristic work of the Italian period in Leros. Built by the Italians to function as a center of administration and military management, Lakki was designed based on the standards of fascist urban planning (Venturini, 1988). The architect Roberto Brascia and other Italian designers created a settlement that stands out for its geometric lines, public buildings with large openings and functional infrastructure (Kolonas, 2002).

Important buildings in Lakki:

- ✓ The Municipal Market: An impressive building that currently houses commercial activities and tourist shops.
- ✓ The Italian Cathedral of Saint Francis: An architectural jewel that currently functions as an Orthodox church.
- ✓ The Former Italian Town Hall: An administrative center of the time, which now houses public services.

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### **3.2. Old Military Hospital (S. Andrea)**

The Leros Hospital, known as S. Andrea, is one of the most important buildings of the Italian occupation. It was built to serve the needs of the army and included modern healthcare facilities. Today, the hospital has been converted into the Leros History Museum, hosting exhibitions that highlight the island's turbulent history (Leros Military History. (n.d.) ).

### **3.3. Military Facilities (Leros Military History. (n.d.))**

The strategic importance of Leros led the Italians to build a number of military facilities:

- ✓ Fortifications at Partheni: An extensive network of forts and ammunition depots.
- ✓ The Seaplane Base: On the western side of Lakki, the Italians built seaplane facilities, strengthening the island's military and commercial connections.
- ✓ The Barracks in Lakki and Merikia: Today, these spaces are used for cultural events and exhibitions.

### **3.4. Public Infrastructure and Housing**

The Italians also designed workers' housing and public infrastructure, such as schools, squares and roads, with the aim of serving the military and civil administration.

Important examples:

- ✓ The Italian School in Lakki: Today it functions as a cultural space.
- ✓ The Rotunda Square: It was designed to be the center of social life.

### **3.5. The Naval Settlement in the Port of Agia Marina**

The Italians constructed buildings for the needs of the navy in the port of Agia Marina. These buildings are distinguished by their simplicity and durable construction. The Aerophone on Leros is one of the most important remnants of the island's military history, which played a crucial role during World War II. Leros, due to its strategic location in the southeastern Aegean, served as a key naval and air base, especially during the Italian occupation (1912-1943). The Italians, realizing its importance, fortified the island extensively, constructing defense infrastructures such as underground bunkers, gun emplacements, and warning systems, among which the Aerophone is included (Leros” by Neni Panourgia).

The Aerophone was a primitive but effective aeroacoustic detection system, which used large funnels or metal sound collectors to detect the movements of enemy aircraft before they became visible (Leros” by Neni Panourgia). This technology, developed in the early 20th century, relied on the ability to pick up sounds from long distances, giving anti-aircraft forces valuable time to prepare for air raids (The Aerophone of Leros).

The importance of the Aerophone peaked during the Battle of Leros (November 1943), when German forces launched heavy aerial bombardments to capture the island from the British and Italians, who had allied themselves with the Allies after Italy's armistice. Despite strong defenses, Leros fell to the Germans, marking one of the last major German victories in the Aegean (“Mount Patela and the Parabolic Acoustic Wall”).

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Today, the Aerophone is a rare and unique technological relic of the era, attracting the interest of historians, researchers and visitors. In combination with the other military fortifications and museums of Leros, it contributes to preserving the memory of a critical period in Greek and European history (“Unseen Leros”).

### **4/CULTURAL TOURISM DEVELOPMENT OF LEROS: THE ROLE OF ITALIAN MONUMENTS**

Leros attracts visitors from all over the world who are interested in discovering its history and architectural heritage. Tours of the Italian monuments, combined with the rich natural beauty of the island, enhance the tourist identity of Leros.

Beyond their architectural and historical value, the Italian monuments of Leros have become a key pillar of the economic development of the island. Many of them have been restored and reused, now serving modern needs (Zannas, 2003).

These spaces host:

#### *• Events and Exhibitions*

Many of the buildings from the Italian occupation are now used to host cultural events, such as art exhibitions, concerts and theatrical performances. This new use is reviving the interest of the local community and visitors (Syrigos, 2004).

#### *• Educational Activities.*

The schools of Leros have included in their programs visits and activities related to Italian monuments, in order to raise awareness among students about their historical and cultural value (Hellenic Ministry of Culture, 2015).

Leros, beyond its natural beauty, has a cultural identity based on its turbulent history and unique architectural heritage. The Italian monuments constitute one of the main pillars on which the economic and tourist development of the island can be based, offering new opportunities for both residents and businesses (Zannas, 2003).

The cultural heritage of Leros, centered on the Italian monuments, is a pole of attraction for a growing number of visitors interested in historical and architectural attractions (Papageorgiou, 2019; Aegean Islands Portal, n.d.).

- ✓ Multiculturalism: Leros attracts tourists who want to experience the unique combination of Greek and Italian architecture, as well as the military history of the island.
- ✓ Events and Festivals: The organization of festivals, such as thematic exhibitions on the Italian occupation, historical reenactment events and tours of Italian monuments, enhance the attractiveness of Leros as a tourist destination (Manola et al., 2023).
- ✓ Promotion of Special Tourism: In recent years, Leros has become known for diving tourism, focusing on the underwater shipwrecks of World War II. Combined with visits to Italian monuments, a comprehensive experience is created for the visitor (Maniou, 2023b).

The Italian monuments are a major attraction for tourism in Leros. Visitors wander the neighborhoodsof Lakki, photographing the impressive buildings, while participating in organized tours of the military sites (Komninos, 2002; Leros Island Official Website, n.d.).



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Many of these buildings have found new uses (Hellenic Ministry of Culture, 2015):

- ✓ Hotels and accommodations: Some old buildings have been converted into boutique hotels, offering a unique accommodation experience.
- ✓ Gastronomic Venues: Restaurants and cafes are housed in historic buildings, combining tradition with modern culture. (Manola, 2022a; Papaioannou et al., 2024).

## 5/TOURISM AND CULTURAL EXPLOITATION

One of the main ways of exploiting monuments is to integrate them into the tourist and cultural map of Leros. Places such as the Old Military Hospital have been converted into museums and cultural venues, attracting thousands of visitors every year. This cultural renaissance strengthens the island's tourist identity, making it an attractive destination for those interested in history, architecture and culture (Papageorgiou, 2019).

Visitors who arrive in Leros to experience the Italian monuments are not limited to day trips. Many stay overnight in local hotels, dine in restaurants serving traditional cuisine and participate in local activities, thus strengthening the local economy. Furthermore, cultural tourism is a sector that attracts high-income visitors, which increases the island's overall income (Zannas, 2003).

The conservation, restoration and management of the monuments have created new professional opportunities for the inhabitants of Leros. Architects, conservators, tour guides, as well as workers in the hospitality and catering sectors benefit from the activities related to the Italian monuments (Maniou, 2023b). At the same time, the organization of cultural events in these places enhances further the employment and participation of the local community (Leros Island Official Website. (n.d.)).

The recognition of the importance of the Italian monuments has also led to investment opportunities. International and domestic bodies have funded restoration programs, while local authorities have undertaken initiatives for the promotion and management of these monuments (Hellenic Ministry of Culture, 2015). These investments are not limited only to the restoration of the monuments themselves, but also extend to the island's infrastructure, such as roads, ports and hospitality services (Syrigos, 2004).

The Italian buildings in Leros form a significant part of the cultural heritage of the region, encompassing both tangible and intangible elements of social value. This cultural heritage extends beyond the buildings themselves and includes traditions, language, and religious practices. The authenticity of the past is linked to contemporary identity and cultural communication between generations and peoples. The entrepreneurial and touristic utilization of this heritage can contribute to the local economy, while sustainable development that respects the environment and local community is essential. The use of new technologies, such as digital mapping and virtual reality, offers new opportunities for promoting this heritage and enhancing tourism. (Maniou et al., 2025; Maniou 2023; Maniou 2024a; Maniou 2024b; Maniou 2024c; Manola, 2022b; Mitoula & Maniou, 2024).

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### 6/THE CONSERVATION AND MODERN USE OF MONUMENTS

The current state of the Italian monuments on Leros varies. While some have been restored and used, many of them remain in a state of abandonment. Nevertheless, interest in their conservation and promotion has increased significantly in recent years (Kostopoulos, 2015).

Despite the contribution of Italian monuments to the contemporary life of Leros, their exploitation is not always a simple matter. There are challenges related to preserving their historical authenticity, financing restoration projects and managing tourism (Hellenic Ministry of Culture, 2015).

The transformation of monuments into tourist attractions carries the risk of altering their historical identity. It is important that restoration projects respect the original architecture and do not transform the sites into commercialized attractions, disconnected from their historical significance.

The preservation of monuments requires significant financial resources. Although considerable investments have been made, securing stable funding remains a challenge. Furthermore, cooperation between public and private entities is essential for the sustainable management of these sites.

Increased tourist traffic can put pressure on the island's infrastructure and natural environment. For example, excessive visitor numbers can lead to deterioration of monuments or environmental degradation. It is essential to implement sustainable tourism development policies that ensure a balance between development and protection.

Leros has the potential to further strengthen its position as an international cultural destination, strategically utilizing its Italian monuments and historical heritage (Tsatalmpasoglou et al., 2024).

- ✓ International Promotion: Through cooperation programs with international organizations, Leros can be promoted as a model of cultural heritage preservation.
- ✓ Development of Digital Tools: The creation of digital tours, augmented reality applications and virtual tours can attract new types of visitors.
- ✓ Collaboration with Universities: Research and education around the monuments can bring students and academics to the island, strengthening its economy and cultural identity.

The Italian monuments on Leros have the unique ability to act as a bridge connecting the past with the present and the future. On the one hand, they remind us of the geopolitical importance and turbulent history of the Aegean. On the other hand, they contribute to local development, strengthening the island's economy and attracting international interest (Manola, 2022).

The future of these monuments depends on Leros' ability to manage them with respect and strategic thinking. With the right approach, these monuments can continue to inspire, educate and strengthen the economic life of the island, while maintaining their historical significance. In this way, Leros can emerge not only as a place of historical importance but also as a model of sustainable tourism and cultural development in the Aegean. In this way, the Italian monuments will remain living parts of local life, proving that history is not just a relic of the past, but an invaluable resource for the present and the future.

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While tourism is a key driver of economic growth, Leros needs to carefully manage the balance between tourism development and the protection of its Italian monuments. Excessive development can lead to deterioration, while a sustainable tourism strategy can ensure long-term benefits (Kostopoulos, 2015).

## 7/CONCLUSION

The Italian monuments on Leros are not simply historical relics of another era, but have become living parts of the island's contemporary economic and cultural life. Through their touristic exploitation, job creation and strengthening of the local economy, these monuments continue to contribute to the sustainable development of Leros (Venturini, 1988).

However, the challenge lies in maintaining the balance between economic exploitation and the preservation of their historical and cultural authenticity. Leros is called upon to face this challenge with responsibility and long-term planning.

The integration of monuments into modern life should not lead to the degradation of their cultural value. On the contrary, preserving authenticity, highlighting their historical significance and raising awareness among the local community and visitors are essential steps for a sustainable approach. Education, events, and the promotion of academic research around Italian monuments can enhance collective understanding and ensure their protection.

Furthermore, local authorities and entrepreneurs are called upon to maintain a balanced tourism policy that will ensure the quality of the visitor experience, without affecting the daily lives of residents or the natural environment. The monuments, as symbols of historical heritage, belong not only to Leros but also to the collective memory of the Mediterranean. Thus, their preservation concerns not only the local community, but also the international cultural landscape.

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### RELIGIOUS FESTIVALS AND CULTURAL ENTREPRENEURSHIP IN THE MONASTERIES OF LESVOS FROM THE TIME OF THE TRAVELLERS TO THE PRESENT DAY

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#### Abstract

Religious festivals are important events linked to religious traditions, festivals or important events and are crucial for religious life in different countries and cultures. These festivals, while differing according to religious and cultural traditions, have common characteristics that include spirituality, worship and the connection of believers to the divine. At the same time, they offer cultural and tourism value as they attract crowds of devotees, tourists and visitors from different corners of the world.

The holy monasteries of Lesvos play an important role in the history and culture of the island, while the religious festivals associated with them have contributed to the development of cultural entrepreneurship from the time of the travelers until today. The interaction of monasteries with religious tourism and the local economy has evolved over the years, creating opportunities for small and medium sized businesses. Tourists visiting Lesvos in the 19th and 20th centuries often described the unique natural beauty of the island and its impressive monasteries. These descriptions brought to the fore the spiritual and cultural importance of monasteries, such as the Holy Monastery of Limon and the Holy Monastery of Ypsilos. The monasteries functioned not only as spiritual centres, but also as centres for the production of local products, such as olive oil and wine, offering hospitality to travellers and attracting pilgrims and visitors. This timeless function of the monasteries was an early form of religious tourism. In modern times, religious festivals around the holy monasteries remain central to the religious life of Lesvos, while at the same time they are a driving force for the local economy and cultural entrepreneurship.

**Key Words:** religion, festivals, cultural entrepreneurship, cultural entrepreneurship, outermost islands, Lesvos



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### **Special session: SUSTAINABLE DEVELOPMENT, SOCIAL SUSTAINABILITY AND SOCIAL POLICY: TRENDS, TRANSFORMATIONS AND RISING CHALLENGES**

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#### **Abstract and Topics**

Sustainable development is based on three interrelated and equally important pillars; the environmental, the economic and the social one. The environmental refers to the preservation and respect of the natural ecosystem and its functions; the economic is related to the creation of stable economic systems that ensure social justice without hindering the functioning of the free market while respecting the environment; and the social involves building a framework that promotes the well-being of the whole population with the ultimate aim of preserving social cohesion (Ekins, 2000, Burford et al 2013), while reducing social discrimination.

Social sustainability constitutes one of the main theoretical pillars of the sustainable development concept (Baker et al, 2005; Castro, 2004), although it is open to variations in its content and meaning, as there is no commonly accepted definition so far (Shirazi & Keivani, 2019). In any case, this concept refers to the need to create a society that contains all the conditions for sustainable development in terms of equality, social justice, opportunities, equal life-chances and social well-being (Nussbaum & Sen, 2002, Papadakis & Tzagkarakis 2024).

The inclusion of social sustainability in the sustainable development conceptualization is first identified in the Brundtland Report (WCED, 1987) and the Rio reports of the United Nations (UN, 1992), in which a synthesis of the ecological, economic and social dimensions of social development takes place. Hence, these three areas were called dimensions or pillars of the concept of sustainability. At the same time, these pillars are not independent of each other but are interrelated and the existence of all three is a necessary condition for forming a comprehensive content to the concept of sustainability. In any case, the concept of social sustainability is related both to environmental issues and to issues of social well-being and cohesion, while considering the contribution of the private and public sectors to the processes of achieving these objectives, i.e. improving living conditions on equal terms.

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The United Nation’s (UN) most recent “Agenda 2030” for Sustainable Development (“Transforming our world: the 2030 Agenda for Sustainable Development”), signed in August 2015, sets 17 global strategic goals that will balance social, economic and environmental needs and commit to the effective implementation of Sustainable Development. At the same time, in the European Union, the establishment of the European Pillar of Social Rights in 2017, sets certain objective in the course of satisfying social rights, thus making a crucial step towards social sustainability (ETUI, 2021). Although European integration in social issues has not taken a comprehensive dimension, the European Pillar of Social Rights is particularly important because it includes the principles and necessary values in order to achieve social prosperity and social cohesion, thus social sustainability.

The economic crisis, the pandemic and the current energy crisis highlight the necessity of the welfare state in protecting citizens from the multidimensional economic and social risks that are being reproduced, multiplied or readjusted (Papadakis & Tzagkarakis 2024). At the international level, the socio-economic context is becoming more complex, with more interdependence and a speed of events that is constantly increasing (Schwab & Malleret, 2021), creating new challenges for achieving economic, environmental and social vulnerability. The permacrisis era (multiple crises- see Oyelere et al 2023), along with the Mega-Trends that are taking place and seem to gradually prevail (e.g. globalization, digital economy, digitalization, demographic and social changes, climate change, etc.- Eurofound, 2020: 3-4) have a clear impact on the structure of economy and labour market, industrial relations systems, and business models.

All the abovementioned highlight that the respective public policies need to be more prepared for phenomena that one might mistakenly consider rare and pose a series of news challenges for a true and actual sustainable development within momentous times (see Papadakis et al 2024).

Given the abovementioned, the **key topics of the present Session** are the following:

- Sustainable development and social sustainability: Theoretical Insights and Definitional Issues
- The role of the (active) Welfare State for Social Sustainability
- Social Policy and Social Substantiality
- Social sustainability challenges in Europe and Globally
- Social Sustainability within the framework of a) the UN “Agenda 2030” for Sustainable Development and b) European Pillar of Social Rights
- Perma-Crisis, Mega Trends and Social Sustainability
- The (actual and potential) role of Education, LLL, Employment, Public Health and Social Care in social sustainability
- The interrelation among social, economic and environmental sustainability.
- Social vulnerability, socio-economic inequalities, economic and employment precarity as challenges for the actual achievement of social sustainability
- Multiculturalism, refugee-migrant Crisis and the stake of migrants and refugees’ social inclusion
- Policy Learning towards social sustainability: analyzing best practices
- Social Sustainability, within the public policy complex.

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# MEGATRENDS, THE NEW EUROPEAN STRATEGY ON SUSTAINABLE DEVELOPMENT AND THE ROLE OF EDUCATION, EMPLOYMENT AND RESKILLING IN SOCIAL SUSTAINABILITY

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## Abstract

In the era of perma-crisis (namely the multiple and consequent crises, from the 2008 credit crunch crisis and the resulting recession under the austerity doctrine to the onset of the refugee-migrant crisis in 2015, the COVID-19 crisis, and the current energy and inflation crisis), socio-economic problems and inequalities augmented, causing further strain on social cohesion of modern societies. Additionally, the impact of the ongoing Megatrends (i.e. digital economy) is more than evident and persistent in the above-mentioned.

The concept of social sustainability is related both to environmental issues and to issues of social well-being and cohesion, while considering the contribution of the private and public sectors to the processes of achieving these objectives, i.e. improving living conditions on equal terms.

Taking all the above-mentioned into account, the present paper analyzes the role of both Employment and Education (in their capacity as key components of the Welfare State), in social sustainability. The research methodology, use, is based on literature review and secondary quantitative analysis.

Hence, the paper briefly analyses a) the key determinants of the new European Strategy on Sustainable Development (2021-2030), b) the state of play in education and employment in the EU (emphasizing, among others, issues such as the rise of precarious employment and its correlation to social vulnerability and in-work-poverty, the association between educational capital and employability, the socio-economic inequalities' impact on education etc) and c) the ongoing transformations in the labour market, the (so-called) “future skills”, aligned with “future jobs” and the role of reskilling (via VET) in coping with the demands of the changing Labour Market. Within this context it investigates the critical dimensions of the

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current and future role of Employment, Education and Reskilling in sustainability and in particular in social sustainability, as well as the major policy challenges in these substantial domains of the Welfare State.

**Key Words:** Mega-Trends, European Strategy on Sustainable Development, Social Sustainability, Education, Employment, future skills and jobs, Welfare State

### 1. Preliminary Remarks

Gradually, during the political and academic discourse and the relevant policy initiatives on sustainable development, it became evident how necessary is to find viable solutions that combine ecosystem protection while promoting economic and social progress (Papadakis & Tzagkarakis 2024: 105; Baker et al, 2005; Castro, 2004).

Social sustainability is not only an analytical but also a normative concept, as it is based on rights derived from nationally and internationally recognized treaties as well as social norms. Consequently, social sustainability refers and relates to the quality of societies (see Papadakis & Tzagkarakis 2025 and Tzagkarakis 2023).

### 2. The EU Strategy towards Sustainable Development and Social sustainability

Sustainable development has become the focal point of the EU Strategy towards 2030. The High-Level Political Forum is the main United Nations platform on sustainable development. It has a central role in the follow-up and review of the 2030 Agenda for Sustainable Development the Sustainable Development Goals (SDGs) on a global level.

Sustainable development is a core principle of the Treaty on European Union and a priority objective for the EU's internal and external policies (see: [https://commission.europa.eu/strategy-and-policy/sustainable-development-goals\\_en](https://commission.europa.eu/strategy-and-policy/sustainable-development-goals_en)).

Hence, according to the European Commission, “the importance of consistently progressing towards the SDGs and engaging with partner countries and civil society as well as the Union’s representation at high-level international fora, including the United Nations High-Level Political Forum on Sustainable Development, is crucial to advance the EU’s commitment to and leadership in sustainable development” (see: [https://commission.europa.eu/strategy-and-policy/sustainable-development-goals/eu-and-united-nations-common-goals-sustainable-future\\_en](https://commission.europa.eu/strategy-and-policy/sustainable-development-goals/eu-and-united-nations-common-goals-sustainable-future_en))

The European Commission has adopted an holistic approach for sustainability and the SDGs. Within this context, the European Commission has focused on delivering concrete actions that will bring tangible progress in the areas of the Sustainable Development Goals (SDGs). The President’s political guidelines and the Commission’s annual work programmes constitute this Commission’s strategy to implement the SDGs (see analytically: [https://commission.europa.eu/strategy-and-policy/sustainable-development-goals/eu-whole-government-approach\\_en](https://commission.europa.eu/strategy-and-policy/sustainable-development-goals/eu-whole-government-approach_en))

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**Figure 1: European Commission’s Priorities**



**Source:** European Commission 2024

The Commission’s comprehensive or “whole of government” approach to implementing the Sustainable Development Goals (SDGs) comprises several strands (see analytically: [https://commission.europa.eu/strategy-and-policy/sustainable-development-goals/eu-whole-government-approach\\_en](https://commission.europa.eu/strategy-and-policy/sustainable-development-goals/eu-whole-government-approach_en)), within the framework of a multi-level governance approach.

**Figure 2: EC Whole Government Approach towards SDGs**



**Source:** European Commission 2024

### 3. Social sustainability challenges in Europe: On the State of play

The Social Policy-related Factors that contribute to social sustainability include all those factors related to the satisfaction of basic needs and the improvement of life quality. Therefore, they are related to the level of individual income, poverty, income distribution, unemployment, education, training and lifelong learning, housing, health, insurance and employment that satisfies both material and psychosocial needs (see Papadakis & Tzagkarakis 2024 and Tzagkarakis 2023). The achievement of these goals-factors can only be realized if there is a



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level of social justice that implies fairness in terms of opportunities for quality of life and participation in civil society (Nussbaum & Sen, 2002; Löffler, 2004).

The economic crisis, the pandemic and the current energy crisis highlight the necessity of the welfare state in protecting citizens from the multidimensional social risks that are being reproduced, multiplied or readjusted (see Papadakis & Tzagkarakis 2025).

At the international level, the socio-economic context is becoming more complex, with more interdependence and a speed of events that is constantly increasing (Schwab & Malleret, 2021), creating new challenges for tackling social vulnerability and enhancing social cohesion.

The Permacrisis era (multiple crises which form a context of permanent crisis) highlights that the respective public policies need to be more prepared for phenomena that one might mistakenly consider rare (see Oyelere et al 2023 and Papadakis & Tzagkarakis 2025).

The Covid-19 pandemic, as well as all other crises occurred the last decades, is not a "black swan" phenomenon but a "white swan" phenomenon (Schwab & Malleret, 2021: 34), as humanity has experienced similar situations many times in the past (Huremovic, 2019). At the level of social policy, permacrisis legacy indicates the importance of an organized, effective and inclusive welfare state (Papadakis & Tzagkarakis 2024).

#### **4. The role of employment for social sustainability**

Employment is one of the key development factors and at the same time, constitutes the basic precondition for achieving social sustainability, as on the one hand, it plays a key role in meeting needs and on the other, it improves living conditions by combining the satisfaction of social and environmental factors.

Employment, which is the dominant factor for achieving individual autonomy, through the existence of appropriate norms, institutions and normative-protective frameworks, could achieve individual well-being if promoted in a socially just context within the framework of an active Welfare State (Drakaki et al 2022, Papadakis et al 2022).

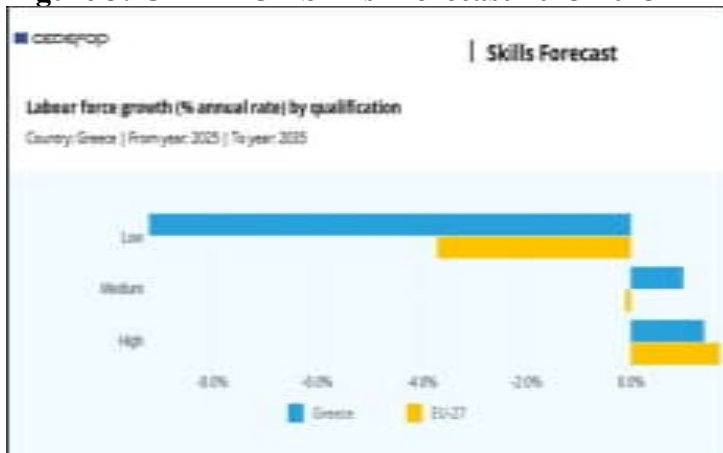
Within the EU, despite the fact that the unemployment rate is at its lowest level since the onset of the 2008 Mega-Crisis (April 2024: 6%), the quality of employment seems to decrease, mainly due to the rising of precarious forms of employment (especially among youth- see Kalleberg & Vallas, 2018) which are associated with poverty and social exclusion (Papadakis et al 2021) and could result in a “new precariat” (Standing 2014).



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**Figure 3: CEDEFOP Skills’ Forecast 2025-2025**

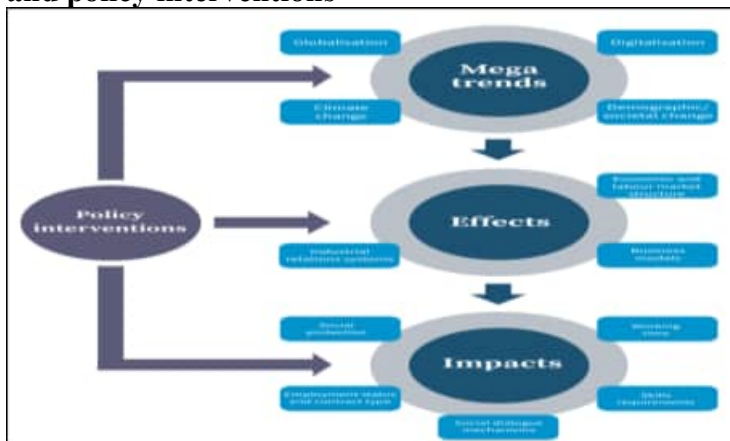


Source: CEDEFOP, 2024: <https://www.cedefop.europa.eu/en/tools/skills-forecast>

The rising intensification and its social impact are due on the one hand to the impact of the multidimensional economic Recession on employment and labour market, and on the other hand due to Mega-Trends that are taking place and seem to gradually prevail (e.g. globalization, digital economy, digitalization, demographic and social changes, climate change, etc.) (Eurofound, 2020: 3-4).

These Mega-Trends had a clear impact on the structure of economy and labour market, industrial relations systems, and business models, having, in turn, direct impact on work relations, forms of employment and contracts types and, consequently, on social welfare systems in Europe (Eurofound, 2020: 3-4) (see Figure 4).

**Figure 4: Relationship between megatrends, effects and impacts on the labour market, and policy interventions**



Source: Eurofound, 2020: 4.

At the point we should also mention the rising of precarious employment and its association with social vulnerability.

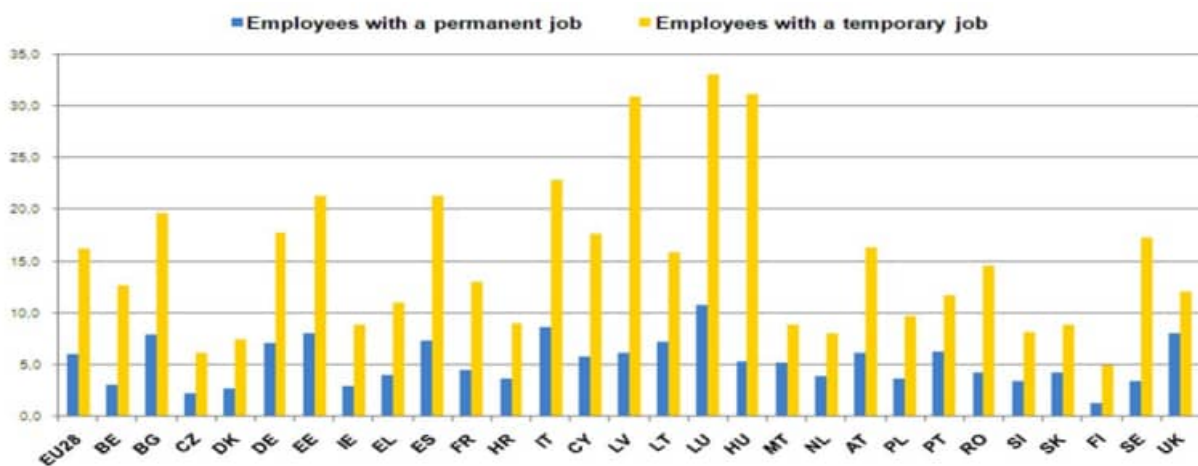
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According to Eurostat (2020c), in 2020, part-time workers in the EU28 were twice the risk of poverty than those employed full-time. Moreover, during the years 2010-2019 the poverty risk rates (Eurostat, 2020a) recorded in part-time employment, were consistently higher for workers aged 16-24 than for those aged 25-54, with differences ranging from 1.6 to 3.3 percentage points. During the years 2010-2018, the risk of poverty in temporary employment increased considerably in the majority of EU28 countries (Eurostat, 2020b). The risk was almost three times higher for employees with temporary jobs, than for those with permanent jobs (Eurostat, 2020c).

**Figure 5: EU28 Member States, 2018 In-work at-risk-of-poverty rate by type of contract**



**Source:** Eurostat, 2020c (EU-SILC Survey, online data code [ilc\_iw05]), elaborated by the authors

## 5. The role of Education in Social Sustainability

### 5.1. On the current state of play

The role of Education is of vital importance for social inclusion and subsequently for social sustainability. However, in the EU severe and multi-parametric socio-economic inequalities affect education, where the inter-generational transition of educational achievement (or even poverty) is evident all across Europe and affects young people's life chances (Papadakis 2022, Papadakis et al 2024).

Based on the data, published in the Education and Training Monitor 2021 (see European Commission 2021: 4 and Figure 2), at the end of the EU2020 strategy and its Educational branch, we can be optimistic in terms of the achievement of objectives set for tertiary education attainment, early childhood education, early leavers from education and training as well employment rate of recent graduates.

At the same time, we cannot be equally optimistic concerning the achievement of goals related to the reduction of low achievers in key competences (reading, maths, science), and

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participation in LLL till 2020. There is a clear progress within the recent years, yet several key challenges remain.

**Figure 6: EU targets in education and training by 2020**



Source: European Commission, 2021: 4

### 5.2. Socio-economic inequalities and Education

The EU average of early leavers from education and training is very close to achieve the 9% (specifically less than 9%) EU benchmark by 2030 (European Commission, 2021: 84). However, in 2021, the EU average of native-born early leavers was much lower (8.8%) than the respective EU average of foreign-born early leavers (22.4%) (see in detail Eurostat, EU Labour Force Survey 2020. Online data code: [edat\_lfse\_02] and [edat\_lfse\_30] as cited in European Commission, 2021: 89).

Progress is continuing in the headline target for tertiary educational attainment, since the EU has met its target of raising the rate of tertiary educational attainment to at least 40% of the population (30-34 years). Within this context, Member States have agreed on an EU benchmark, that the share of 25-34 years with tertiary educational attainment should by at least 45% by 2030 (European Commission, 2021: 95). However, it should be mentioned that, “there are clear discrepancies between urban and rural areas; the average rate in cities (50.9%) being substantially higher than it is in rural areas (28.9%).” (European Commission, 2021: 95).

In spite of the prioritization of adults' participation in LLL, even since the Lisbon Strategy period, in terms of the target related to adults' participation in learning (aged 25-64),

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the progress that has been made from the M-S is very slow. In 2019 the EU average was 10.8%, decreasing by 1.6pps (9.2%) in 2020, 5.8 pps below the EU2020 benchmark of 15% (European Commission, 2021: 110). Additionally, a major deficit in the LLL, namely the under-representation of socially vulnerable groups and low skilled, is still visible and remains a challenge. As European Commission points out in 2018, low-skilled adults, -who need more than anyone else the access to learning, - participated the least in learning, while the age group of adults aged 25-34 are almost three times more likely to participate in learning than adults aged 55-64 (see in detail European Commission, 2019: 71-73, Papadakis 2022 and Papadakis & Drakaki 2023).

To conclude: It becomes evident that that there is a strong association between educational attainment and social outcomes (Papadakis & Drakaki 2023: 7), while the inter-generational transition of educational poverty still affects various aspects of both education and social inclusion (Papadakis 2022: 217-219).

“People with only basic education are almost three times more likely to live in poverty or social exclusion than those with tertiary education” (European Commission 2017: 9), while major inequalities “do not only raise concerns in terms of fairness, as they usually reflect a high risk of poverty and social exclusion, but also in economic terms, as they lead to an underutilization of human capital. Inter-generational transmission of poverty compounds these negative impacts” (E.C. 2017: 22).

Further, even though supply and demand in skills seem to move towards the same direction, supply seems to rise quite faster than demand when it comes to Higher Education Graduates, namely highly skilled human resources (see European Commission, 2017: 55-67). According to the CEDEFOP “Skills forecast (regarding labour force) on the basis of qualifications in the EU & Greece (2025-2035)”, there is a persistent tendency towards the increase of the gap, in terms of employability, between Higher Education Graduates and their less qualified peers (CEDEFOP 2024: <https://www.cedefop.europa.eu/en/tools/skills-forecast>).

All the above mentioned set a challenge “that cannot be confronted by just a new Education, Training and LLL strategy (without underestimating its importance and necessity). It requires major transformations in the public policy complex and a new equilibrium between the macroeconomic agenda and the Welfare policies (in fond of the second) and subsequently a “brave” turn towards a new “re-distributive pragmatism” (Papadakis & Drakaki 2023: 7).

### **5.3. The role of Education in Environmental Sustainability**

As social sustainability means an inclusive society and welfare for all there should be a focus on the knowledge society as well as on investments in education, training, reskilling innovation and new technologies. In times of permacrisis, the welfare state is more necessary than ever. It is therefore essential for the state to undertake systematic interventions to boost demand and thus create new jobs, while enchasing environmental awareness and “sustainable-driven” ethics and actions. Integration into the labor market and investment in innovation should guide the educational process from infancy through the phases of vocational training and university education. Thus, closer cooperation between employment services and

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employers, as well as social economy players, is essential (see in detail: Papadakis & Tzagkarakis 2024: 110).

It should be noted at this point, that “EU Commission (2015) defines green as a skill to minimize resource consumption, reduce greenhouse gas emissions, recycle, use environmentally friendly products, protect the environment, and so on. It also refers to decision-making skills, including selecting processes and technologies in performing an activity considering environmental factors. Meanwhile.... UNESCO-UNEVOC (2017) defines green skills as the technical skills, knowledge values, and attitudes required in a job and in turn supports the socio-economic outcomes and a more sustainable environment. This argument coincides with the statement of (CEDEFOP European Centre for the Development of Vocational Training (2014) that the balance of generic skills, green skills and the improvement of existing work-related skills is more important in developing a sustainable economy” (Ramli et al 2022: 63-64). Within this context, the role of education and subsequently the role teachers in developing green skills, through both their teaching and their daily actions, becomes self-evident.

Alteris verbis, life skills for sustainable development, taught within the school system, are of vital importance (Fien et al., 2009), while “*UNESCO has also been working with other agencies, most notably Cedefop, ILO and OECD, to develop a concerted approach to green skills, as reflected most clearly in the Inter-Agency Working Group’s policy recommendations on “meeting skill needs for green jobs” (IAWG, 2013) and Cedefop and OECD’s two recent Green Skills Fora (Martinez-Fernandez et al., 2013, Cedefop and OECD, 2015)..... (and) the Cedefop OECD Green Skills Fora emphasized the link between skills and knowledge needs and inclusive green growth (Martinez-Fernandez et al., 2013; Cedefop and OECD, 2015). This is further supported and reinforced by the policy trajectory committed to by individual nations*” (McGrath & Powel 2016: 14).

### **6. On future jobs and skills, within the digital Era and the Lego-Flexibility Economy**

In the coming years, global employment supply is expected to increase jobs related to new technologies, artificial intelligence, digitization and automation, while it is expected to decrease traditional forms of employment such as secretarial support, accounting, administration and unskilled labor (World Economic Forum, 2020).

It is no longer a question of simply knowing some computer and videoconferencing skills, but of combining specialized digital technology knowledge with soft skills (such as problem-solving, team work, leadership, creativity & flexibility- see in detail: World Economic Forum, 2020, McKinsey Global Institute, 2021, Marr 2022, Papadakis 2019, Papadakis, Petousi, Tzagkarakis 2023).

Labor markets and economies that invest in this combination can identify opportunities of investment in innovation and, through, a truly, inclusive education as well as targeted training and retraining interventions, can lead the workforce in these directions and thus become better (leaders) in accelerating new digital age (Tzagkarakis 2023). Otherwise, they risk becoming laggards, which will have adverse effects on economic growth, employability (given the increasing role of the transformed economy- based society- see Garrouste & Rodrigues, 2014; Azmat et al 2012) and social sustainability (Papadakis & Tzagkarakis 2024).



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Lego flexibility raises a new challenge, since it refers to the fact where the production of each product is divided into its component parts (see in detail Garud et al., 2002; Sennett, 2006, Tzagkarakis, 2023, Papadakis & Tzagkarakis, 2025: 7).

Lego flexibility depends on having an organizational form in which multifunctional teams are the smaller units and global competence teams are the global unit (Azmat, 2012; Papadakis & Tzagkarakis, 2024: 109).

Within this context of rapid digitalization of the economy and the labour market, there are different predictions on which are the most need future skills.

One of the most precise and inclusive is probably the one of Bernard Marr. According to him, the 20 Skills and Competencies Everyone Needs are the following: “*Digital Literacy/ Data Literacy/ Technical Skills/ Digital Threat Awareness/ Critical Thinking/ Judgment and Complex Decision-Making/ Emotional Intelligence and Empathy/ Creativity/ Collaboration and Working in Teams/ Interpersonal Communication/ Working in Gigs/ Adaptability and Flexibility/ Cultural Intelligence and Diversity Consciousness/ Ethical Awareness/ Leadership Skills/ Brand of “You” and Networking/ Time Management/ Curiosity and Continual Learning/ Embracing and Celebrating Change/ Looking After Yourself*” (Marr 2022: vii).

It becomes crystal clear that Education and Teachers’ role in the development of the vast majority of them (and especially the soft- transversal ones) is of vital importance.

## 7. Conclusions

Globalization and increasing internationalization of Education has clearly resulted in a persistent demand for the further transformation of Education & Training Institutes, towards competitiveness and contribution to development and employability. “What is actually in stake is the employability, while another key issue is the harmonization with the economy and the labor market. That raises, of course, a lot of issues concerning the gradual transformation of the Education and the relation between Education and Society at Large” (Papadakis & Drakaki 2021: 105).

In addition, Mega-Trends such as digitalization have substantially affected all the above mentioned, which is crystal clear in large scale initiatives, in Europe, such as the “Bologna Process”, as well as the Education & Training Work (Framework) Programmes 2010 & 2020, within the framework of the relevant EU strategies (Lisbon Strategy and EU2020- see in detail Papadakis 2022b), while it affects the imitative towards the European Education Area in 2030.

It has become clear that the new policy priorities, at the EU level, focus on the strengthening of the close connection of Education, Training and HE with employability. However, according to the European Commission “some countries continue to suffer from the effects of the crisis on the employment levels of recent graduates” (European Commission 2019: 65; European Commission 2020a: 65-66; Papadakis, Drakaki, Kyridis, Papargyris 2017: 8- 10). All the above-mentioned pose new challenges both to Education Policy, the Active Employment Policies and subsequently to the whole public policy complex. In case it still remains without a viable and holistic policy response, both at the supranational (EU) and the national level, it could result in further undermining the social cohesion.



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# THE MIGRATION-REFUGEE CRISIS AS AN ‘ASYMMETRICAL THREAT’ IN THE MEDITERRANEAN REGION: FIELD RESEARCH

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## Abstract

This study focuses on the recent migration and refugee phenomenon in the Mediterranean, highlighting its multiple dimensions as a modern asymmetrical threat. In the first part, a short reference is made to the history of the migration crisis from 2015 to 2024, describing the different phases of the crisis, from the peak of the crisis in 2015 to the resurgence of the phenomenon in recent years. This is followed by an analysis of the concept of asymmetrical threats as a form of modern warfare, as well as the links between this concept and the migration phenomenon. The study then examines approaches to addressing these asymmetrical threats. European efforts are highlighted, followed by a focus on Greece's response. Next, the analysis of the questionnaire results are presented, with the final part consisting of the conclusions and the proposals that emerged from the completion of the study.

**Key-words:** Migration, Refugee, Asymmetrical Threats, Hybrid Warfare, Mediterranean.

## Introduction

Migration, a phenomenon deeply rooted in human history, has reached an unprecedented scale and complexity in recent years, posing significant challenges to countries in the Mediterranean region, such as Greece, Italy, Spain, and Cyprus. These nations, located at the borders of Europe and the Mediterranean, find themselves at the forefront of what can be described as an asymmetrical threat, not only to their own stability and security but also to that of the broader European Union. Greece, with its strategic position at the crossroads of Europe, Asia, and Africa, has become a primary entry point for migrants and refugees. Islands such as Lesbos, Chios, Samos and Kos, as well as the country's mainland, often serve as the first European territory reached by migrants and refugees traveling along the Eastern Mediterranean route (UNHCR, 2019). However, this situation is not limited to Greece. Italy, with its extensive Mediterranean coastline, has faced similar challenges. Its islands, such as Lampedusa, have become symbols of the migration crisis due to the continuous flow of migrants, often arriving under perilous conditions. Likewise, Spain encounters its own challenges, with territories such as Ceuta and Melilla in North Africa serving as key entry points, along with the Canary Islands, which have seen a rise in migrant arrivals. At the heart of this migration crisis lies the European Union's struggle to formulate a coherent and



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effective response. The EU’s approach has largely focused on strengthening border control, enhancing asylum processing, and cooperating with third countries to manage migration flows. However, this strategy has faced criticism for prioritizing security over humanitarian values, often leading to contentious debates about balancing border protection with safeguarding the rights and dignity of migrants. The situation is further complicated by the uneven distribution of responsibility among EU member states. Countries such as Greece, Italy and Cyprus bear a disproportionate share of the burden related to rescue operations, reception, and processing of asylum applications. This imbalance has fueled calls for a fairer redistribution of migrants across the EU and for more substantial support to frontline states. Local communities, particularly in areas with large numbers of arrivals, have had to adapt to rapidly changing demographics and the accompanying challenges. Moreover, the migration crisis in the Mediterranean, and by extension in Southern and Eastern Europe, constitutes an asymmetrical threat in multiple respects. It challenges traditional concepts of national security and border control, as countries must navigate the complex interplay between humanitarian obligations, international law, and domestic political pressures. Additionally, the influx of migrants has significant socio-political impacts, including the rise of nationalist and anti-immigration sentiments in various European countries, potentially destabilizing the political landscape. Addressing the root causes of migration is also of critical importance. The European Union seeks to go beyond immediate border control by tackling issues such as war, persecution, economic hardship, and climate change in migrants’ countries of origin. Furthermore, the development of comprehensive integration programs for migrants granted asylum is essential to fostering social cohesion and preventing marginalization.

### **Purpose and objective**

The purpose of this study is to examine the relationship between the extensive migratory and refugee flows and the disruption of the internal stability of the host countries, rendering them potential asymmetrical threats at both the national and European levels.

### **The Migration Influx during the last decade**

The period from 2015 to 2024 marks a critical time for Europe, as the unfolding migration crisis challenges its political structures, social fabric, and core values. Irregular migration underwent significant changes during this period, influenced by various global and regional factors. The years 2015–2016 were characterized by an unprecedented wave of irregular crossings (exceeding 2.3 million), primarily driven by conflicts in Syria, Afghanistan, and Iraq. The images of overcrowded boats reaching European shores and life jackets washed up on beaches became symbols of the hardships that compel people to embark on such perilous journeys (de Haas, H., 2016). The European Union (EU) was unprepared for such a large-scale human movement and influx within its territories, putting the existing asylum and migration frameworks to the test. The Dublin Regulation, which assigns responsibility for processing asylum applications to the first country of entry, placed disproportionate pressure on so-called frontline states, exposing the need for a more equitable system of burden-sharing among EU member states (Gattinara, P., 2016). In the subsequent years, the number of



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irregular crossings declined, a development attributed to the EU's strengthened border management and migration policies. One of the most significant measures was the EU-Turkey Agreement (Triandafyllidou, A., 2018). While this agreement reduced the number of arrivals, it raised concerns about compliance with international law, particularly regarding the principle of non-refoulement (Anastasopoulos, G., 2023). By 2023, the upward trend continued, with the first seven months showing a 25% increase in asylum applications compared to the same period in 2022 and a 52% increase compared to pre-COVID-19 levels. The Central Mediterranean route, primarily from North Africa to Italy, remained one of the most active and dangerous pathways. The Eastern Mediterranean and Western Balkans routes also recorded significant activity. The migration crisis from 2015 to 2024 has highlighted the complex interplay between migration, politics, and human rights in Europe. It prompted a reassessment of migration policies, the development of new agreements and frameworks, and ongoing discussions on finding better ways to manage the migration crisis effectively and with respect for human rights.

### **The Concept of Asymmetrical Threat**

The concept of asymmetrical threat is understood as a specialized term within the broader framework of hybrid warfare. Asymmetrical threats extend beyond traditional military confrontations, encompassing a wide range of non-conventional warfare strategies. These threats have become particularly prominent in the post-Cold War era, where the nature of conflict has evolved significantly, compelling nations to adapt their defense mechanisms beyond conventional military capabilities (Chorafas, V., 2019). Asymmetrical warfare represents a method by which weaker adversaries employ unconventional strategies to exploit the vulnerabilities of stronger states, seeking to "level the playing field" in ways that conventional combat tactics cannot achieve (Brzica, N., 2018). The term "asymmetrical threat" first emerged in the 1990s. Weaker entities may resort to tactics such as guerrilla warfare, terrorism, or cyber warfare, all designed to undermine the military superiority of a stronger opponent. When a weaker entity faces a stronger one, especially in situations where their vital interests clash, the motivation to adopt asymmetrical tactics increases significantly (Ntokos, T., 2008). In the modern era, asymmetrical threats often exploit technological advancements and the interconnected nature of global societies. Cyberattacks, disinformation campaigns, and economic sabotage are prominent examples of how asymmetrical strategies can be used to create widespread disruption. These tactics are designed to leverage the vulnerabilities inherent in open societies, with the aim of influencing public perception and undermining the operational capabilities of the targeted entity. Such strategies emphasize the strategic use of limited resources to achieve disproportionately significant impacts—a core principle of asymmetrical warfare (Lampakis, S., 2004). Integrating military, technological, informational, and policy strategies at the state level is essential for effectively countering the dynamic nature of these threats. This comprehensive approach not only addresses immediate security concerns but also aids in the development of long-term strategies to maintain stability and prevent future conflicts (Miles, F., 1999). The concentration of populations in urban centers dramatically increases societal vulnerability to asymmetrical threats (Balomenos, K., 2023). Modern societies are increasingly dependent on the smooth functioning of state

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institutions and the services they provide, such as water supply, electricity, and healthcare systems. Therefore, if an adversary manages to strike a critical infrastructure, it could lead to the disorganization or even the collapse of the state apparatus (Chorafas, V., 2019).

### Forms of Asymmetrical Threats

Asymmetrical threats related to migration have emerged as significant challenges, encompassing economic, social, and political dimensions that critically affect national security in various ways. From an economic perspective, migration can disrupt labor markets by displacing native workers and driving down wages, potentially leading to increased unemployment and underemployment (Metlev, S., 2016). Such economic disturbances may result in social unrest and heighten nations' vulnerability to other forms of asymmetrical threats. From a social and cultural perspective, large-scale migration from diverse backgrounds can lead to social fragmentation, rising xenophobia, and heightened social tensions, which may escalate into conflicts and civil unrest (Szkurlat, I., 2019). This deterioration of social cohesion directly impacts national security by destabilizing societies from within.

Moreover, uncontrolled migration can serve as a conduit for terrorism, organized crime, and other illegal activities, exacerbating security risks. The complexity of adequately monitoring and registering new arrivals can overwhelm existing security protocols, making it difficult to distinguish between genuine asylum seekers and potential security threats. Politically, migration can challenge states' governance capacities, leading to political instability. Governments may face increased pressure from political opponents, who either oppose or advocate for stricter migration controls, resulting in political polarization and weakened governance structures (Böhmelt, T., et al., 2020).

Cross-border terrorism can be defined as terrorism involving individuals or groups conducting terrorist acts across national boundaries. This type of terrorism is particularly concerning due to its impact on international security and the complexities associated with preventing and countering such threats. A notable example of cross-border terrorism in Europe was the Madrid train bombings in 2004, which highlighted the vulnerabilities of open borders within the EU. These attacks were coordinated by a group that traversed multiple European borders, underscoring the challenges posed by free movement to security services (Boer, M., & van Tubergen, F. 2019). Further illustrating the need for enhanced cross-border cooperation, the 2015 Paris attacks demonstrated how terrorists exploited open borders under the Schengen Agreement to move across Europe undetected (Kot, E., 2022). The response to these attacks included increased focus on enhancing information-sharing and strengthening border controls, reflecting the ongoing evolution of European security policies aimed at mitigating such threats. The Schengen Information System (SIS) and the Visa Information System (VIS) were instrumental in facilitating the rapid exchange of information among European countries, which is vital for tracking and apprehending suspects who may seek to exploit Europe's open borders (Crockett, K.A., et al., 2017).

Organized crime refers to a structured group of individuals whose primary objective is profit through illegal activities, often with lasting and severe consequences for society and

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economies. This definition encompasses various criminal activities, including drug trafficking, money laundering, extortion, human trafficking, and others.

The Frontex Risk Analysis for 2023/2024 highlights a significant rise in organized crime in Europe, with a notable focus on illegal drug trafficking and human trafficking, which intensified after the COVID-19 pandemic. The easing of pandemic-related restrictions allowed organized crime groups to capitalize on increased cross-border movement and economic activities to expand their operations (Tolbaru, C., 2023). Particularly prominent is the strong network of drug trafficking operations channeling large quantities of cocaine and other narcotics into the EU (Shapovalov, V., & Samorodov, A., 2023). Human trafficking remains a persistent issue, with the report indicating that trafficking networks exploit migration routes to smuggle vulnerable populations into Europe (Murphy, M., 2023). These networks are often interconnected with other forms of smuggling, creating complex challenges for law enforcement agencies.

Islamic fundamentalism or extremism, as the term later evolved to justify acts of violence, is characterized by an expansionist ideology that is difficult to counter and is often seen in Europe as a force that clashes with Western values, contributing to cultural tensions (Kardis, K., et al., 2022).

Nationalism, as an ideology and overarching philosophy, aims to expand national boundaries at the expense of other peoples and states. It emphasizes strong allegiance to one's nation and culture, often to the detriment of others. It manifests in policies and sentiments that prioritize the interests of the native population over those of migrants, further deepening social and political divisions.

### **Linking Asymmetrical Threats with Migration**

The migration issue can be directly linked to asymmetrical threats, although this does not imply that migratory flows or migrants/refugees themselves constitute a threat per se. However, these flows and individuals can be exploited by other actors to achieve their objectives. In 2015, the European Union faced a significant number of terrorist attacks, with France being the hardest-hit country, suffering 148 deaths and more than 250 injuries in terrorist incidents. Both "lone wolves" and organized militant groups contributed to the growing threat of Islamist terrorism in Europe. This threat is exacerbated by the fact that some individuals, though born and raised in Europe, rapidly radicalize and assume roles as indirect or direct participants in terrorist actions (Europol, 2016). In 2015 alone, 211 attacks (completed or thwarted) were reported in Europe, resulting in 151 fatalities. Additionally, 1,077 individuals were arrested for terrorism-related offenses, a notable increase from 774 arrests in 2014. Most of these arrests were linked to jihadist terrorism, with 687 suspects detained, reflecting a sharp rise compared to previous years. The perpetrators' profiles in France varied significantly from those of terrorist groups operating outside Europe. Europol's 2016 reports identified the main threat as attacks carried out by Foreign Terrorist Fighters (FTFs) on European soil, such as the November 13 attacks in Paris. Moreover, "lone wolves," like the attackers involved in the Charlie Hebdo incident, who were European citizens of Algerian descent and trained by Al-Qaeda in Yemen, posed substantial threats (Moran, M.,

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2017). Another significant attack, orchestrated by the Islamic State (ISIS), was the massacre at the Bataclan theater on the evening of November 13, 2015 (Vargo, M. E., 2021). Religiously inspired terrorism, particularly jihadist terrorism, has been a critical and ongoing threat to European security over the past decade. Notable attacks in 2016 included the Brussels bombings in March, which resulted in 32 deaths and over 300 injuries. The perpetrators were linked to the same network responsible for the November 2015 Paris attacks (Karagiannis, K., 2016). In 2016, terrorist organizations also extensively used social media for radicalization and recruitment. ISIS and Al-Qaeda, in particular, effectively leveraged social media platforms alongside encrypted communication tools to spread their ideologies, recruit new members, and coordinate attacks (Europol, 2017). In 2020, the European Union continued to face the threat of terrorism amidst the COVID-19 pandemic. A total of 10 completed attacks were recorded, resulting in 21 deaths and numerous injuries (Europol, 2021). The social and economic impacts of the pandemic were considered potential aggravating factors for radicalization and recruitment efforts by terrorist groups. According to data from Europol and European Union reports, the majority of perpetrators responsible for attacks categorized as "religiously inspired terrorism" were individuals of Islamic faith, often described as "lone wolves." Some of them were first- or second-generation immigrants raised in European countries, where they later radicalized (Ranstorp, M., 2019). Religious fanaticism leaves little room for doubt about the righteousness of its cause, as it is perceived as "sacred," thereby justifying any means used in the struggle. This perspective links executed attacks to the concept of asymmetrical threats, given the extensive use of means such as vehicles, knives, explosive devices, and firearms against civilians, aiming to increase the number of victims compared to previous years, when attacks often had more symbolic purposes. The primary goal has become to instill fear and a sense of helplessness, depriving society and citizens of their sense of security, a fundamental human need. Nevertheless, a significant consequence of such attacks is the substantial reinforcement of state security measures to counteract such actions (Laskowski, J., & Laskowska, A., 2022). While there is no concrete evidence to prove that terrorists systematically exploit migratory flows to enter Europe, it has been observed that attacks followed the pattern of fluctuating migration flows. Many incidents occurred during the 2015–2017 period, coinciding with a surge in migration. Conversely, in subsequent years, a notable decline in attacks correlated with reduced migration flows up to 2023. However, during this period, the number of arrests related to jihadist terrorism remained high, suggesting that organizations like ISIS and Al-Qaeda exploited asylum seekers and migrants from their areas of influence, recruiting them via the internet (Ranstorp, M., 2019). Europol reports indicate that European countries at higher risk of jihadist terrorist attacks include France, Germany, the Netherlands, and the United Kingdom, as these nations have the greatest cultural diversity (Laskowski, J., & Laskowska, A., 2022). Greece, Italy, and Spain primarily serve as transit countries and are generally not direct targets, although the risk remains present.

Another asymmetric threat that a state may be required to address is the internal threat, coming from groups attempting to promote their own agenda by exploiting circumstances and events, such as the migration issue. The mass influx of migrants into Europe has been utilized by these groups to incite xenophobia and justify violent actions (Europol, 2016). Mudde, C. (2019) confirms this trend, highlighting how right-wing extremist groups capitalized on the

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migration crisis to spread fear and legitimize violent actions. The rise of populist political movements across Europe, which often used anti-immigrant rhetoric, was considered a contributing factor to this (Europol, 2016). The political climate, characterized by the incorporation of anti-immigrant rhetoric, has significantly contributed to the rise of right-wing extremism (Eatwell, R. & Goodwin, M., 2018). There has been extensive use of the internet and social media by right-wing extremists, who spread their ideologies and recruit new members through these platforms, leading to an increase in attacks on migrants (Europol, 2017). The role of the internet in radicalizing individuals and facilitating extremist activities has been extensively discussed by Conway, M. et al. (2019), emphasizing the importance of monitoring online spaces. The increasing complexity and coordination of right-wing extremist groups, facilitated by the internet and modern technologies, highlight the evolving nature of this threat (Ranstorp, M. 2016). The COVID-19 pandemic in 2020 affected terrorist activities, including those of right-wing extremists. Nevertheless, many far-right groups exploited the pandemic to promote their interests, spreading conspiracy theories and misinformation through fake news (Europol, 2020). Socioeconomic distress caused by the integration of migrants and the rise of extremist activities have historically been linked, suggesting the need for comprehensive socioeconomic policies to mitigate these risks (Bhui, K., Everitt, B., & Jones, E., 2014). Throughout the period from 2015 to 2023, right-wing extremist groups consistently exploited migration crises to promote their agendas. Right-wing extremists presented migrants as a threat to national identity, security, and economic stability, often using “incendiary” and xenophobic rhetoric (Mudde, C. 2019). The migration issue played a significant role in the radicalization and recruitment strategies of right-wing extremist groups, which targeted individuals who felt disenfranchised or threatened by the influx of migrants. Online platforms and social media were crucial for spreading anti-migrant propaganda, recruiting new members, and coordinating activities (Conway, M. et al. 2019).

The migration issue in the Mediterranean and Europe, particularly from 2015 to 2024, significantly affects the demographic landscape, as well as the national and demographic identity of the region, while also creating asymmetric threats that impact social stability and security. The influx of migrants and refugees into Europe, and particularly Greece, has been a critical issue since the onset of the migration crisis in the Mediterranean in 2015. According to Daniiloudi E. and El Ghamari M. (2022), Greece has been one of the main entry points for these migrants due to its geographical proximity to Turkey and the Eastern Mediterranean route. The demographic impact of this migration wave is profound. The arrival of a large number of migrants has altered the population structure in several European countries. In Greece, the migrant population represents a significant demographic group, with statistical studies showing that legal migrants constitute about one-tenth of the population (Kasimis C. et al., 2003), and specifically the percentage ranges from about 7% to 9% (Hellenic Statistical Authority, 2023). This demographic change clearly impacts the age structure, as many migrants are younger than the native population, potentially offsetting some of the aging problems faced by European countries. Greece's national composition has been influenced by the presence of migrants from the Balkans, the Middle East, and Africa (Rovolis, A., & Tragaki, A. 2006). This ethnic diversification has led to the coexistence of multiple cultural identities within the same national borders, challenging traditional notions of national identity and social cohesion. Many scholars have pointed out the challenges migrants face, including



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discrimination, limited access to healthcare, and difficulties in employment (Anagnostopoulos D. et al., 2016). The Greek experience, as explored by Vlachadi M., Koufioti G., and Kounio A. (2021) and Triantafyllidou A. (2020), shows a gradual evolution of migration and asylum policies aimed at better managing the integration of migrants. The portrayal of migrants in the media was often negative, presenting them as burdens or threats, which exacerbates social tensions and prejudices (Arcila-Calderón et al., 2023). Such representations have significant consequences on the public's perception of migrants and can hinder their integration by cultivating a climate of hostility and exclusion. The rise of xenophobia and nationalism is a notable consequence of the demographic changes caused by migration. The negative framing in the media and political discourse can fuel xenophobic sentiments, strengthening nationalist movements that view migrants as a threat to national identity and security (Amores J. et al., 2020). This rise in nationalist sentiments can lead to social polarization and increase the risk of hate crimes and violence against migrants. The creation of ghettos is a direct consequence of inadequate integration policies. They often appear in economically disadvantaged areas where migrants face high unemployment, inadequate housing, and limited access to healthcare and education (Kasimis C. et al., 2003). This separation exacerbates social isolation and marginalization, contributing to the erosion of social cohesion and fostering environments where ethnic and cultural conflicts are more likely to occur. For example, the increased presence of migrants in urban areas like Athens has been linked to increased tensions and the spread of xenophobic sentiments (Triantafyllidou, A., & Kouki, H. 2013). The challenges of integration are multifaceted. Language barriers, cultural differences, and legal obstacles prevent many migrants from fully participating in the economic and social life of their host countries. Research shows that migrants often remain in low-paying jobs with poor working conditions, further entrenching their socio-economic marginalization (Mavrommatis, G. 2017). The failure of integration also stems from systemic issues within host countries, such as inadequate policy frameworks and a lack of political will to implement inclusive integration measures (Triantafyllidou, A. 2014). The asymmetric threats arising from the failure to integrate migrants include increased crime rates, social unrest, and the potential for radicalization. The marginalization and alienation experienced by migrants can lead to frustration and dissatisfaction, which extremist groups can exploit. Studies have shown that inadequate integration can create environments where second-generation migrants, in particular, may become disillusioned with their host societies, increasing the risk of radicalization (Anagnostopoulos, D et al., 2016). Moreover, the formation of ethnic enclaves can facilitate the maintenance of transnational ties, which can be exploited by external actors to influence host countries, representing a strategic threat (Vlasova, K., 2021).

Radicalization is essentially the process through which individuals or groups adopt extreme belief systems inspired by religious, political, or other ideals (Giannaki D & Panos D, 2016). In the context of radicalization among migrants, it is essential to consider the socio-political and economic environments that may contribute to this process. Factors such as social exclusion, discrimination, poor living conditions, and negative public opinion can significantly increase the risk of radicalization (Bossis, M. & Lampas, N., 2018). These conditions create fertile ground for individuals to adopt radical ideologies as a form of resistance or as a means of seeking a sense of belonging and purpose. The radicalization and militarization of migrants in Europe, particularly in hotspots, is a complex phenomenon



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influenced by various socio-political, economic, and psychological factors. The process involves migrants adopting extremist views or joining groups, often in response to perceived or actual injustices, marginalization, and denial of rights in their host countries. A primary cause of radicalization among migrants is the experience of social exclusion and discrimination. Migrants, especially those from predominantly Muslim countries, often face significant socio-economic disadvantages and political marginalization in Europe. This exclusion fosters a sense of alienation and can lead individuals to adopt radical ideologies that promise a sense of belonging and purpose (Murshed, S., & Pavan, S. 2009).

### **Addressing and Countering Asymmetrical Threats in the Mediterranean**

The security of borders, particularly European borders, increasingly relies on the use of armed forces and law enforcement agencies, alongside the technological resources at their disposal, to address the challenges posed by migration, always in relation to the aforementioned asymmetric threats. The involvement of armed forces in border security is part of a broader strategy to tackle uncontrolled migration, treating it as a "threat" whenever necessary, with the objective of ensuring the safety of societies and maintaining the territorial integrity of countries. Due to the absence of a European army, the Union depends on the military resources and capabilities of NATO and their cooperation, utilizing the latter's resources as many member states participate in it (EUR-Lex, 2023). Similarly, each Mediterranean state, aiming to address asymmetric threats, independently utilizes its available resources to ensure not only border security but also the safety of society and citizens within. The operational action of the European Union is described in the CSDP (Common Security and Defense Policy), according to the Maastricht Treaty. According to the CSDP, the utilization of national and/or Union resources, military or non-military, is authorized with the objective of achieving the goals set by the Council, with the ultimate aim of maintaining peace and preventing new conflicts.

The European Defense Agency (EDA), established in July 2004, plays a central role in promoting cooperation and integration in the European defense sector. Its primary goals include enhancing defense capabilities, promoting defense research and technology, encouraging cooperation in the area of armaments, and creating a competitive European defense equipment market. It seeks to strengthen the European Union's strategic autonomy by enabling member states to address defense shortages with indigenous European solutions, thereby reducing dependence on non-European resources (Calcara, A. 2017). It also plays a crucial role in unifying the defense procurement process. By coordinating pan-European projects and establishing common standards, it helps member states develop a cohesive and integrated defense strategy (Georgopoulos, A, 2014). This unification is necessary to create a unified defense market and promote technological innovation across Europe (European Defense Agency, 2024).

In 2004, with European Regulation 2007/2004, the European Agency for the Management of Operational Cooperation at the External Borders of the Member States of the EU (Frontex) was established, headquartered in Warsaw. According to its founding regulation, Frontex's mission includes coordinating operational cooperation for managing external borders, setting common training standards for national border guards, preparing annual risk

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analysis reports, identifying migration trends, border-related criminal activities, facilitating information exchange between border authorities, and coordinating joint return operations (Valinakis, I. & Strimpis, I. 2021). With Regulation 1168/2011, additional authority was granted to the Agency in matters related to training, risk analysis, and assistance during crisis situations (EUR-Lex, 2021). It also plays a crucial role in cooperation with non-EU countries, particularly in the Western Balkans, assisting in tackling irregular migration and cross-border crime (Ranaldi, V. 2020). Over the years, Frontex has participated in many operations, including Nautilus, Hera, Poseidon, Triton, Sophia, Themis, and Indalo, all aimed at addressing irregular migration, combating cross-border crime, and enhancing maritime security. The Poseidon operation, launched in 2006, focused on managing migration flows in the Aegean, primarily between Turkey and Greece. This operation emphasized border surveillance, combating human trafficking, and supporting Greek authorities (Campesi, G. 2014). The Triton operation, which took place from 2014 to 2018, replaced Italy's Mare Nostrum and focused on border management in the Central Mediterranean, providing support to Italian authorities amid a significant migration influx. However, it faced criticism for lack of resources compared to its predecessor and for prioritizing border control over search and rescue (Mustăţea, M. 2020).

Since 2015, the European Union has altered its approach to deal with the migration wave in the Mediterranean. Under the guidelines of the CSDP, it introduced emergency measures and tactics, including the naval military operation EUNAVFOR MED IRINI. The objective of this operation is to support peace efforts in Libya and enforce the UN arms embargo by deploying aerial, maritime, and satellite resources from various countries. The mission begins by identifying migration routes and gathering intelligence, then proceeds to boarding and inspecting vessels, and in the final phase, the military force is authorized to destroy or neutralize vessels and assets linked to human trafficking, with the consent of the involved coastal state (Markozani, E. 2015).

NATO's decision to assist in addressing illegal human trafficking and migration in the Aegean through a naval force, specifically the Standing NATO Maritime Group Two (SNMG2), marks a significant development in international efforts to manage the crisis. The SNMG2 operates both in Greek and Turkish territorial waters, playing a supportive role without direct involvement in policing or repelling illegal migration (Jacobs, A. 2016). Instead, its task is to facilitate the rapid and accurate exchange of information between Greek and Turkish authorities and coordinate with Frontex. While this cooperation has been pivotal in addressing migration challenges, it has sparked debates regarding the militarization of migration management, as explored by Garelli and Tazzioli (2018), who describe this approach as part of a broader military-humanitarian strategy in the Mediterranean.

## Research part

### Purpose of the Research

The aim of the research was to gather descriptive knowledge on specific aspects of the research topic. The data collected through the questionnaire provided a foundation for

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understanding the different perspectives of the participants regarding the migration crisis, as well as their perceptions of asymmetric threats.

### Methodology-Sample

The methodology adopted for data collection is based on the use of a questionnaire as the primary tool for primary research. The questionnaire was designed to investigate and descriptively analyze the views, attitudes, and experiences of the participants regarding the migration crisis and its association with the asymmetric threats that may arise from this phenomenon. For the distribution of the questionnaire, an electronic format via online platforms was used to ensure wider participation and facilitate access for a diverse and varied sample of the population. This approach allowed for the collection of rich and varied data, reflecting a broad range of views and experiences related to the research topic. The sample of the research consisted of individuals of various genders, ages, professional training, and educational levels, all of whom were Greek citizens.

### Research Limitations

There is a possibility of sample bias as all participants were Greek citizens, and the topic of the study concerned not only Greece but also the broader Mediterranean and European region. Therefore, there is a possibility of bias since Greece is particularly affected by the migration-refugee phenomenon.

### Results of the Survey

The majority of the participants in the questionnaire belong to the age groups 26-35 and 18-25 (54.3% and 28.6% respectively), indicating that the issue primarily concerns younger adults. These individuals are at the beginning or in the middle of their careers and seem to be interested in the impact of the migration crisis on social, economic, and political stability. Younger generations have also been more exposed to globalized information and political discussions on the topic, which makes them more aware and participatory in such research.

The majority of the participants (60%) believe they know the difference between the terms "Refugee," "Migrant," "Asylum Seeker," and "Internally Displaced Person," while a significant percentage (40%) is either unsure or claims not to know the difference. This shows that, although most seem to have a basic understanding of the terms, there is a notable knowledge gap or uncertainty among a large portion of the population. There is a need for more education and awareness so that everyone can fully understand the important differences between these terms. Especially in matters related to political and humanitarian action, a clear understanding of these terms is crucial for properly addressing the migration and refugee crisis. The fact that 40% lack clear knowledge, suggests that information about the migration crisis may not be as widespread as we think.

Point of interest proved to be the distinction between the terms "Illegal" and "Irregular", with the participants being divided between the two terms, with a slight majority (49%) preferring the term "Illegal." This suggests that most people perceive illegal migration as a

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violation of laws, which is reinforced by the broader political and legal discourse that uses the term "illegal" to describe such situations. The term "Illegal" is often used in the media and politics to describe the unlawful entry of individuals into a country, implying a violation of laws. Those who selected this term (49%) likely view migration through a stricter legal lens, where non-compliance with laws and procedures is considered a clear violation. 43% of participants chose the term "Irregular," which indicates that there is also a portion of the public that considers this term less aggressive and perhaps more appropriate for describing a situation where legal procedures are not met, without implying criminal behavior. These participants view migration from a more liberal or inclusive perspective, where the use of the term "Illegal" is seen as stigmatizing migrants and associating them with criminal acts. In contrast, "Irregular" migration might be viewed simply as a deviation from the prescribed legal processes, without carrying the same weight or implying malicious intent from the migrants.

The fact that the majority of the participants (80%) report being either "Quite" or "Very" concerned about the migration phenomenon reveals that the migration and refugee crisis is directly related to challenges that seriously occupy public opinion. This may be linked to how the crisis affects issues such as national security, social stability, and the economy. The high level of concern is indicative of the potential impacts people foresee, whether it be increased migration flows, social tensions, or humanitarian concerns. This finding may be connected to the perception of the migration crisis as an "asymmetric threat." The participants believe that this crisis involves unpredictable consequences, whether through socio-political impacts or security concerns. This sense of threat could result from how the crisis is portrayed in the media and public discourse, particularly when linked to issues like terrorism, crime, or social tensions. The fact that a small percentage (12%) expresses "Moderate" concern shows that while the issue concerns them, they do not consider it as urgent as others. Meanwhile, 8.6% of participants (with responses of "A little" and "Not at all") seem not to feel strong concern about the issue, likely because they either do not perceive it as an immediate threat or may not have been directly affected by the crisis's consequences.

Concerning Information, the largest percentage (43%) states they are moderately informed and a significant percentage (20%) claims to be poorly or not at all. This suggests that despite the frequent coverage in the media and public discourse, there is still a significant gap in knowledge or information. The fact that 12% consider themselves very well informed indicates that there is a more informed segment of the public, due to greater personal involvement or access to specialized sources of information. This finding highlights the need for better and more specialized information on the migration crisis.

The majority of participants (86%) stated that they get their information from the internet and social media, indicating the dominance of digital media in shaping public opinion. These media provide direct access to information, allowing users to stay informed quickly and easily, but they also present risks such as misinformation or lack of credibility (Fake News). A significant percentage (46%) still relies on newspapers and television, showing that traditional media still hold importance as sources of information. Although their influence has decreased compared to the internet, they remain key sources of information for a large portion of the population. This is connected to their role as more professional and institutional sources, which offer a sense of reliability. Interestingly, 40% of participants rely on observing events

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in their area and general discussions to form an opinion on the issue. This indicates that the refugee crisis is not only a theoretical concept for many people but also has direct impacts on their local communities, affecting how they perceive the phenomenon. At the same time, a much smaller percentage (12%) of participants relies on official European and national reports and studies. This suggests that official sources of information are not widely disseminated or accessible, or they may be seen as less engaging by the general public, likely due to their more specialized and technical nature. Furthermore, only 8.57% of participants rely on academic studies or papers, indicating that academic sources of information do not play a central role in shaping public opinion. This may be due to the perception that academic sources are difficult to access or understand.

83% of the participants believe that European countries are not managing the migration issue properly. This indicates a widespread perception of failure not only at a national level but also at a European level. This negative opinion may stem from insufficient cooperation among EU member states, the uneven distribution of responsibilities and burdens, as well as the general lack of a unified and effective migration policy. Participants may feel that European policies are not cohesive enough or have not provided solutions to the challenges faced by countries like Greece. Only 12% of participants believe that Europe is managing the issue properly, indicating little trust in European initiatives. A small percentage (5.7%) is uncertain, suggesting that some may not have enough knowledge or a clear opinion on European policies.

Concerning information about EU's and Greece's legislative frameworks regarding Migration-Refugee issues the following were observed. Regarding EU's legislative framework, the majority of participants indicate that they are either slightly or moderately informed. This shows a lack of clear information and understanding about the European legal framework governing migration. Regarding Greece's legislative framework, the results are similar. Again, the majority state that they are either moderately or slightly informed. The responses to these two questions show a general lack of awareness about both the European and Greek legislative frameworks on migration. Despite the migration issue being frequently in the news, it seems that there is either a lack of access to clear and reliable information or people are not actively seeking sufficient knowledge. This may point to the need for better information and communication from the relevant authorities so that citizens have a more comprehensive understanding of the laws governing migration at both the national and European levels.

There is significant concern among citizens regarding the link between migration and religious terrorism. 45% believe there is a strong connection, while 28% believe the connection is small. The fact that these two categories make up the majority suggests that participants perceive the migration crisis as a potential security threat, possibly due to concerns about the radicalization of some migrants. However, a significant percentage, 14%, believes that there is no connection between migration and religious terrorism at all. This indicates that there is a group of people who reject the connection between the crisis and terrorism, viewing the phenomenon more from a humanitarian or social perspective.

The largest percentage of participants (51%) believes that the migration crisis is fairly linked to the rise of the far-right, while 28% believes the connection is very strong. These findings suggest that the majority of people directly associate the migration phenomenon with the strengthening of far-right movements. The rise of these movements in many European



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countries has been linked to concerns about security, loss of identity, and social unrest caused by migration. The fact that a large percentage of participants believes that the migration crisis has contributed to the rise of the far-right indicates that the political consequences of migration have been incorporated into public perception as an issue that affects not only economic and social structures but also the political sphere. On the other hand, a smaller percentage, 14%, believes the connection is weak. This suggests that, despite the general view that migration is linked to the political rise of the far-right, there is a smaller but existing group of participants who either do not share this concern or do not have enough information.

The fact that nearly half of the participants believes migration will cause "considerable" (42%) demographic change, suggests concern about the potential population increase, mainly due to migrants and refugees. This group may associate migration with a shift in the demographic structure, mainly because of the younger age and higher fertility rates of refugee populations. At the same time, this concern could be related to the lack of adequate integration and assimilation structures, which would exacerbate social inequalities and unemployment. Participants who believe the change will be "very severe" (17%) are likely fearing a more rapid change in the demographic balance, considering that migration flows could lead to problems such as overcrowding, strain on healthcare and social welfare systems, and political conflicts between native populations and new migrants. A strong percentage, 17%, expresses a more moderate stance, considering that the impact will be small. This group believe that, despite migration flows, issues related to demographics (such as population aging) will not be dramatically affected by migrants or that proper management of migration flows could be beneficial. 14% believe that the refugee issue will not worsen demographics at all. This is a perspective that migrants may be a potential solution to demographic problems (e.g., reduction in the workforce) or belief that the numbers of migrants are manageable and will not impact the overall population.

The largest percentage of participants believes that migrants and refugees pose a threat to national security to a "fairly" large extent. This view may reflect concerns about the instability that could arise from increased migration flows and the possibility of affecting public order, border security, or other internal dynamics. The second largest percentage though believed that migrants pose a "small" threat. These participants recognize some risks but consider them limited and manageable through existing security measures and integration policies. The majority of participants, therefore, express moderate concerns about the likelihood that migrants and refugees pose a threat to national security, with a significant percentage believing the threat is fairly real. At the same time, there is a smaller percentage who believes the threat is "small" or "nonexistent," emphasizing that migrants can integrate into society without compromising security. The results reflect a society that is divided on the degree of threat associated with migration, with a significant portion expressing strong concerns.

Another question showed that the majority of participants (66%) believe that managing the migration-refugee issue requires cooperation between both European and National authorities. This suggests an acknowledgment of the need for a joint European approach and the utilization of the capacities of European organizations, as well as the experience and human resources of national authorities. It is clear that citizens expect a strong and coordinated approach from Europe, in cooperation with their Nation, to address such a complex and multifaceted issue. On the same question the second most popular opinion is



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involving Security Forces along with the Armed Forces. There are also suggestions for cooperation between these forces, but with clear and distinct roles. These choices show that, for some, the management of the migration crisis should also rely on security, but without disregarding the need for distinct roles to avoid overlapping responsibilities and conflicts. One of the most interesting suggestions is involving the Security Forces, supported by professionals from social services (e.g., social workers, psychologists, interpreters, etc.). This approach reflects the need for a humanitarian dimension in managing the issue, beyond purely military or police interventions. It acknowledges that migration and refugee flows are primarily a social and humanitarian issue, requiring specialized and multidimensional solutions. The suggestion of the exclusive involvement of European bodies, such as Frontex, or only Security Forces, received few votes, suggesting that participants do not believe in a unilateral approach by European or national organizations. The results show that the majority of respondents prefer a multidimensional approach involving both European and National authorities. The fact that the overwhelming majority supports cooperation rather than unilateral action confirms that the migration crisis requires coordinated and comprehensive solutions. Involvement of Security Forces and the Armed Forces is considered necessary but not sufficient on its own, as there is recognition of the need for a humanitarian approach, European solidarity, and specialized support.

### Conclusions-Suggestions

The migration and refugee crisis in the Mediterranean emerges as one of the greatest challenges Europe has faced in recent decades. This crisis involves not only the management of large flows of populations but also significant issues of security, political stability, and humanitarian values. At the same time, the migration crisis is often presented as an asymmetric threat, as it can be weaponized by external actors and affect the security of "host" countries.

From this study and the analysis of the questionnaires, conclusions arise that describe the reality of the crisis and the asymmetric threats that stem from it. Initially, it became apparent that the migration crisis is multi-dimensional and has affected the Mediterranean countries, particularly those on the "front line," such as Greece, Italy, and Spain. These countries have borne a disproportionately large burden in managing migration flows and refugees. Local communities, especially on the islands and borders of Greece, have faced abrupt changes in demographic data, creating concerns about social cohesion and economic stability. The increasing influx of populations tests the limits of the host countries' capabilities, while the European Union is called upon to play a central role in managing the crisis. The lack of common and cohesive policies within the EU exacerbates the situation, as the management of migration flows primarily depends on frontline states.

The European Union has adopted a range of measures to manage the migration crisis, such as strengthening borders and reforming the asylum framework. However, these policies have not achieved the expected balance between security and humanitarian aid. The need to protect the external borders of the Union has prioritized security actions, resulting in the neglect of the humanitarian needs of refugees and migrants.

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The participants in the research questionnaire expressed strong concerns about the EU's stance, arguing that too much emphasis is placed on border protection rather than supporting host countries. At the same time, the lack of a fair distribution of migration flows between member states has caused intense political and social tensions within the Union.

In the migration crisis, asymmetric threats manifest through terrorism, organized crime, the alteration of a state's social and cultural identity, and the radicalization of migrants and refugees. Within the context of these threats, the weaponization of migration is clearly evident, with countries or other actors exploiting the vulnerability of these people. The period from 2015 to 2017, when migration flows peaked, was accompanied by an increase in terrorist attacks in Europe, mainly through "lone wolves" who had been radicalized within host countries rather than through the direct exploitation of migration flows. However, it should be emphasized that most refugees and migrants have no connection to terrorist activities, as shown by Europol data, and are simply seeking safety and better living conditions. Therefore, any generalization that could lead to false impressions should be avoided. The participants in the survey expressed significant concern about these aforementioned threats, believing that European authorities have not yet developed the necessary tools to effectively address them. Additionally, they highlighted the need to strengthen integration and monitoring mechanisms in host countries to limit radicalization within these communities.

It is clear that the broader public views the migration crisis as one of the greatest challenges to national security. The participants expressed strong concern about the impact of the crisis on social cohesion, economic stability, and public safety. Greece, as a "transit" country, often functions as an intermediate station for migrants aiming to reach other European countries. This position has somewhat reduced the direct threat of terrorism; however, the pressure on the social system is significant. The increasing ethnic differences and the difficulties of integration have raised fears about social stability and cultural identity. The development of xenophobic and nationalist movements in Greece and Europe in response to migration flows is a worrying trend that intensifies social tensions. Social conflicts arising from the lack of integration of migrants and the rise of extremist movements from the native population similarly threaten internal security.

Considering the findings of this study and acknowledging that migration flows can be mitigated but not easily "eliminated", a collective approach to the issue is necessary. The migration and refugee phenomenon must be addressed at its inception. One of the first steps is enhanced international cooperation with third countries. This is a critical strategy for managing the migration crisis, especially regarding the swift return of irregular migrants and combating human trafficking networks. Such cooperation is vital to enhance security and create safe and legal migration pathways. The European Union must maintain close relationships with the countries of origin and transit of migrants to reduce illegal flows and stabilize crisis-hit regions. To achieve this, it is important for the EU to continue examining and strengthening readmission agreements with third countries, enabling faster and safer returns for migrants who do not meet the conditions for staying in the EU. This can be achieved through negotiations with third-country governments and offering incentives, such as economic and technical support. Furthermore, joint operations with countries of transit and origin must continue to combat illegal human trafficking networks. This can be done through information exchange and coordinated operations between European authorities and third-

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country authorities, along with providing technical assistance to improve their capacity to counter illegal activities. Additionally, the European Union must focus on developing policies and programs for economic aid and development to address the root causes of migration, such as poverty, conflict, and unemployment. Funding development programs and promoting cooperation policies to improve local conditions will reduce the need for migration. A more ambitious step would be strengthening peace diplomacy in crisis areas, aiming to stabilize politically unstable regions and resolve conflicts that drive migration flows. Even if these efforts fail, it is important for the EU to collaborate with third countries to create legal migration programs that allow migrants to enter Europe through safe and controlled methods. This can be achieved through bilateral agreements (e.g., visas), which would offer alternative solutions to illegal migration.

Regardless of previous efforts, the development of an effective information system is crucial. This is a critical proposal for addressing asymmetric threats related to migration, such as terrorism and organized crime. An efficient information system can provide early warning, allowing authorities to detect threats at an early stage and respond promptly. Early detection of risks, such as terrorist actions or criminal activities, will improve the ability of state agencies to take immediate measures and limit the impact of crises. The upgrading of the Schengen Information System (SIS), for example, is essential for enhancing information management within the European Union. The SIS is the primary tool for cross-border security, and strengthening it will improve the ability to access information about individuals suspected of criminal activity or terrorism, as well as irregular migration flows. This can be achieved by upgrading technological infrastructure: The EU should invest in technologies to improve the management of large volumes of data, as well as faster processing and information exchange between member states. The use of artificial intelligence (AI) and big data analytics can increase the speed and accuracy of information. The human factor also plays a significant role. For this reason, border guards, police officers, and intelligence services must be continuously trained to acquire skills in using new information systems. Regular training programs will ensure that staff can effectively identify and manage potential threats.

The next important step is the acceleration of asylum system reforms for the effective management of migration flows within the European Union and to relieve frontline countries such as Greece and Italy, which bear the greatest burden. The acceleration of asylum procedures can be achieved through the digitization and automation of applications, allowing faster submission and tracking of applications across all member states. Additionally, recruiting more staff in national asylum services will reduce waiting times, speeding up the process and relieving countries that host the highest number of applicants.

Another proposal is the Multi-Level Cooperation of National Authorities. This is necessary for the effective handling of the migration crisis, as it affects various aspects of society and security. Coordinated cooperation between ministries, internal security services, armed forces, local government, and international organizations is required. The synergy of these entities ensures comprehensive crisis management at multiple levels, aimed at maintaining social stability and security. Information and Expertise Sharing is important. The regular exchange of information and data among agencies will allow for the timely identification of threats and the preparation of appropriate responses. The creation of joint

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information exchange systems will enhance cooperation and allow better coordination, avoiding overlaps and delays in response.

Another important step is to strengthen migrant and refugee social integration to ensure social cohesion and stability. The creation of comprehensive programs and actions promoting integration will help reduce social tensions and prevent the marginalization of migrants. Integration is crucial, as the failure of this process can create conditions that favor increased crime and extremism. Language learning programs for the host country's language must be intensified to facilitate the smooth social and economic integration of migrants. The creation of special programs will help migrants communicate and interact with the local society. At the same time, access to formal education for migrant children will allow their integration into the educational system and the development of language and academic skills. For adults, the creation of vocational training and education programs, tailored to the needs of the labor market, will allow them to acquire skills that will help them integrate into the workforce.

Finally, it is important for societies themselves to be informed about addressing racism and xenophobia. Public awareness campaigns and the promotion of multiculturalism through the media and education will help shape positive attitudes toward migrants. Promoting intercultural dialogue and developing actions that enhance mutual understanding between communities will strengthen mutual respect. Programs that encourage understanding of different cultural and religious traditions, both from the host society and migrants, will help avoid tensions and conflicts.

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### **SOCIAL SUSTAINABILITY AND SOCIAL VULNERABILITY IN FOCUS: THE CASE OF GREECE**

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#### **Abstract**

Social sustainability focuses on the various prerequisites essential for creating a prosperous and welfare-oriented society. Achieving such critical objectives requires implementing specific social policies aimed at reducing social inequality, addressing social problems, and creating better opportunities for all citizens. Therefore, establishing a sustainable, effective, and efficient welfare policy framework is crucial to tackling the challenges posed by the multiple crises that characterize our era.

Conversely, social vulnerability stands as the primary challenge to social sustainability, as its increase can lead to conditions of social disruption. The past fifteen years in Greece have been marked by turbulence and multiple crises, beginning with the debt crisis of 2010, followed by the refugee crisis in 2015, the COVID-19 pandemic in 2020, and the ongoing energy-inflation crisis, thus making difficult the increase of social sustainability even though the economy seems to be positively driven the last five years.

This study aims to analyze the dimensions of social sustainability alongside the levels of social vulnerability in order to assess Greece's current state of social sustainability. It will identify the main policy challenges that policymakers need to address and explore the social policy interventions required to promote sustainability while fostering prosperity and social welfare in the country. Greece is chosen as a case study due to its experience with prolonged crises over the past decade, the effects of which are likely to have a lasting and wide-reaching impact.

**Key words:** Social sustainability, social vulnerability

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# **TOWARDS AN IMMERSIVE VR AND GAMIFICATED EDUCATIONAL MODEL FOR CONSTRUCTION COURSES. A VIEW ON THE BENEFITS AND DRAWBACKS**

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## **Abstract**

Virtual Reality and Gamification are gradually gaining more and more influential ground as methodological tools in a huge variety of teaching approaches, which can either replace or strengthen the conventional educational models in a lot of different sectors of education. A part of such digital approaches can also be found in the training of engineers like architect or civil engineers, specifically for the courses related to the Construction. In these methodologies a direct and remote virtual familiarization with building construction sites or even a gamified experience of them is used by educators. The incorporation of the above different approaches is applied independently on the basis of forming a multi-channel teaching framework. Furthermore, the successful attempts and proposals of their independent implementations have also led to their joint use as a combination of educational methodologies in the learning experience of engineers and students of engineering science. More specifically, it has to do with the simultaneous use of VR full immersions into building construction site environments, which are enriched with specific features of Gamification for the educational experience with the construction site processes within them. The use of such models requires an initial understanding of the theoretical background of the benefits and the drawbacks accordingly. The selected methodology of this study concerns a review and analysis on relative findings from theoretical and empirical studies, through the years. This resulted in specific conclusions about the different types and categories of the reported benefits and drawbacks. As well as specific guidelines that can be used for a framework of their safe and efficient application, as optimization and correction but also through limitations where necessary. The clarification of

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the two sides led also to some suggestions for future research regarding the adoption of this framework by educators of engineering science.

**Key words:** virtual construction site, gamified construction site, immersive learning

### Introduction

At present, modern teaching scenarios are becoming more and more inclusive regarding the implementation of VR (Virtual Reality) and Gamification practices, as learning tools, in terms of reforming, facilitating and strengthening the existing conventional teaching models. According to Macpherson & Keppell (1998) VR is produced as a mind status on behalf of an individual that can -to a range of degrees- absorb their awareness similarly to the manner of actually being in a real environment, and according to Deterding et al. (2011) Gamification describes the “use of game design elements in non-game contexts” (p. 10). So, it concerns a more subtle use of these elements and as Kapp (2013) explained via examples it is like taking a functional piece from an entity. Both their success in different areas and their technical, conceptual familiarity have led to the expansion of their independent utilizations in their collaborative co-existence, on the same mixed educational models. Therefore, the product of this mutually beneficial synergy is the utilization of Gamified Virtual Learning Environments and in particular of the Immersive ones.

Generally, a Virtual Environment is defined as an “interactive, virtual image displays enhanced by special processing and by nonvisual display modalities, such as auditory and haptic, to convince users that they are immersed in a synthetic space” and has the role of a communication medium for interaction between a human and a machine (Ellis, 1991 as cited in Ellis, 1994, p. 17). The Immersive ones are those where a user can experience immersion which as Agrawal et al. (2020) explained is about a deep mental engagement of an individual that contributes to a cognitive shift in their attention having to do with the disassociation of their awareness from the physical world. The further gamified modification of such environments concerns an additional layer of integrated elements and principles of the Gamification typology which can be better explained through the framework of MDA (Mechanics, Dynamics and Aesthetics) where Mechanics refer to the traits used for the representation of data and algorithms (e.g. controls) that are at the user’s disposal. Dynamics are elements like a time constraint that have to do with how Mechanics affect the inputs of the players and each other’s outputs. Aesthetics like the common sense of challenge is related to the desired feelings of the player, while they are interacting with the system of the game (Hunicke et al., 2004).

In these immersive virtual spaces, the user can be surrounded by 360-degree content (graphical or captured via camera), using relevant hardware and software, which mainly contribute to the telepresence and interactivity inside them. For instance, a Head-mounted Display can track their head motions so as to be able to have several viewpoints in the altered space or by using joysticks the individual can point, select and manipulate the integrated virtual objects and the game-objects as well. The more advanced the special equipment is, the more precise the navigation and the overall simulation mode can be. Consequently, in the case of the successful accomplishment of such practises in the context of pedagogy, students feel



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like they have been placed in an altered learning environment rather than the physical one (e.g. classroom, lab). These immaterial learning spaces are offered to students serving as more engageable and enjoyable practical simulations, which can be significantly more advantageous in terms of usability and learning efficiency.

In that direction, related plots have been studied and implemented in the educational field of Engineering Studies, with significant research interest in the sub-class of teaching courses related to building constructions in related schools and departments as most commonly the Architectural and Civil Engineering ones. One representative example is the immersion of students in virtual building structures and construction sites (authentic or not) of projects in the development process. By being tele-present in each one of the above virtual spaces, students can be facilitated to be remotely, timely, consecutively etc. in touch with the theoretical as well as the practical principles of the construction process, which were introduced in a conventional manner in the physical educational settings.

Such innovative educational methodologies, when integrated into the field of engineering pedagogy can potentially enhance the learning experience in a more realistic way, as opposed to the various difficulties and the educational weaknesses that occur in the cases of the actual visits and tours in real building sites. More specifically, the joint educational utilization of Virtual Reality and Gamification in the relevant academic subjects in engineering pedagogy can provide an ILE (Immersive Learning Environment) that is based in a building construction site and presents the embedded constructional actions, processes, etc. as well as its general characteristic ambience in a more dynamic version. Furthermore, after the incorporation of several elements and practices of a Gamification-centered approach, such an environment can be even more enhanced in terms of its potential to provide additional benefits, that reinforce the immersive visit, like fun, motivation and engagement among others. The elements of Gamification can be layered and be represented by graphical icons which are well-acquainted throughout a plethora of video-game playfields in virtual worlds.

The resulting mix-approached environments can be added as subject materials in specific educational settings related to building constructions, where the learner can navigate and interact with building sites and their included objects, factors etc. So, in addition to their immersion, mini quizzes can also be found that test their prior acquired theoretical knowledge, they can gain or lose points according to their educational performance, they can level up after succeeding, act in a specified time frame and take advantage of an abundance of other features that can be incorporated. The above-mentioned methodological synergy placed in the frame of construction education leads to outcomes that derive from their joint practices, which provide different classes of benefits, but also drawbacks.

As follows, the specific research will provide a cognitive basis regarding the former and the latter in accordance with the mixed methodological framework under examination, based on its utilization for the Construction Courses and more specifically its focused uses on the academic engineering studies. That clarification based on relative research findings will moreover lead to a collection of guidelines regarding the secure suggestion of them as educational tools at both educators and students' disposal. Additionally, further research will be outlined as a complementary supportive approach for the most successful adoption of such an educational framework of use possible.

**Independent and synergistic Gamified and Immersive VR Learning related approaches**

Through the years researchers and educators of the Construction Education field have either proposed or applied independently and collaboratively the use of VR practices and the ones that derive from Game Design. Regarding the former, tools from its spectrum as Kim & Leathem (2018) noted covers a range from the low-level immersion, presence and telepresence in desktop systems to the high-level ones when an HMD (Head-mounted Display) is used. More analytically, the inferior ones refer to the context of NIVR (Non-Immersive VR), also called Desktop VR, which is when a virtual environment is displayed and provided for interactions in one or more simpler monitors like the computer screen ones (Mandal, 2013). A Virtual Environment describes a space that is produced via a computer and within it there are objects which are displayed on a device, and it is offered for interactions in real-time through technological interface, in contrast to their actual existence (Flavián et al., 2019). More specifically NIVR has two sub-classes which are the 2D-3DNI, with the first being based in monocular view and the second in stereo-presentation view through anaglyphic glasses (Kozhevnikov & Dhond, 2012). On the other hand, IVR is mostly based on the use of wearables like Head-mounted display (commonly known as VR headsets) for achieving visual isolation as well as sound independence, data-gloves and hand-controls as joysticks for tactile, haptic relationships with virtual elements with the aim of re-creating the virtual equivalents of the real moves of the user in the virtual environment.

In the context of virtualizing the educational field of Construction Education, over the last decades different VR tools have been adopted. In general, in addressing design and construction issues, VR has been applied to issues such as: 1) early design decision-making and design processes, construction education, safety education, facility management, conflict detection, project coordination, design education, urban planning and project design (Alizadehsalehi et al., 2019). More specifically the categories of educational uses of VR in constructional education cover the: 1) architectural visualization and design education, 2) training for construction safety, 3) safe equipment and operational task training, 4) structural analysis (Wang et al., 2018).

From the NIVR to the high-level IVR the overall aim is to provide students of Engineering Sciences with realistic simulations of spaces representing building structures or even more complex construction sites as well as their workplace ambience from the inclusion of their internal procedures. As these methods are heavily dependent on each VR era technological capabilities per its historical phases, the earliest attempts were based in desktop systems. The more timelessness of the CAD modelling for construction plans and models which even today still replaces a significant part of the traditional drawing procedure in the related academic studios. Such early CAD based VR applications showcased in Penn State University by Messner et al. (2003) where students of Architectural Engineering Program tested a 4D CAD model, meaning 3D design plus time via two experiments, reviewed and identified construction schedule conflicts about the project of an office building. Later, in the Virginia Polytechnic Institute and State University Setareh et al. (2005) introduced the VSAPD system including an immersive edition with an HMD, a tracked tablet and pen, to manipulate objects and navigate around and above the building structure among others. These examples provide a better sense of interaction which according to Mihelj et al. (2014) can be

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generally categorized into manipulation, navigation and communication and overall as Steuer (1992) explains has to do with how the user can modify an environment which is mediated in real time, in terms of its form and content.

The above IVR examples served as pioneering to the earlier more advanced attempts in which there is a more authentic simulation both related to the representation techniques and the immersive ones as well. So, through the years more sophisticated cases were showcased and utilized in the related pedagogical field, using simple graphical or data-rich BIM models of building structures but even graphical or authentic (based on 360-degree captures) construction sites. These more realistic approaches included crew members sharing task-related information or more practically operating while wearing special equipment (e.g. safety helmets), using necessary tools (e.g. drills) or even heavy machinery (e.g. bulldozers). The more dynamic depiction of the workplace rather than the ones presenting only the building structure can lead to the better immersion in the environment in question, in terms of a work-related simulation. As according to Agrawal et al. (2020) immersion is associated with immersive potential and immersive tendency, where the first refers to its system or its content ability to arouse it and the second refers to the individual's predisposition to become immersed. So, by displaying a full construction site, educators can trick the students' sensory boundaries and guide them towards the ultimate feeling of being fully engaged in these educational spaces as they are really inside them.

### **General benefits of VR and Gamification in education**

The tools and methods of VR and Gamification when integrated in educational scenarios have been proved beneficial in how pieces of knowledge -even taken from the most abstract and difficult topics- are presented, delivered and absorbed, facilitating the job for students and educators as well. Their well-established incorporation in modern education is shown through an abundance of relative applications at different educational levels (e.g. schools, universities) based on purposeful learning scenarios. Their partial or total uses can either accompany or replace the more recognized systems of the conventional way of teaching and provide innovative practices (e.g. framework of use) and materials (e.g. special VR devices) at the disposal of educators. Both of them are related to different beneficial learning outcomes that derive from their justified, organized and theory-based utilization when that is necessary (as a solution to a well-known gap) or simply better. For instance, in cases where the traditional pedagogical ways appear to be unable to cover the lack of providing an effective simulation space for practical familiarization with previously given (e.g. in lectures) theoretical topics. An overview of their general educational positive effects is needed prior to the examination of the targeted ones in Construction Education and moreover for the justification of the value for their joint uses in mixed scenarios as a manner to increase the profitable outcomes.

A widely accepted summary of the characteristics of VR, which justify it as a means in the educational process, was presented very early by Kalawsky (1996), that included possibilities as: 1) experiencing both places and situations that are not possible, 2) experiencing events that are impossible due to real time limitations, 3) scale changing for a better insight given, 4) controlling physics towards a better understanding, 5) form real or

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abstract spaces as basis for learning, 6) manipulating of conceptual representation for better comprehension and last 7) motivating.

Since the above-mentioned advantageous factors support students' position in the VR learning process it is worth mentioning the ones that enhance educators' job as a guide to such methodology. Kalawsky (1996) highlights distinct possibilities on behalf of educators as: 1) flexibility, 2) the ease to upgrade to different applications, 3) feeling of presence, 4) high interaction, 5) easier 3D interaction and display, 6) realistic scale in relative fields, 7) safety that exceeds limitations, 8) safety that exceeds dangers, 9) ability to observe internal things, 10) interaction and 11) ability to provide teaching of complex cases.

These beneficial factors are in general related to the VR educational systems like the desktop ones and not specifically to the ones where immersion of students occurs. Therefore, it is worth noting the latter with more focused specific points presented by Häfner (2020) that emphasized in immersive learning systems, linked to the enhancement of motional coordination, physical skills, motivation and engagement, focus and concentration, fostering of skills like communication, collaboration, problem-solving, the saving of time and costs, the adaptation to special needs and the usage of different didactic approaches.

Rather than the non-specific advantageous effects of VR in education, the general ones associated with Gamification should also be mentioned for outlining the basis of their educational rationale for use. Mirzaie Feiz Abadi et al. (2022) presented the matter of the boost of learners' engagement by the aspect of having fun, the boost of motivation via a feeling of achievement, challenges that ensure maximized potential, instant feedback, individual pace for learning, social interaction, problem solving, optimized hand-eye coordination.

The presented features as laying the cognitive foundations for the justification of the two practices potential positive outcomes -of course in relation to a responsible approach on behalf of the involved educators-, should not be seen as isolated from the drawbacks that may appear, which are going to be introduced as follows.

### **General drawbacks of VR and Gamification in education**

Having established a better understanding of the positive side of using VR and Gamification in education generally, it is worth mentioning distinct native or potential drawbacks that may appear, and that can possibly threaten the right flow of the learning process. The specific initial elucidation will serve as a valuable preparatory background for the strengthening of these new methodologies in advance. The specific disadvantages are strongly needed for the introductory clarification, as the specific tools in the field of pedagogy have only been widely known for the last decades, in contrast to other well established traditional methodologies that have been proved timeless. In addition, their applications in several educational settings, topics, cultural environments, countries etc. have not been tested widely and indeed throughout a large chronological frame. Such an introductory background is seriously necessary for posing some relative limitations to the new methods independently or collaboratively with the traditional teaching tactics, as a means to fill some of their gaps. Likewise, in the case of the general educational beneficial effects, the following presentation stands as a prior approach to the examination of the more focused ones in Construction

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Education and moreover for the defense of their suggested collaborative utilization in mixed strategies, by preventing both sides of the potentially derived negative outcomes.

A good hierarchized synopsis of the limitations of VR, which should be concerned to address its secure incorporation in the educational process, was presented by Kavanagh et al. (2017) who noted matters such as: 1) usability of the software, 2) lack of engagement, 3) cost, 4) inaccuracies regarding recognizing 5) non sufficiency in terms of authenticity, 6) lack of enough effectiveness, 7) hardware usability about the input, 8) need for training, 9) lack of feedback, 10) motion sickness and other issues.

Like in the case of the previous approach (for the advantages) the pre-mentioned disadvantages can be regarded generalized for the various VR tools and methods. So more focused points listed by Häfner (2020) about Immersive VR included the technical drawbacks related to presence, immersion and acceptance such as lags and discomfort, distraction from the learning situation, physical negative issues like motion sickness, sanitary issues, emotional damage, lack of communication due to wearables and miscellaneous issues.

As far as the negative aspects of the added Gamification practices are concerned, a very representative approach was made by Mirzaie Feiz Abadi et al. (2022) who demonstrated significant factors as that it is expensive to be developed, it does not have timeless value but it diminishes over time, games that are only poor masked quizzes, pointsification, competition, assessment challenges, retaining information issues, cheating, frustration, regulatory and legal issues, effect assessment.

### **Targeted benefits and drawbacks upon the Immersive VR and Gamified educational experiences of building construction sites**

The above pros and cons serve as cognitive grounds for the following clarification of the most targeted benefits regarding their inclusion in every educational domain where the former can take a different form and gravity linked to the domain's nature. More specifically, in this section the above presented general benefits and drawbacks of VR and Gamification will be targeted in relation to their use in experiencing gamified and virtual construction sites in a state of full immersion by students of Engineering Sciences. The process of tailoring the pre-mentioned general benefits to the special context under examination will be supported by relative findings in literature and personal observations, that support each one of the selected and adjusted points.

Starting with VR, regarding the focused benefits the authors of this paper specialized some of the general ones which they suggested as more relevant to the pre-defined educational use and these concern the:

- 1) Possibility of experiencing a construction site and its related procedures which would not be possible in any physical manner. As Kostopoulos (2022) argued traditional educational settings are dissociated by the practical application of the building process in the real world, therefore he proposed a scenario-solution of Practice-based Learning methodology for the Building Technology Education upon a design-build project in real time. Another problem related to location-related limitations is the objective negative issue of not being able to find all the construction structures available in the area of the university institution (Zhang et al., 2017). But even in the case where location is



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not a problem, there may be other spatial and temporal constraints. For example, Kim & Leathem (2018) mentioned time conflict with other classes, large class for site's size, limited university support or resources. Another experience that would not be possible is the one of the presentations of several safety related problems for the enhancement of students' situational awareness. As Gamberini (2021) noted nowadays, VR implementations can provide safe recreation of dangerous issues for which there is no ease to be experienced in the real world. One more significant factor that is virtually possible is the one pointed by Ku & Mahabaleshwarkar (2011) and it has to do with real-time communication as well as interaction between users that are geographically dispersed.

- 2) Opportunity to experience constructional events in non-real time that in an authentic visit in a site would be too short or too long. A problem related to the time factor is the inability to find an available construction site, where construction work is carried out with the relevant knowledge introduced in the course (Zhang et al., 2017), so the available construction sites may not be in a state that is linked to the current lecture topic. Also, the use of animations that are time-based on 4D models can project the progress in a constructional project through time, providing better comprehension that for instance are seen in 2D drawings or charts (Kunz & Fischer, 2012). Moreover, time lapse representations can be added in the virtual space showing the evolution of the construction process from start to end, that typically would require months or years of unstoppable observation. In this way, Messner et al. (2003) showcased a virtual system of identifying construction schedule conflicts (e.g. sequencing rules) through time in the undergraduate Architectural Engineering Program of Penn State University. But rather than the 4D animated construction sequence in planned time Ibrahim et al. (2008) argue about the necessity of an as-built process documentation which can be addressed with the use of time-lapse based photographic movies attached to a VR model.
- 3) Provided options to make changes in the scale of the overall construction site or its integrated objects that provide more significant insight. Also, in a three-dimensional virtual environment the users can have any point of view, even the one of disconnected and reconnected elements again and again (Thabet, 2002). The specific treatment can be easily done in a BIM model, but not without limitations. As Huang (2021) argues Extended reality (XR) -including VR- offers solutions to the BIM weakness, where even though the user has the ability to walk into a project that used to happen on a non-human scale. Whereas in an immersive experience a student can feel the environment surrounding them on a realistic scale, like actually being inside it.
- 4) Ability to control the underlying physics in a construction related situation for a better understanding. From that perspective students can easily modify virtual objects representing structural elements, like extruding them, exploding them or seeing-through them. For instance, in the case-study of the construction of a wall in Sampaio (2004) research the presentation of that wall could show an explosion of the vertical panels.
- 5) Choice to use a real or an abstract construction site for the enhancement of the learning process. As an example, Shojaei (2021), Kim & Leathem (2018) used panoramic captures from real construction sites to use as a basis for the virtual environments. Nowadays the specific tactic is easy due to the advancement of capturing devices. Huang



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(2021) presented two ways, the low-cost method of unifying photos with a mobile phone to produce a panoramic view as well as with a 360-degree camera to form spaces in which users can be immersed. On the contrary, there is also the ability to use an abstract environment that does not exist at present, like constructions in past historical eras, in which students could obtain valuable construction details about building techniques of the past.

- 6) Capacity to experience the construction site in a safe way. A way that could inform students about hazards and accidents, without risk. The innate nature of remote visualization and experience in VR leads to the risk-free provision and examination of constructional tasks that are typically dangerous. Li et al. (2018) had earlier proceeded to categorize safety reinforcement mechanisms in related settings as the: 1) work environment containing hazards that users can experience virtually, 2) work behavior in terms of learning about safety equipment, 3) workflow that if done incorrectly can lead to problematic issues, 4) high-risk equipment use. Indeed, the necessity of a virtual safety-related preparatory familiarization can be highlighted by Spišáková et al. (2020) who in their research on increasing safety on construction sites presented a percentage categorization of the most common accidents: 1) falls (33.5%), 2) being struck by an object (11.1%), 3) electric shock (8.5%), 4) entrapment (5.5%). While in addition they noted a categorization of the risk scenarios of construction sites from low (e.g. someone could trip), low to medium (e.g. falling from a ladder), medium (e.g. electrocution from cables), medium to high (e.g. being hit by a heavy vehicle) and finally high (e.g. falling from a high point).

Concerning the same approach for the targeted benefits according to the gamified approach of these virtual construction sites, the authors presented as more relevant the:

- 1) Problem solving-based visit in the construction site. A practice that is in the direction of learning by doing and therefore students can gain practical knowledge and hands-on experience in a virtual manner.
- 2) Training of the hand-eye coordination upon high-risk construction activities which contributes to the overall site's inspection. In that direction, students can start to increase their situational awareness towards a construction site and prevent themselves and others from facing dangerous situations.

On the other hand, the previous general negative aspects of VR still apply but in a different way in the applications in the educational context under examination. The tailored ones for this category are the:

- 1) Lack of efficient realism of the construction site. Non-efficient realism can trouble the tendency and the process of becoming immersed and that fact may create a cognitive gap between the simulated and the real, which may lead to the non-development of situational awareness valuable in the real world's dangerous scenarios. Also, the students should be able to sense the materials (textures) which is not possible in relation to their virtual equivalents.
- 2) The unsatisfactory manipulation of the construction elements due to input hardware usability problems. Problems with the supportive devices which may lead to low level interactions with the construction elements and are necessary for obtaining a full understanding of the environment in question.

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- 3) The limited manipulation of the construction elements due to recognition of inaccuracies. For example, gestural recognition and object manipulation of structural elements may not be effective. In addition, there might be a problematic type of walking through the construction site, which poses a serious technical malfunction in the overall tour in the site. Lucas (2018) refers to movement lags which are likely to happen when simulation is very detailed for the processing power of HMD. In addition, there may appear a lack of efficient kinesthetic simulation which affects the high-risk equipment operation (Li et al., 2018).
- 4) The lack of immediate safety-related awareness due to lack of educators' feedback. More specifically, negative feedback from educators or leading engineers on the real construction sites towards their safety-related mistakes. On the other hand, positive feedback associated with safe-related correct actions to boost their confidence. These two types of feedback on behalf of the educator are not so easy to be given in a self-paced and isolated experience like immersion.

According to Gamification practice, the chosen targeted negative outcomes from its supplemental use in the experience of the virtual construction sites in question that are highlighted in this research are:

- 1) The marginalization of the significance of the severity risk factors by the fun and the playful character as the integrate game-oriented features may not be purposefully placed in terms of an overall didactic focus.
- 2) The undermining of the team spirit in constructional operations due to the emphasis on the competition-based aspects. Soetanto et al. (2012) highlighted the necessity of introducing aspects of collaboration at a multidisciplinary working level, meaning between building design teams in the stage of Construction Education curricula, for their preparation of themselves as built professionals. Gamification's innate nature of competitiveness may threaten the general team spirit which is an essential mindset in the construction site workplace.

### **Guidelines for optimizations and limitations**

Regarding the above tailored benefits and drawbacks potentially found in the specific methodological synergistic tool, the authors continued with providing particular guidelines for optimizing the benefits and constraining part of the drawbacks. These are listed as categories that each one may cover different areas of the issues that were posed earlier, such as the:

- 1) Mixed-approach of modeling the immersive virtual construction site involving different spatial versions in relation to the various time-dimensions of the project building phases. Meaning that it would be fertilized that the case-study building site given illustrates the evolution of its different spatial versions through time (e.g. with timelapse). Therefore, the student can experience -in a relatively short period of time- changes that otherwise would cost them months or even years. On the other hand, the aspect of involving time could be used for slowing down or restarting the display of specific procedures that realistically could not be undone and repeated.

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- 2) Use of Gamification aspects to provide immediate feedback on safety-related factors, with serious game-penalties and loss of points to provoke gradual behavioristic changes upon these matters.
- 3) Use of authentic virtual environments of constructions sites from 360-degree captures of actual sites that involve real people (e.g. crew members) on hands on experiences, but also communicating with each other in a collaborative way, reflecting both their group successes and failures for the desired authenticity.
- 4) Offering the exact number of interactions in the construction site that are necessary for less negative technical performances as the goal is not to provide a full actively engageable environment like the ones of the Gaming Industry, but an educational one. Both the developers and users of such learning spaces should consider them as entities of simulations for educational visits in construction sites, where by protocol students are not allowed to manipulate random elements and tools.
- 5) Providing real-time feedback from the educator to the student while they are immersed in the VR constructional environment. This act can be accomplished via several techniques and is somewhat opposed to the self-paced nature of Immersive Virtual Experience as it could make students feel partially re-attached to the real educational setting. However, it could provide a subtle connection with the educator’s feedback concerning a subtle control of the experience where necessary.
- 6) Offering subtle design elements for the synergy with Gamification, where necessary for didactic purposes, that do not overlay the overall purposefully design of the teaching scenario by a generous infusion of fun aspects.
- 7) Use of team-based teaching scenarios as a basis for the presented methodology that enable the collaborative spirit and a simulation of interacting as a crew group. For instance, immersive VR construction site of multi-presence of students in groups should be considered.

## Conclusions

The presented research was about exploring the clarification of the different sides of the Immersive VR and Gamified education methodology for the construction courses related to an innovative way of being in a virtual construction site. As was explained, the two different practices can be used in synergistical scenarios for learning in virtual building construction sites in a mixed-model that can enhance the student’s experience with additional game-oriented tools that support the overall didactic aim. By presenting the educational benefits and drawbacks independently for the two practices in general, an initial cognitive background of understanding towards their integration in the field of pedagogy was outlined. Based on these two sides, the authors proceeded with a tailored approach so as to illustrate their targeted occurrence in the educational setting under examination. The approach in question was based on relative findings with which their special impact on the mentioned focused area of use was drawn. Finally, specific points as lines of guidance for optimizing or putting limitations where necessary were listed and described. Each of these suggestions when applied correctly can cover more than one of the concerns that were initially highlighted. The listing points in question can be utilized as a valuable tool for the creation of an efficient and secure

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framework of use of the presented innovative teaching and learning tactics. Finally, supplemental research work is proposed towards a model based on the above suggestions that will be tested via primary level research in students of the field of Engineering Sciences. This following research will address both the user’s experience on behalf of the students, but also its use from the perspective of the relevant professional educators. Such a study should involve relative experiments with the use of HMD devices in order to achieve the desired outcomes.

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# A REVIEW OF VR AND GAMIFICATED EDUCATIONAL METHODOLOGY IN VIRTUAL CONSTRUCTION FROM NON TO FULL IMMERSION

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## Abstract

VR has a significant role as a tool of educational models in digital learning. Particularly, a sub-group concerns the use of Virtual Learning Environments, depicting building construction sites remotely for the Construction Courses. This concept is seen in the earliest VR editions, where a construction site is projected via basic means (screen, mouse) in Non-Immersion (the user maintains the feeling of his presence in the real space). The necessity of more realistic simulation and the advancement of technology led to an expanded body of cutting-edge research related to Full-Immersion in these sites with more sophisticated techniques, devices (Head-mounted Display devices), where learning becomes isolated from the real environment and is transferred into a sensory level to a 3D and 360° graphic or video, representing a building in the construction phase.

A smaller group of these tours involves Gamification simultaneously to enrich the educational procedure with benefits like user engagement and involvement. During the Gamification of these immersions, traits of the Game Design, (e.g. badges, scores) are incorporated. More analytically, the virtual construction site is projected either in a Non-Immersive or Full-Immersive simulation, as a grounds for the addition of traits of Gamification.

This research addresses the historical perspective of the use of gamified virtual tours in constructions from Non to Full Immersion. Methodologically, the authors used a review in relative applications and proposals, emphasizing on the historical continuity of their development. In conclusion, it occurs that the gamified Full-Immersions in constructions in education should not be regarded as an independent method, but as an evolution of simpler

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applications, with which specific traits and guidelines are aligned, and have been modified accordingly to notable gaps of the past. Finally, supplemental research is proposed regarding the comparisons between the early and modern ways of the learning process in question.

**Key words:** virtual construction site, gamified construction site, non-immersion, full-immersion

## Introduction

Extended Reality technologies have long been integrated into educational scenarios in the context of the digitalization of the conventional learning processes. In this direction over the years Virtual Reality (VR) tools have provided innovative ways of approaching an educational subject, case etc. To better understand its concept, it should be mentioned that Steuer (1992) considered VR to be “a real or simulated environment in which a perceiver experiences telepresence” (p. 76-77). Its provided capacities are dependent on its different categories associated with the level of immersion, which as Agrawal et al. (2020) proposed is a mental engagement in a deep way in which the individual is led to a cognitive attention shift that has to do with their disassociation, in terms of their awareness of the real world. Supplementary, they correlated it with immersive potential and tendency. The first refers to the systems or contents liable to provoke it and the second to the predisposition of the person to become immersed. More specifically the above-mentioned categorization leads to the Non-Immersive VR (NIVR), Semi-Immersive VR (SIVR) and Immersive VR (IVR) (Badomu & Ye, 2013). The former, known also as Desktop VR, describes the case when a user views and interacts with a virtual environment displayed on one conventional monitor (e.g. computer screen) or more (Mandal, 2013). Moreover, it can even be more sub-categorized into the 2DNI and the 3DNI, with a difference being in the monocular view or a view mediated by anaglyphic glasses for stereo presentation (Kozhevnikov & Dhond, 2012). The second one, also called Hybrid or Augmented provides immersion, with the simplicity of a desktop VR system or the use of real models. Examples of such systems are the CAVE (Cave Automatic Virtual Environment) and the driving simulator (Badomu & Ye, 2013). The CAVEs are basically cubic rooms with projections on the walls, floors and ceilings which encompass the user and were widely utilized in previous years in a lot of different educational sectors. Finally, the latter refers to a surrounding experience in a way that is perceptually similar to the one of actually being inside its space (Hodgson et al., 2019). This can be accomplished by several types of software and hardware, such as 3D modelling programs, game-engines, Head-mounted Display, joysticks, data gloves, omni-directional walking/running platforms etc. Their successful use can potentially lead to visual isolation, sound independence, tactile, haptic relationships with virtual objects and the re-creation of the user’s real moves virtual equivalents.

Each of the above types provide a different way of being, interacting etc. with a Virtual Environment, which can be regarded as an environment generated by a computer where its integrated objects are displayed on a device, offered for real-time interactions via a technological interface, rather than existing in a genuine way (Flavián et al., 2019). When

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used in an educational frame and purpose it can be regarded as a Virtual Learning Environment (VLE). When the user approaches such an environment according to the principles of the more sophisticated and complex IVR, they can highly acquire the basic concepts of VR, which according to Walsh and Pawloski (2002) are telepresence, interaction and immersion. First, telepresence can be thought of as a kind of sense of feeling present in an environment that is distant in physical terms (Schloerb, 1995). Secondly, according to the concept of interaction, the user of a mediated environment can modify it in real time, in terms of its form and content (Steuer, 1992) and as Mihelj et al. (2014) noted that it can be generally distinguished in manipulation, navigation and communication. Lastly, in an IVR Learning Environment, the user can obtain not a partial but a full sense of immersion which was described earlier. Such features in the case of a VLE, can provide the user with a sufficiently realistic simulation of an educational practical approach as a supplemental extension to the theoretical part of a course.

The resulting potential cognitive gain led researchers and educators of the pedagogy for the Engineering Studies to investigate how to implement these practices in academia. Specifically, throughout the past years there has been an increasing interest in the implementation of such methods into Construction Education in a plethora of related schools and departments. The relevant proposals and applications either as pilots or as fixed methodologies, can facilitate students with additional means for getting in touch with virtual structures, construction sites and other related settings.

Their successful use led to the synergy of these practices with the additional use of Game Design traits, techniques etc. for the enhancement of the whole innovative educational concept, to improve it further. In fact, these elements in collaboration with VR can lead to learning outcomes in accordance with different Learning Theories and their sub-theories. More specifically, as Kanellopoulos and Antoniou explained (2025), the unification of VR and Gamification methodologies in educational settings can result in the co-existence of different learning theories and consequently to a mix of beneficial learning outcomes that derive from each one.

The above methodological collaboration is progressively becoming an object of research, as nowadays it appears to be a transition to the more subtle educational use of Game Design elements, in contrast to other game-related strategies like Serious Games and Game-based Learning. These three game-related practices share similarities as Krath et al. (2021) underlined because they use gameful experiences in a positive way and rather than entertainment they have a serious aim.

The previously mentioned subtle dimension of use was described easier by Kapp (2013) who sees Gamification related to Games like a piece to a puzzle. In other words, a collection of conceptual and structural parts that guide the gaming experience but can also be borrowed to be used elsewhere. Alvarez (2008) defined Serious Games as “IT applications that combine aspects of tutoring, teaching, training, communications and information, with an entertainment element derived from videogames” (p. 11) and provided a scheme that briefs his definition: Utilitarian scenario + videogame scenario = serious game, that according to their objectives can be split into the: message-based that deliver a specific message, training ones that have to do with the improvement of cognitive and motor skills and the simulation or serious play ones with various uses. Game-based Learning is related to environments where

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game content and play boost knowledge, skills obtaining, and the integrating problem-solving cases are accomplished by game activities, providing a feeling of achievement (Qian & Clark, 2016). Gamification according to a widely accepted definition coined by Deterding et al. (2011) is the “use of game design elements in non-game contexts” (p. 10). According to another more education-related definition, it is about “using game-based mechanics, aesthetics, and game-thinking to engage people, motivate action, promote learning, and solve problems” (Kapp, 2012 as cited in Kapp, 2013). Its basic concept can be described by the consecutive use of the elements of Mechanics, Dynamics and Aesthetics. Mechanics (e.g. betting in a card game) are elements for the representation of data and algorithms, like actions, behaviors and controls that are available to the player. Dynamics (e.g. time constraint) describe how Mechanics affect the inputs of the players and each other’s outputs. Lastly, Aesthetics (e.g. challenge) have to do with the wanted feelings aroused in the player, while interacting with the game system (Hunicke et al., 2004).

Today, there has been an increasing interest in implementing Gamification in full Immersive Environments for educational purposes and indeed in Engineering Studies. Thus, this research addresses the clarification of the historical background of its evolution in the specified topic of gamified IVR visits in construction sites. This perspective covers its maturation both in terms of the VR typology used and the game practices as well. The authors reviewed the matter through different examples from early to modern relative methods, regarding the differentiated evolutions of the two tactics under examination, which are in a synergistically collaboration in the gamified IVR educational experiences of virtual construction sites.

### **Early attempts at implementing VR in learning for building constructions**

The educational field of pedagogy for the Construction Education has over the last decades adopted different VR tools for the creation of realistic simulations concerning building structures, construction sites etc. representations and their internal procedures, ambience etc. The different VR types cover a spectrum from low immersion, presence and telepresence from desktop to their high form using Head-mounted VR (Kim & Leathem, 2018). The same range of uses appears historically regarding the above-mentioned educational implementations, as being dependent on each VR era’s technological capabilities offered, in the matter of available software, hardware and experience. So, the earliest attempts of such methods were mainly developed and applied to NIVR, but also simple SIVR and IVR systems were used. Indeed, according to a review from Wang et al. (2018) between 1997 and 2001 the most common used form of VR in construction education of engineers was the Desktop-based one. Related to that, one of such NIVR approaches concerns the utilization of the modeling systems of Computer Aided Design (CAD) (Isdale, n.n., as cited in Badomu & Ye, 2013). Using CAD teaching practices appear to be a sub-class of the wider CAL (Computer-aided Learning), such a program -as Shelbourn et al. (2001) noted- was first developed in 1954 and led to the broad acknowledgment of its target of bringing settings as simulating concepts in which learners can be navigated by using an abundance of learning resources and tools. CAD modelling is used even in today’s educational settings in the process of creating construction plans and 3D models in Engineering Studies for self-evaluation and external evaluation. So,

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the use of software like AutoCAD, ArchiCAD etc. has replaced partially or in total the traditional drawing procedure made by hand and analog geometric tools in the related studios. Consequently, students can plan and model precise, exhaustive detailed and rendered 3D representations to visualize their construction designs, along with the added materials, textures, such as concrete, wood grain. As a result, they get better spatial and aesthetic understanding, due to their projections in software interface in conjunction with simple hardware, such as an electronic computer, rather than paper.

Furthermore, as NIVR indicates they can manipulate the -given or created by them- building structure under examination, using their mouse and keyboard, so as to obtain ample degrees of freedom, like multiple perspectives by using specific commands (movement, scaling etc.). The flexibility provided of experiencing models rapidly proved more effective and timelier in comparison with the more established conventional axonometric or perspective depictions of the past. CAD as today's conventional practice of building design studios may have enhanced them but not without drawbacks. As Kostopoulos (2022) pointed out, these are dissociated from the real-world practical application of the building process. An argument that led him to a scenario of a Practice-based Learning methodology for the Building Technology Education, towards a collaborative teaching strategy upon a tangible design-build project in real time and data-based. Based on the earlier, the turning point of CAD breakthrough appears as an early educational inclusion of experiencing building structures in NIVR, that pioneered the way for the implementation of further developed VR systems, particularly in terms of more realistic simulations.

In this direction, one of the earliest attempts at using VR in the academic context was presented by Messner et al. (2003) in Penn State University in the undergraduate Architectural Engineering Program. Students developed and tested a 4D CAD model (3D design plus time) via two experiments. The first was about reviewing and identifying construction schedule conflicts (e.g. sequencing rules) in an office building project. The second was a CAVE-like display system visualizing a 3D nuclear power plant project, where the students developed a sequence of construction by interacting with graphical elements like air handling units.

These kind of early simple editions of 4D Desktop-based VR seem like a precursor which set the foundations for the shape of the latter 4D BIM-based IVR. Such a model like the 4D BIM-based Digital one can integrate an abundance of data like structural data, MEP (Mechanical, Electrical and Plumbing) data, but also data about the schedule, the cost estimation of the construction among other factors (Alizadehsalehi et al., 2019). In the next year, Sampaio et al. (2004) used a virtual 3D model of a double-brick external wall as a case didactic tool for Civil Engineering Education for the simulation of the sequencing of the construction processes. Initially the 3D model was developed using AutoCAD which was then transposed to the VR system for a visualization which emphasized the dynamic evolution during the gradual additions of the components (e.g. bricks). In its space, manipulation of such elements was available, while they could be seen in animations, for instance with exploding exhibitions of doors or windows for didactic purposes (e.g. examination of the connections).

Later, in the same context Setareh et al. (2005) presented the system VSAPD, in the Virginia Polytechnic Institute and State University. It included desktop, semi-immersive and total immersive interfaces for interacting with building structures. The desktop one was based



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on simple hardware (computer, mouse, keyboard). Their CAVE was based in a cubic room with surrounding projections and user's interactions based on joystick's pointing and buttons. In the immersive edition an HMD, a tracked tablet and pen were used for actions like object manipulation or even to “fly” around the structure. The portable edition of the latter used only HMD orientation and a chord keyboard device for selection.

After the years the virtual visualizations became even more advanced, indeed Sampaio et al. (2010) in the beginning of the previous decade presented relevant work in the context of Civil Engineering Education. Their scenario was far more detailed and realistic in terms of the representation of the 3D models (rendered views of a bridge under construction) and believable animations that allowed the step-by-step inspection of the several sequential stages, able to be projected on PC VR display. Rather than bridge elements the visualization was associated with the use of the necessary equipment, like the temporary supporting systems.

### **Modern utilizations of Immersive VR in learning for building constructions**

In the modern phase of the universal attempts on digitalizing sections of academic education, Construction Education relative stakeholders implement way more improved types of full immersions in construction sites, with a more advanced level of realism. The desirable progressed realistic approach has to do with how the model is displayed, but also with the user's simulation of the feeling of “being” inside it and interacting with it. As NIVR means served as the technological precursors of high IVR in teaching contexts in general, it seems reasonable that the same relation appears in the educational experiences of construction structures and sites.

In the pioneering educational scenarios of becoming immersed into construction-based virtual environments, these spaces were mainly developed in connection to a 3D graphical representation of a building model. Consequently, engineering students wearing special equipment could feel themselves present in such an environment in which they could test previously acquired knowledge from the theoretical parts of the Construction Courses in lectures. Moreover, they could obtain valuable pieces of practical insight that was not able to be sufficiently delivered in the conventional way -even in the case where a video of a real constructional operation is used as tutorial material- which is a far cry from offering actual familiarity with constructional phases, due to an abundance of objective drawbacks and constraints.

After the years, advancements in VR research made it possible to overcome limitations of previous versions via highly competent software capabilities and realistic simulating devices. These realistic simulations supported by means of IVR equipment benefited engineering education serving as a medium that can bridge the previous theory-practise gap to a certain degree and are inseparable in full immersive constructional experiences. For instance, the currently well-established VR headsets provide visual and auditory isolation to the under-examination space and independence from the physical one. Also, the hand control devices (e.g. joysticks) can replicate the real-world movements to their equivalent to virtual-environment movements, necessary for manipulating building elements (e.g. columns, bricks) or others. In total, the various devices which are used as extensions of the human body's



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sensory organs have led to a new dimension of the available tech-centred subject material for students and educators alike.

The current technological advancements are aligned with the increasing need of getting immersed into construction sites, rather than in more simple graphical representations of building structures of the past. Meaning the full workplace environment of a building under development taking place in a plot of land, including safety signage, heavy machinery, temporary structures etc. and most importantly construction crew members, in a more dynamic manner. That different practise has become more popular since it not only provides construction knowledge as it used to happen with its simpler precursors, but furthermore a cognitive background for students of engineering about the work-environment in a more authentic way. The offered authenticity provided by IVR in construction sites rather than: 1) NIVR and SIVR in construction sites, but even 2) IVR only in building structures, assists them way more in terms of bridging the perceptual gap between their present academic and their future professional development by providing a prior exposure to the construction work environment and thus familiarity with their upcoming work challenges. Let alone the virtual workplace equivalent can lead to their smooth transition to their eventual occupation in their future careers.

A modern example presented by Bashabsheh et al. (2019) in the context of the architectural pedagogy for building constructions, tested the use of a VR software, via a sample of students of Architecture. Its immersive display (by a headset) allowed them to view a 4D graphical model of a house in construction through several phases like the placement of the formwork for the necessary foundations. In relation to the wide use of graphical representation of models, it is worth mentioning that in modern immersive types of VR in learning for building constructions BIM models are commonly used as spatial basis. Their employment in this context is familiar from the early NIVR visualizations and at present BIM-based IVR aided construction education represents one of the state-of-the-art of fully immersive VR experiential simulations of tours in construction-related environments in a dynamic manner. As Huang argues (2021) Extended reality (XR) -including VR- offers solutions to the BIM weakness of unrealistic presentation of information in terms of scale, as the user may have the possibility of walking into a project but not on a human scale manner. So, the collaborative use of BIM and IVR technology can lead to data-rich (total) surrounding environments that also involve the progress of work reflecting to the model's morphology under examination. This cutting-edge type of IVR has its roots in the early 4D CAD based NIVR, as it similarly provides a 3D model enhanced by constructional project data which is valuable for the better comprehension of the students. As the specific review started with the initial example of the NIVR approach of CAD software in construction studies, it should be mentioned that they can also contribute to the modern more complex immersions. Indeed, most of these types of software that are based on BIM, such as Autodesk Revit or Autodesk Civil 3D provide the opportunity - by VR plugins- to extract the model in a suitable format to be displayed with a headset (Huang, 2021).

In the case of these more complex IVR scenarios, a virtual space is offered for full immersion -completely sensory isolated from the real environment- rather than projection, where the user maintains a strong feeling of being present inside it. One such example is the one presented by Han et al. (2022) about testing a VR-driven learning system using headset

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and other devices to get into a graphical model of a construction site in comparison with the traditional teaching based in textbooks, with the assistance of university students -without efficient site experience- as experimental participants. Their implemented construction site model was able to provide a realistic approach of virtual scenes where the students could - with first person views- navigate, interact with the overall setup (using a control) regarding the accomplishment of the site's safety-related tasks.

On the other hand, because of the specific educational field being based on an essential need for optimum realistic simulations, there has been a growing need for life-like IVR environments which are aimed to provide an authentic experience as a treat to the lack of real construction-site experiences in the traditional educational settings on an academic level. That need is being addressed by using virtual spaces that derive from actual captured construction sites, that can be in every part of the world. Therefore, in a lot of modern studies correlated to this topic, it appears that there is an increasing interest in using 360-degree photos or videos of a building construction site (that currently exist or existed in the past) of the actual world. Rather than the graphical representations of the past, today's advanced capturing equipment have led to high-resolution VR depictions and therefore immersions in the source constructions sites, as well as in their work-ambience. Of course, there is a significant number of graphical approaches of construction site models that incorporate virtual human figures of workers dressed in uniforms (helmets etc.), much like the gaming Non-Playable Characters which are placed for enhancing the content narrative and bringing the virtual environment to life. Sometimes in the cases of Serious Games and Game-based Learning the students are actively engaged in them, as they provide instructions, guidance, serve as hint and quest-givers and therefore facilitating their game-driven experience.

Yet, even in these cases, the virtual construction sites do not offer a full realistic approach, whereas they provide a game-looking space, in which there is a possibility that the aspect of entertainment overlaps to some extent the overall didactic aim. Since the target of this research is the evolution of the described educational methodology to the full-immersive editions, it is worth mentioning that realistic immersive experiences are now easier and more upgraded than ever, due to the progress of the 360-degree capturing mechanisms. This is closely related to the subjective basis of an individual's immersion to such an environment because the user recognizes the realistic spatial reference. So, many of the modern widely implemented true-to-life IVR environments depict the authentic immaterial objects that are necessary (e.g. structure), but in addition to that they integrate the recorded crew member human factors (visually and auditory) operating tasks, using heavy machinery etc. or even communicating with each other (e.g. task information sharing). In these cases, immersion is optimized, because as mentioned earlier it depends on the subjective perceptual state of an individual being already predisposed to become disassociated from the real and become immersed into the virtual. Therefore, the most possible realistic depiction of construction workspaces can trick their perceptual limits leading to the ultimate version of their immersion, so to fully obtain the sense of being present while they are only actually viewing and interacting across mediums.

Today's advanced capturing technologies can provide realistic portrayals of any space given, with cutting-edge capabilities such as higher resolution rather than the ones of the past, addressing the above-mentioned need for authenticity towards real-world spaces. The

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resulting displays in suitable formats can be imported into virtual engines (even in the most affordable and user-friendly ones) that enable their role as a basis for the creation of an IVR environment. Huang (2021) presents two of the many ways, the low-cost method of joining photos to a panoramic one with mobile apps and the capture technique with a 360-degree or omnidirectional camera in which users can be immersed. According to this method Feng et al. (2022) added that it is the fastest way of creating a virtual environment, that needs less computational demands. But the most significant constraints are the lack of manipulation of the photo-captured objects and walk-through is based on predefined routes through point of teleportation. Modern representative examples of the use of photo captured mechanisms are the ones presented by Eiris (2021), Shojaei (2021) and Kim & Leathem (2018) who all used 360 panoramic displays based on captures from construction sites of the real world.

The authentic 360-degree depictions of the construction sites in question can be imported in game-engines like Unity and serve as backgrounds for the development of scenes in which graphical objects (e.g. start buttons, progress bars, point system, timers) related to game mechanics that in sequence enable dynamics and so aesthetics which can be layered to the scenes. The produced mixed environments can lead to a gamified and full immersive educational scenario to engage engineering students and facilitate academic educators, who for a long time could not address mainly the: 1) lack of ready-for-use full construction sites and indeed in lifelike editions and also 2) lack of motivation-boosting strategies that rather than the fun aspect offer additional learning outcomes and indeed in an indirect game-full manner.

### **The basis of Serious Games and Game-based Learning in learning for building constructions**

Having outlined the gradual evolution of VR practices in experiencing construction-related spaces, the authors proceeded to an overview pertaining to the evolution from earlier common commercial games and game-oriented educational approaches to Gamification, which stands as the most cutting-edge part of this game-driven methodological ecosystem. As the center of this ecosystem is gameplay it is worth beginning with representative examples of actual games which provide knowledge about constructions -but not as their main aim-, differentiated by any related method with a targeted use in typical educational settings.

Quite an old example found at the end of the previous century in 1996 which was related to the game Tonka Construction, released by Hasbro Interactive and created by Vortex Media Arts. It could be supported on the Macintosh platform in CD-ROM form, with the supplemental use of a keyboard and mouse, as singleplayer. This game for children aimed at introducing different construction projects within five environments, uses of necessary vehicles for the completion of seven projects, leading to the claim of the title of Master Builder (Moby Games<sup>83</sup>). Another construction-themed game is the Construction-Deconstruction one, which was released in 2003 by ValuSoft Inc. in the United States of America, developed by Gabriel Interactive Inc a. This single-player CD-ROM PC game was created for the Windows platform, with keyboard and mouse as main input devices. This

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<sup>83</sup> <https://www.mobygames.com/game/14902/tonka-construction/>

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construction simulation game focused on the utilization of seven different types of vehicles in nine different construction site environments for the completion of distinct projects (Moby Games<sup>84</sup>). A later example from the previous decade is Professional Construction-The Simulation, released by United Independent Entertainment in 2012 and created by VIS-Games. In this game heavy equipment and vehicles were utilized for the construction of road networks, offering a number of different challenges such as road repairs, excavations etc. (Steam<sup>85</sup>).

Rather than games that primarily developed for entertainment, there are a lot of Serious Games that by definition have as a main goal a specific serious purpose. Various studies of Serious Games implementations in construction health, safety training and skills development in comparison with traditional education and evidence from empirical research showed the former as more effective (Feng et al., 2022).

A related popular Serious Game is the VCS4 simulation game which involved learning about the design and management process of a construction project. This game was targeted at engineering students emphasizing on building elements and methods as well. Game tactics such as challenges, time limitations among others structured and drove the overall experience of the user (Castronovo, 2018). Initially, it was based on a 4D CAD system dependent on a 3D building model (in 3D game engine interface) about a construction project. Another example in the beginning of the last decade presented by Lin (2011) was about a 3D video game called Safety Inspector which provided a safety training environment for checking for hazards which was tested in the Department of Construction Management at the University of Washington.

On the other hand, Game-based learning approaches are also widely used like the one introduced by Zhang (2017) which was basically a construction site investigation game for civil engineering students in a 3D highly game-looking graphical environment that involved questions and tasks among other gaming features. An additional very modern game-based approach was presented by Lawani et al. (2022) and was about a game-based construction site inspection by providing simulation of the use of drones flying around a relative 3D graphical environment able to be displayed in web browsers. Furthermore, a game-based learning for building constructions approaches can be applied using a pre-existing common game (e.g. studying building projects in Minecraft) when integrated correctly into an educational context, as its key-factor is how this game is being utilized.

### **Modern Gamification’s practices in learning for building constructions**

Nowadays, researchers and stakeholders of education are more focused on integrating elements and practices that derive from Game-design in the innovative framework of Gamification. So, there has been a transfer of the research interest of the modern pedagogical approaches mainly from Serious Games and Game-based Learning to Gamification. In other words, over the last years there has been a shift in the way educators lend and use Game Design traits mostly in terms of their proportion and their incorporation. So, it appears that the

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<sup>84</sup> <https://www.mobygames.com/game/13164/construction-destruction/>

<sup>85</sup> [https://store.steampowered.com/app/502450/Professional\\_Construction\\_The\\_Simulation/](https://store.steampowered.com/app/502450/Professional_Construction_The_Simulation/)

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former game-oriented learning means have been reshaped to more subtle inputs in educational scenarios, which emphasize more on the additional learning outcomes, rather than the playful character of the user's experience.

In that direction Serious Games and Game-based Learning in construction education paved the way gradually for the gamified approaches or even the remote visits in building structures and construction sites. Particularly, as it pertains to the pre-existed independent employment of VR in construction education, Gamification can stand as a collaborative tool in the context of their methodological synergy. The synergy in question alters significantly in relation to the different types of VR, mostly concerning the level of the students' immersion in each construction-related space. Indeed, in relevant studies and applications the incorporation of Game Mechanics, Dynamics and Aesthetics in Virtual Learning Environments, occurs at a non-immersive, semi-immersive and full-immersive level. Yet, these factors are not necessarily dependent on virtual reality, for instance Reyes et al. (2021) formed a contest-based gamification activity of a test with photos and filling the gaps, about building material damage.

Such an example in IVR was showcased by Wolf et al. (2019) using mobile VR for construction training in a graphical construction site with the ads of Gamification's elements as score, time limit etc. related to the safety awareness training. Another gamified form in a graphical representation of a construction site was shown by Mora-Serrano et al. (2021) who used an IVR system with adds of gamification elements like a scoring system and a health level counter. One very modern application of IVR combined with Gamification practices presented by Kraus et al. (2022) using a prototype model of basement wall construction details, was experienced by students on immersion with HMD devices. Moreover, in this environment gamification tools were placed like tables, hints, quiz modes. This example is very interesting as it provides immersion to a plain environment which is used as a scene for a focused view of a detailed case. Another example of being present in a realistic construction site was presented by Szóstak et al. (2024) and had to do with the usage of Unmanned Aerial Vehicles for the construction in scenarios that also implemented Gamification techniques. For example, there were questions and immediate feedback about the win and loss. Finally, as the current historical perspective initiated from the NIVR CAD, it should be mentioned that this early type nowadays can also contribute to the synergy under examination. In fact, with the spread of the software of 3D modelling editions of Autodesk like Autodesk 3ds Max or Autodesk Maya, it is possible to use virtual environment with the supplemental use of game scenarios (Feng et al., 2022).

Yet examples like the above do not offer a full authentic sense of being in a real construction site, a concern that as was said paved the way for the use of environments made by captures which can also be gamified. One Gamification application in a platform-based VR was examined by Eiris et al. (2020a) and was about gamifying the construction safety training in both a graphical and a 360-degree panorama training space, overlaid with game elements like informative tables, questions etc. regarding safe-related matters. Another example combining the photorealistic presentations and the graphical game traits was presented by Eiris et al. (2020b) who subtly gamified a virtual construction site created by 360-degree panoramas served for the placement of tables and icons, animated virtual guides, narration etc. which could be experienced via a VR headset.



**Alignments and modifications throughout time**

The historical view towards the educational implementation of gamified IVR tours in construction sites was outlined by the presented scenarios and pointed out distinct similarities and alterations. These have to do with technical or conceptual factors that either remained unchanged or were modified for the overall optimization of the IVR experiences in question. The following points cover the fundamental traits that gradually structure the latter as most importantly the representation tactics, the immersion mode and the incorporation of game-linked elements, ideas, appearance etc.

Firstly, to date such methods are aligned with the use of the tested principles of their precursors concerning the model's representation techniques. Even in the era of the progressed immersion with available software and hardware that are capable of providing the needed realism, researchers still do not only utilize authentic life-looking environments but also graphical and rendered ones. Today's researchers and educators in the construction pedagogy employ both graphical and photographic models to establish their learning environments and execute different didactic approaches. Yet, both of these different display approaches are currently established in the idea of the modification of the past use of simple structures to full and dynamic constructions sites. The evolving interest in using complete constructional workplaces is based on the former concepts which served as foundations in experiments with the aim of integrating the on-site ambience, rather than just the building elements, operational tools or constructional sequencing.

Alternatively, as far as the modifications are concerned, it appears that there has been also an effort in borrowing tested and successful techniques from the most familiar forms of the Serious Games and Game-based Learning, but with alterations. That shift regards the redefinition of the way game-design elements, thinking, strategy etc. and conventional factors, course material coexist in the learning context and let alone the immersive one. That gradual reconstruction of the above led to a similar change to the general game-looking environment to a more realistic one, with the subtle overlaid placement of Gamification's traits.

Regarding the immersion level it seems that a plethora of NIVR approaches of construction sites -which are still in use- set a lot of valuable foundations for the IVR as they were the basis of how game-elements can be integrated in several virtual environments. In addition, in these simple desktop-based strategies another innovative shift took place which was the alternative way of using construction sites, even the photo-captured ones that bring their overall ambience, instead of simpler building structures. Two practices that are increasingly found in the modern IVR approaches, but in a more technically advanced manner.

Finally, as the basis of these applications is strongly dependent on the technical background it is worth mentioning the increasing use of advanced devices of spatial and auditory isolation, aligned with the aim of achieving the high form of immersion. But regarding the hardware involved it seems that today's developing BIM models to be used as a basis for IVR environments has its roots in the early CAD development progresses for the NIVR applications.



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### Conclusions

The aim of this research was to explore the historical background towards the evolution of today's gamified immersive visits and experiences in virtual construction sites. Having reviewed representative educational scenarios of its game-related and VR-related precursors, the historical continuity of the method under examination was drawn. It was thus clarified that it is technically and conceptually based in accordance with established methods of the past with similarities but also alterations for optimizations where it was deemed necessary or more practical.

It is now clear that the full immersive level of this gamified learning tactic stands not just as an independent method, but as a product of historical evolution of simpler applications in terms of distinct factors. That gradual multidisciplinary evolution was set on the grounds of providing more authentic experiences for the students that imitate the real construction sites. Indeed, in the best possible manner using more sophisticated types of software and hardware, emphasizing on the wearable devices like HMD.

Rather than the case of immersion and in the same direction of providing the needed authenticity, virtual environments used in modern scenarios depict dynamic construction sites in contrast to the most common use of simple structures. Indeed, using even real-world construction sites captured (360-degree), in contrast to the earlier graphical displays.

Concerning the integration of game-design elements, it seems that such modern applications are more and more attached to the more subtle Gamification, which have been gradually disassociated from the rich game-look and gameplay-oriented uses in Serious Games and Game-based Learning, so as to now seem more targeted at the educational rather than the gaming-related experience.

Yet rather than the above modifications, similar practices now used in modern education still cover the whole spectrum of VR and game-linked tactics and for instance run in NIVR or in the context of Serious Games. So, it seems that their modified nature to altered practices did not lead to their non-use. On the contrary, there is still justified educational reasoning for their utilization where necessary.

Finally, the specific research provided valuable points, which should be examined in supplementary stand-alone research of a comparative analysis between the uses of Serious Games, Game-based Learning and Gamification for learning in IVR construction sites, via primary level research on a sample of engineering students.

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### **SUSTAINABLE SCHOOL: ENHANCING ENVIRONMENTAL AWARENESS AND ENTREPRENEURSHIP THROUGH SCHOOL PROGRAMS AND VIRTUAL BUSINESSES. THE CASE STUDY OF THE UNIFIED SPECIAL VOCATIONAL HIGH SCHOOL OF AGIOS DIMITRIOS, ATTICA, GREECE**

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#### **Abstract**

Sustainable education is central to the future schools, offering students the opportunity to develop environmental awareness and entrepreneurial skills. This subject allows for consideration of ways in which schools can support sustainability through environmental programs such as recycling, energy conservation, waste management and plant cultivation, alongside the incorporation of virtual enterprise programs. These school programs enable students to develop key entrepreneurial thinking and innovation skills, implementing ecological solutions and enhance understanding of sustainable production practices. Through this experience, students learn to care for the environment and apply sustainable management principles, while participating in a virtual business gives them the opportunity to design and produce products with environmental value, cultivating leadership and innovation skills. This paper analyzes the implementation of environmental education school programs in a school with students with disabilities, combined with the creation of a virtual business, with the aim of sustainable development and social inclusion. Students, with the support of their teachers, actively participate in activities that promote recycling, waste management, energy conservation and plant cultivation. At the same time, the virtual business allows them to develop entrepreneurship skills, designing environmentally friendly products and contributing to the cultivation of environmental awareness and leadership skills. Actions are implemented through European eTwinning projects, which broaden the learning framework and strengthen cooperation with other countries. In addition, the use of a 3D printer offers students the opportunity to create original products with environmental value, cultivating sustainable production and innovation skills. The proposed approach enhances the active participation, creativity and social integration of students, forming a school environment that meets the needs of the 21st century.



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**Key words:** Sustainable school, Environmental Education, Virtual Business, eTwinning, 3DPrinting, Special Education, Social Inclusion

### Introduction

This thesis focuses on the sustainability of education and specifically on the enhancement of environmental awareness and entrepreneurship through school programs and virtual businesses. The subject of the study is highlighted through the example of the Unified Special Vocational Gymnasium-Lyceum (ENEEGYL) Agiou Dimitriou, where it is examined how educational practices that promote sustainability can cultivate important skills in students, creating an environmentally and socially aware generation.

The main objective of the thesis is to explore how school programs and virtual businesses can function as effective tools for the development of environmental awareness and entrepreneurship. The main question is: How can the educational process integrate sustainable practices and enhance entrepreneurship skills in students through practical applications and examples?

The paper examines a series of concerns concerning the role of sustainability in education, the contribution of virtual enterprises as experiential learning tools, the benefits and challenges of implementing environmental education programs in special schools, as well as the importance of the example of ENEEGYL Agiou Dimitriou on exploring these issues.

The analysis will be carried out through literature review, case studies, and interviews with teachers and students of the specific school. The structure of the thesis includes the presentation of the theoretical framework for sustainable education and entrepreneurship, the analysis of educational practices and virtual enterprises, the identification of the advantages and challenges that arise, as well as the conclusions and proposals for the implementation of sustainable educational practices.

### Methodology

This thesis approaches the issue of integrating sustainability and entrepreneurship in school education through a multidimensional methodology, which combines literature review and case analysis. This approach aims to explore how educational practices can be adapted and incorporate sustainable and innovative strategies, with emphasis on the example of ENEEGYL Agiou Dimitriou.

### Literature review

The literature review process focused on the search and evaluation of scientific sources, reports of international organisations, and academic articles related to sustainable education and entrepreneurship. The review included the use of specific keywords and phrases to ensure that the sources were relevant to the subject of this work. Indicatively, terms such as "sustainable education," "environmental awareness in schools", "youth entrepreneurship," and "virtual enterprises in education", as well as phrases linked to the development strategy of UNESCO and the European Commission, were used.

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The search was carried out in authoritative academic databases, such as Scopus, Web of Science, and Google Scholar, as well as on the official websites of international organisations such as UNESCO, the OECD, and the European Union. At the same time, sources from journals such as the International Journal of Sustainability in Higher Education and the Journal of Business Venturing were used, as they provide up-to-date research and theoretical frameworks related to the topic.

For chronological coverage of the bibliography, emphasis was placed on sources from 2010 onwards in order to consider the latest developments and current guidelines of international organisations. In particular, the years 2014 and 2020 were important milestones, as they mark the publication of the Roadmap for Implementing the Global Action Programme on Education for Sustainable Development by UNESCO (2014) and the European strategy Education and Training 2030 (European Commission, 2020).

The review was based on specific selection criteria, such as the academic validity of the sources, the relevance to the topic and the applicability of the proposed practices in the school environment. In addition, sources that did not meet reliability requirements or did not focus sufficiently on sustainable education and entrepreneurship were rejected. This process ensured the collection of reliable and comprehensive data, which supported the study.

The literature review focuses on global and European sources that highlight the importance of sustainable education and entrepreneurship. The United Nations (UNESCO, 2014) in its roadmap for the implementation of the Global Action Programme on Education for Sustainable Development, stresses that education must play a central role in cultivating environmental awareness and enhancing skills, such as critical thinking, creativity, and innovation. In addition, UNESCO refers to the need to combine theoretical knowledge and experiential learning, an approach that proves to be particularly effective for students with different learning needs, such as those attending ENEEGYL.

As part of the European Education Strategy, the Education and Training 2030 programme of the European Commission (European Commission, 2020) highlights the importance of education in promoting sustainable development and entrepreneurship as key skills of the 21st century. The guidelines emphasise the need for programs that offer students opportunities to apply their knowledge in real-world environments, promoting active participation and responsibility. According to OECD (2019), in its Youth Entrepreneurship in Europe project, fostering entrepreneurship in a school environment requires not only theoretical understanding but also the application of tools, such as virtual businesses, which simulate real business scenarios.

In addition, research published in scientific journals such as the International Journal of Sustainability in Higher Education highlights the positive correlation between experiential educational practices and the development of environmental awareness in students. Similar findings have been reported in the Journal of Business Venturing, where it is documented that students involved in virtual businesses develop collaboration, leadership, and strategic thinking skills, skills considered essential for the transition to a sustainable economy.

### Case analysis and description of school programs

The second part of the methodology includes the case study of ENEEGYL Agiou Dimitriou, a school that has incorporated initiatives that promote sustainability and

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entrepreneurship into its educational planning. Students participate in numerous activities, such as the development of virtual businesses, which have as their object recycling, sustainable agriculture and the production of environmentally friendly products. For example, one of the projects involves creating biodegradable soaps from used oils, an initiative that combines environmental awareness with entrepreneurial thinking.

Students are involved in all stages of operating virtual businesses, from design and production to advertising and sales management. This process not only provides them with practical knowledge but also boosts their self-confidence, as described by Meijer et al. (2018), which emphasises the importance of experiential learning in skills development.

The importance of green entrepreneurship for young people is stressed. At the same time, programs implemented at school by their students are presented with a detailed description.

### **Sustainable School - ENEEGYL Agiou Dimitriou**

The Unified Special Vocational Gymnasium-Lyceum (ENEEGYL) Agiou Dimitriou is one of the largest public special schools in Greece, belonging to the Directorate of Secondary Education of the D Athens and under the Directorate of Special Education of the Ministry of Education. The school was founded in 2017 in order to meet the needs of students with special educational needs and disabilities, offering them the opportunity to be trained in professional and academic subjects and to prepare for the labour market or for continuing education at the post-secondary level. The school is attended by about 150 students from different municipalities of Attica and is staffed by 40 teachers and support staff ([gymee-ag-dimitr.att.sch.gr](http://gymee-ag-dimitr.att.sch.gr)).

The school offers a variety of fields and specialities, such as agriculture, technical applications, mechanical engineering, and computer science, offering students a professional education tailored to their needs. Its operation is part of the Special Education School Units (SMEAE) and includes the classes of Junior High School and Lyceum, with the speciality of students being determined following the opinion of KEDDY. After completing schooling, students can go on to various educational and professional paths, such as attending a post-secondary apprenticeship year or joining other educational structures.

### **The Theoretical Framework: Sustainable Education and Entrepreneurship**

The first thematic unit analyses the theoretical framework of sustainable education and entrepreneurship, linking it to the goals and needs of modern society. According to UNESCO (2014), sustainable education is the foundation for the development of skills related to environmental awareness, critical thinking, and creativity. The OECD (OECD, 2019) points out that integrating entrepreneurship into educational programmes not only fosters creativity but also enhances collaboration, skills that are critical for the transition to a sustainable society.

Environmental Education (PE) and Education for Sustainable Development (ESD) began their journey in the 1960s, with the publication of Rachel Carson's book "The Silent Spring" (Carson, 1962), which promoted awareness of the environmental consequences of

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human activity. Since that time, through major international conferences and policy papers, EC/ESD has evolved into an important framework for sustainable development, integrating environmental, social, and economic aspects (UNESCO, 2005).

Following this path, decisive events and conferences, such as the Stockholm Conference in 1972 and the Rio Conference in 1992, established the importance of sustainable development and environmental education. Agenda 21 and the establishment of the Decade of Education for Sustainable Development (2005-2014) highlighted the need to apply these principles at all educational levels, both locally and globally (United Nations, 1992).

However, despite this progress, countries such as Greece have not fully completed the integration of environmental education into their education systems. Therefore, it is necessary to understand environmental problems from an early age, introducing ECEC and ESD practices into the educational process (UNESCO, 2015). Immediate action is needed to reinforce these issues within schools to enhance the environmental awareness and responsibility of young generations.

Data from UNESCO reveals that only 53% of national curricula worldwide mention climate change, and it is often given low priority. Less than 40% of teachers say they feel confident in teaching climate change, and only a third can explain its local implications. UNESCO stresses the critical need for education in tackling the climate crisis and argues that all students should gain the knowledge to contribute to solutions. A survey of 58,000 teachers showed that many are unfamiliar with appropriate pedagogical approaches and face challenges in teaching climate education remotely, especially due to ongoing school closures due to the pandemic. <https://www.unesco.org/en/articles/only-half-national-curricula-world-have-reference-climate-change-unesco-warns>

In response, UNESCO, the UK, and Italy are organising the "Together for Tomorrow: Education and Climate Action" event during COP26, highlighting the integration of climate education and sustainability into global curricula. UNESCO calls for cooperation between the education and environment sectors to fully integrate climate change into education at all levels. <https://www.unesco.org/en/articles/only-half-national-curricula-world-have-reference-climate-change-unesco-warns>

Environmental education (PE) is an educational approach that seeks to raise awareness and prepare individuals to understand environmental challenges, develop skills to solve them, and adopt attitudes and behaviours that will contribute to the sustainability of the planet. It aims to cultivate environmental awareness and responsibility, integrating environmental issues at all levels of education and linking theory with practice through experiential and participatory activities (UNESCO, 2014). According to UNESCO (2020), environmental education includes the teaching process that offers students the opportunity to understand human relations with the natural and man-made environment and develop the necessary skills and attitudes to solve environmental issues.

PE incorporates an interdisciplinary approach, combining natural science, social sciences, and ethics, in order for students to develop integrated knowledge of environmental issues and their connections to social and economic dimensions (UNESCO, 2020). Key pillars of environmental education include developing knowledge of ecology and the natural sciences, understanding the social causes and consequences of environmental crises, and encouraging action through participation in environmental initiatives and fostering responsible

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environmental attitudes (Tilbury, 2011). This holistic approach not only enhances knowledge but also shapes students' personal attitudes towards sustainability, encouraging them to become active and adopt behaviours that promote environmental responsibility.

Environmental education is often combined with Sustainable Development Education (ESD), which aims to cultivate the necessary skills to achieve sustainable development. These two concepts overlap and reinforce in order to promote a sustainable society and help individuals become active citizens who understand environmental and social challenges and contribute to their solutions (UNESCO, 2020). Environmental education is also linked to the formulation of policies and strategies to tackle climate change, recognising its importance in education for the future of humanity and the planet.

Environmental education in practice incorporates a range of pedagogical methods, which include experiential learning, encouraging student participation, and using the community as a tool for the educational process. Students are encouraged to participate in actions that include garbage collection, tree planting, or the development of recycling programs, aiming to link theoretical knowledge with everyday practice (UNESCO, 2020). The experiential approach enhances understanding of environmental issues, allowing students to perceive the direct consequences of their actions on the environment and develop problem-solving and collaboration skills (Cutter-Mackenzie, 2017). Teachers are encouraged to adopt an interdisciplinary approach, integrating environmental education into subjects such as physics, chemistry, geography, and sociology, in order for students to understand the potential interaction of environmental and social parameters.

Another important element of environmental education is to highlight the social dimension of sustainability, related to understanding the economic, cultural, and social parameters that affect the environment. Integrating social justice and sustainability into educational programming allows students to recognise inequalities and differences in access to resources, as well as the impacts of climate change on vulnerable social groups (UNESCO, 2020).

Teachers are called upon to enhance critical thinking and responsibility in order for students to develop the ability to address environmental challenges through solidarity and collective action (Jensen & Schnack, 2006). The utilisation of basic skills for sustainable development, along with the analysis of potential challenges, highlights the potential of theatre as a means that can contribute substantially to the design of educational programs for sustainable development (Pachova and Vassileva, 2024). students, but also for the development of socially responsible and active citizens.

### Importance of green entrepreneurship for students

Fostering entrepreneurship among young people is one of the key objectives of modern education systems, as it prepares students to face the challenges of the global economy and develop critical skills for their working lives. Entrepreneurship at school fosters students' creativity, innovation, and critical thinking, enabling them to understand the importance of entrepreneurial thinking and initiative (European Commission, 2016). Through programs and actions that include the creation of virtual businesses, the development of business plans, or the implementation of social entrepreneurship programs, students develop skills related to management, collaboration, and communication, thus strengthening their future career prospects (OECD, 2015).



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Entrepreneurship in school education is not only about preparing students for the labour market but also about cultivating social responsibility and ethical business action. In 21st-century society, young people are called upon to take an active role in an ever-changing economic and social environment, where social and environmental responsibility is becoming increasingly important. Entrepreneurship programs that promote sustainable development and social sensitivity help students understand the connection between entrepreneurial activity and social progress, encouraging them to create solutions that contribute to the well-being of society and the environment (UNESCO, 2020). The application of these skills in real scenarios through experiential activities and mentoring by professionals in the field prepares students for the modern labour market and provides them with the tools to develop their own business initiatives.

Entrepreneurship at school, as part of general education, also helps to boost young people's self-esteem and self-confidence. Especially in conditions of economic uncertainty, cultivating entrepreneurial thinking helps them develop the ability to think critically, plan, and adapt to new situations. Students participating in business programs understand the process from the conception of an idea to its implementation, thus enhancing their sense of success and accomplishment (European Commission, 2015). In addition, these programs encourage teamwork and collaboration, enhancing social skills and creating support networks that are crucial for their future working life (Linan, 2008).

In Europe, fostering entrepreneurship among young people is one of the central objectives of education policies, recognising the need to equip young people with the necessary skills and knowledge to face today's economic challenges. According to the European Commission, around 50% of pupils in the EU participate in entrepreneurship education programmes, but the practices and intensity of these programmes vary significantly between countries (European Commission, 2016). Although entrepreneurship education is becoming increasingly important, its integration into national education systems is still limited and depends on each country.

Another important element is teacher training, as a European Commission survey in 2014 revealed that 47% of teachers in the EU did not have the necessary training to teach entrepreneurship (European Commission, 2014). However, most teachers consider entrepreneurship education to be crucial for the development of young people, as 82% of them recognise the importance of this education for their economic and professional paths. These results show the great need to strengthen professional programs and develop appropriate tools for teaching entrepreneurship.

Furthermore, the European Entrepreneurship Strategy recognises the need to integrate entrepreneurship into education at all levels. Despite these initiatives, according to the European Parliament's 2020 report, around 25% of education systems in the EU do not offer formal teaching of entrepreneurship and innovation (European Parliament, 2020). This disparity in the supply of educational programs creates a gap in the preparation of young people, making the need for more intensive and accessible educational programs more urgent than ever.

The statistics on entrepreneurship education in universities are also revealing. In the EU, around 31% of students attend entrepreneurship courses or participate in entrepreneurship-related actions during their university studies (Eurostat, 2020). However, its integration into



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all university programmes remains limited, with the result that many young people do not have the opportunity to develop the necessary entrepreneurial skills before entering the labour market.

Green entrepreneurship combines sustainable growth with business opportunities, while previous studies have shown conflicting results for factors such as entrepreneurial education, personal values, perceived behaviour control (PBC), self-efficacy, social norms, and support from universities. While some studies show positive effects, others show negative influences, especially when it comes to social norms. Using a large sample of 690 students and advanced data analysis (PLS-SEM), the research focuses on the role of cultural norms, government policies, and education in shaping intentions for green entrepreneurship, providing valuable insights into policy and educational initiatives that promote sustainable economic development in Saudi Arabia (Ali et al., 2023).

The sustainability training paradigm focuses on developing entrepreneurial competencies necessary for green entrepreneurship. Education for Durable Development (EDD) provides the knowledge, skills, and values necessary for sustainable living. Green entrepreneurship is influenced by internal factors such as creativity and resilience and external factors such as supportive policies and education (Anghel and Anghel, 2022). Key competencies include risk-taking, innovation, leadership, and social responsibility. Positive factors for green entrepreneurship include strong entrepreneurial skills and motivation, while obstacles include bureaucratic challenges and poor resource management (Anghel and Anghel, 2022). These competencies are crucial for students to succeed in creating sustainable businesses (Anghel and Anghel, 2022).

Research in Romania (2020) shows that 60% of entrepreneurs belong to the 31-45 age group (Anghel and Anghel, 2022). Among students aged 26-28, there is a strong interest in green entrepreneurship, driven by factors such as funding opportunities, desire for financial independence, and support for university business incubators (Anghel and Anghel, 2022). Psychologists note that this age group is characterised by self-confidence, independence, and concern for environmental issues, seeing green entrepreneurship as a sustainable career (Anghel and Anghel, 2022). There is a noticeable difference in interest between younger students (22-25) who focus on university studies and those in the larger group who focus more on business development (Anghel and Anghel, 2022).

At the same time, in the study by Moiceanu et al. (2023) respondents believe that achieving turnover in green entrepreneurship is relatively easy, with 35% expressing this opinion. Despite not agreeing or fully understanding many aspects of green entrepreneurship and some not being familiar with the term itself, 46% of respondents said they would consider green entrepreneurship as a viable option based on the statements provided and other factors (Moiceanu et al., 2023). This shows a growing openness to the idea, even among those with limited knowledge or disagreements about specific elements of green business (Moiceanu et al., 2023).

In addition, the study by Niemczyk et al. (2024) found that different groups had different perceptions of green entrepreneurship. Working students mostly associated it with activities such as tree planting and corporate social responsibility, while professionals focused on things like using alternative energy and saving resources (Niemczyk et al., 2024). Students showed greater diversity in their views, linking green entrepreneurship to various areas such

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as environmental protection, business models, and trends (Niemczyk et al., 2024). Professionals, however, had a more consistent understanding, linking it primarily to environmental protection and sustainable business practices. This shows that students still understand what green entrepreneurship means, while practitioners have a clearer, more focused view (Niemczyk et al., 2024).

The above data show the need to further develop entrepreneurship education programmes in Europe and ensure that all young people have the opportunity to develop the skills and knowledge needed to succeed in an ever-changing economic world.

Examples of the application of these theoretical principles can be found in the programs developed by the school. For example, the GROW (Gardening, Researching and Observing the World) project, involving schools from Greece, Turkey, Romania, Poland, and Portugal, is a prime example of linking experiential education with environmental awareness.

The project focuses on understanding and exploring the natural environment through activities that are tailored to the needs of students with disabilities. At the same time, it enhances ecological awareness and promotes skills such as collaboration and communication (European Commission, 2020). Then, it is analysed how these educational practices contribute to the development of environmental awareness, considering the guidelines of international organisations.

Finally, the school participates in the Junior Achievement Greece competition with the 3D Green Pot action. Students create a virtual business. In this programme they combine the concepts of reuse, 3D printing, and plant protection.

### **The GROW Example**

eTwinning projects are an educational initiative of the European Union, which provides an online platform to strengthen cooperation between schools from different countries. Through eTwinning, teachers and pupils have the possibility to participate in joint projects, exchanging knowledge, ideas, and cultural experiences, using new technologies to create cross-curricular learning activities. The aim of the platform is to encourage the development of the European dimension in education, promoting cooperation and understanding between different cultures and education systems (European Commission, 2020). The projects developed incorporate a variety of topics, such as science, art, cultural understanding, and environmental awareness, thus promoting learning with interest and meaningful engagement.

In addition, eTwinning provides an excellent opportunity for teachers to participate in a dynamic professional network. Through the platform, teachers have access to training courses, online learning communities, and materials, which allow them to develop new teaching methods and exchange good practices. The platform offers a supportive environment for creating and implementing innovative teaching approaches, enhancing teachers' digital skills, and fostering collaboration in the professional community. This dynamic environment contributes to teachers' ongoing professional development, enabling them to improve their educational practices and incorporate new technologies into their classroom.

For pupils, participation in eTwinning projects has significant benefits, as it gives them the opportunity to develop skills necessary for the 21st century. Through collaboration with students from other countries, students enhance their capacity for intercultural communication,

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cooperation, and problem-solving while developing their digital skills (European Commission, 2020). Participation in international projects strengthens their sense of European identity and prepares them for a globalised society, while this process encourages active learning and creativity. Students have the opportunity to work on joint projects, create original material, and present the results of their efforts in a global community context, thus offering a real-world educational experience through action.

The GROW project incorporates innovative practices that promote environmental education and entrepreneurial thinking. Students from five different countries participate in activities such as gardening, researching environmental problems, and developing strategies to protect nature. These activities enhance students' self-confidence while offering opportunities for social inclusion and cultivation of their communication skills (Meijer et al., 2018).

The implementation of such programs includes collaborative actions, such as joint garden care, sustainable product development, and presentation of results in competitions or local communities. Teachers use tailor-made tools to support students with disabilities, and activities are designed to be accessible to all.

The multidimensional approach of GROW shows how the combined use of experiential learning and scientific observation can lead to positive results. For example, students in Portugal investigated the use of recycled materials to create artistic works, promoting the concept of reusing materials.

### **Green Pot 3D Virtual Business**

Junior Achievement (JA) Greece offers programs focused on entrepreneurship, financial literacy, and 21st-century skills. Its purpose is to equip students with practical knowledge, enhancing their social and professional skills. Through experiential activities, students develop responsibility, cooperation, and judgement. The programme strengthens schools' connection to the real market and promotes social responsibility and sustainability.

Junior Achievement Greece has designed educational programs aimed at pupils and students, supporting over 148,000 people and collaborating with over 7,200 schools and application units. At the same time, the organisation offers 1.9 million hours of mentoring by 7,300 volunteers and 8,144 teachers.

The programme "Student Virtual Enterprise" of Junior Achievement Greece, in which the Department of B' Management and Economics participates, aims to introduce students to the concept of entrepreneurship through experiential experiences. In collaboration with EEEK Agiou Dimitriou, students take on roles in a virtual business, developing skills such as decision-making, organisation, and collaboration. Through expert guidance, students have the opportunity to create and promote their own business ideas. One of the most interesting outcomes of this collaboration is the establishment of the student enterprise "Hungry Minds", which promotes the concept of "sustainable canteens" through innovative applications and technologies while incorporating the principles of inclusion and environmental protection.

The students of the company participated in several activities, such as meetings with the journalist Maria Nikoltziou, who took on the role of mentor and guided them in the development of their idea. Also, the team visited the headquarters of the Grigoris company,

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where they had the opportunity to learn about the operation of a professional business and gain valuable knowledge about the organisation and procedures of a commercial unit. The participation in the trade fair at The Mall Athens, where they came into contact with other schools and presented their work, was an important experience for the development of students' presentation and communication skills, while at the same time it enhanced their business perception and their ability to exchange views and ideas.

The 3D Green Pot program, developed by the students of ENEEGYL Agiou Dimitriou is an innovative initiative that combines sustainable development, business education, and technology. The aim of the programme is to create three-dimensional pots from recyclable materials, which will be used to rescue abandoned plants from the urban fabric. The students, through the process of developing and implementing the idea, enhance their skills, while at the same time cultivating their ecological consciousness.

The product of the program, the three-dimensional printed pots, was designed with specific features that meet the needs of the modern city. The pots are made from recycled filament plastic, boosting the circular economy and reducing waste. They are weather resistant and have an innovative water storage system to ensure the care of the plant even when its owner is absent for a few days.

The implementation process involves several stages. Initially, students developed the business idea, emphasising sustainability and solving existing environmental problems. Then, the name and logo of the company were designed, while at the same time the roles and jobs were defined, giving students the opportunity to get acquainted with the operation of a real business. Securing financing and procuring the necessary materials were critical steps in starting production.

The project is already underway, with the printing of the first 3D pots completed. In addition, an online platform has been created, through which citizens can report locations of abandoned plants or pots. This action enhances interaction and collaboration with the local community, making the programme a core of social awareness.

The program's strategy includes future expansions, such as the development of a mobile application. Through it, users will be able to locate abandoned plants, order pots, and share information on sustainable gardening practices. In addition, there is provision for expanding the company's reach at a national and international level through partnerships with other organisations.

The 3D Green Pot programme combines education with sustainability, providing students with the opportunity to develop skills that will be useful to them in the future. At the same time, it contributes to the protection of the environment and the formation of a more conscious society, setting a model of sustainable development and circular economy.

Engaging students in entrepreneurship through a programme such as the 3D Green Pot offers multiple benefits that enhance their personal development, professional preparation, and the creation of meaningful skills. First, students gain self-awareness and confidence as they assume specific roles within the "company" and are involved in decision-making processes. Their participation in real business activities, such as resource management, product creation, and goal achievement, offers an early but meaningful "work" experience (Kolb, 1984). This experience allows students to identify and utilise their talents while contributing to their personal empowerment.

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In addition, the programme enhances the process of career guidance, as students are required to take on roles linked to specific professional fields. Through this experience, they encounter the concept of money management and understand how financial resources are created and utilised. This element is important for shaping financial literacy, a crucial tool for adult life, as Lusardi and Mitchell (2014) point out.

At the same time, students learn to collaborate effectively with their "colleagues" or classmates, developing social skills such as communication, conflict management, and teamwork. Participation in such activities also encourages time management and deadline keeping, skills that are essential for professional success (OECD, 2018). The interactive nature of the programme also cultivates the ability to organise, create innovative solutions, and correct behaviour in the work environment.

## Conclusions

Examining the different aspects of environmental education and entrepreneurship among young people in the education system demonstrates the significant challenges and opportunities associated with these two themes. Initially, environmental education plays a critical role in raising students' awareness of climate change and sustainable development. However, international and European statistics show that, although environmental education is integrated in many countries, there are significant variations in the quality and intensity of its implementation, with many education systems, such as the Greek one, not fully incorporating these principles.

Fostering entrepreneurship in schools is equally important for developing new skills in students. Despite the lack of generalised programmes in many countries, entrepreneurship education fosters creativity, innovation, and leadership skills among young people, which are essential for their career paths and participation in the economy. In Greece, entrepreneurship programmes remain limited, with the need to systematically integrate them into the education system to ensure the development of these competencies in students.

Overall, the needs for expanding environmental education and enhancing entrepreneurship among young people are critical priorities for integrating the modern demands of society and the labour market into the school context. In order to effectively address the challenges arising from climate change and create the necessary conditions for economic and social development, it is necessary to formulate strategies that integrate these themes appropriately into education, both locally and internationally.

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## THE PHILOSOPHY OF ENVIRONMENTAL EDUCATION

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### Abstract

Environmental Education (EE) is a critical process that deals with the relationship between people and the natural and man-made environment. Over the years, several hypotheses have been developed to capture the essence of EE, reflecting the complex interplay between perceptions, motivations, and social goals. These cases highlight the urgent need to address environmental challenges through interdisciplinary approaches, local and global perspectives, and individual responsibility. EE serves as a catalyst to enhance environmental literacy and promote sustainable practices. It inculcates environmental awareness, critical thinking and a sense of stewardship from a young age, enabling individuals to deal effectively with environmental issues.

The objectives of Environmental Education are multi-faceted, aiming to cultivate environmental awareness, knowledge and values. It empowers individuals to make informed decisions and take responsible actions to preserve and improve the environment. EE is characterized by its problem-solving orientation, interdisciplinary approach, inclusion in society and the periodic nature of its application.

These characteristics distinguish it from traditional education and underline its holistic and dynamic nature. Strategies and standards for the integration of Environmental Education into educational systems face challenges due to the multifaceted nature of environmental problems and traditional educational structures. Different approaches, such as interdisciplinary and interdisciplinary models, offer distinct advantages and challenges, highlighting the need for flexibility and adaptation in application.

**Keys words:** Education, Enviromental, Study

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### RETHINKING SCHOOL ARCHITECTURE: BRIDGING EDUCATIONAL SPACES AND THE URBAN FABRIC

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#### Abstract

The architectural design of school buildings needs to accommodate a shifting spatial context, fostering an environment that promotes dialogue and social interaction among students. The alternative models for educational buildings in Europe over the past decades have a fluid spatiality, with architects focusing less on form and more on creating a communicative atmosphere that fosters interaction and togetherness. Nevertheless, in most cases, the school remains strictly demarcated—an autonomous space with no connection to the socio-spatial environment or the urban fabric.

Contemporary education is directed towards fluid and interrelated networks within the urban environment. This research explores the spatial and conceptual boundaries of secondary education schools, focusing on their interaction with the surrounding urban fabric. It examines the relationship between the school building and the city, the interplay of indoor and outdoor spaces, to create the potential for extending educational activities beyond the confines of the classroom.

The article critically analyzes the legislative framework governing school design in Greece, identifying constraints that limit architectural flexibility and innovation. These regulations often produce rigid spaces that fail to support contemporary pedagogical approaches (adaptability, interactivity, dissolution of traditional spatial limits).

By bridging insights from architecture, pedagogy, and urban planning, the research seeks to redefine these boundaries between the typical classroom, the schoolyard and public spaces, trying to answer the broader question of whether teaching and learning should remain enclosed or expand into urban contexts. Creating adaptable and inclusive school spaces enhances the educational process and students' social development, while fostering stronger connections with the urban fabric. The challenge is to use school architecture as a medium for educational and societal progress, by establishing schools as active participants in the urban environment, where learning transcends physical and conceptual boundaries.

**Key words:** school architecture, fluid networks, urban fabric, redefining the boundaries

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### Introduction

The design of school buildings plays a crucial role in shaping the educational experience, yet traditional approaches often isolate schools from their surrounding urban environments. In an era of evolving educational methodologies, there is an increasing need to rethink how school architecture interacts with the city, fostering an open and engaging learning environment. This article examines the issue of ineffective public spaces within the urban landscape and their relationship with school environments in the city. Alternative models of school design are being analyzed, emphasizing the importance of spatial fluidity and integration with urban fabric.

### The dysfunctional public space

Open urban spaces play a crucial role in promoting community development and well-being, as they are accessible public areas, while some social science scholars have criticized the privatization and corporate management of such spaces, arguing that they should remain public, inclusive, and free from restrictions or discrimination (Carr et al., 1992). The term "public" should be reserved for gathering places that are truly open and accessible to all, such as streets, squares, and parks. According to social scientists, these everyday spaces encourage coexistence and dialogue among people from diverse social backgrounds (Lofland, 1998).

However, the fragmentation of public spaces is a reality, and it affects many outdoor areas of public buildings. While public outdoor spaces are intended to function as open, shared environments, fencing and restricted entrances frequently discourage, or even outright prevent, pedestrian access. As E. Philippopoulou states, "The public space is the setting where the interests and objectives of diverse social groups intersect. The more fragmented a society is, the more dysfunctional its public space becomes" (Philippopoulou, 2014). Indeed, contemporary urban environments in most Greek cities suffer from a scarcity of open spaces and greenery.

From an urban perspective, a fence acts as a rigid vertical boundary that divides public space into accessible and inaccessible zones, embodying dichotomies such as inside-outside, introspection-extroversion, and order-chaos. Kahn observes that "the fence symbolizes the function of a refuge" (Ashraf, 2007). While it encloses a space, it also creates a distinction between the internal environment and the external urban space. The more obstructed visibility and audibility are from within the enclosed space, the greater the psychological and social detachment from urban life is. At the same time, the restriction creates a sense of exclusion for passersby, particularly when architectural elements such as difficult access points, imposing fences, or solid facades dominate the streetscape. In some cases, even visual contact with the interior is absent.

From another perspective, Hardin's argument suggests that if access to common resources is entirely unrestricted, users may exploit them unsustainably until they are depleted (Hardin, 1968). The responsible use of these resources, therefore, necessitates a regulatory framework. Over the past few decades, rigid boundaries have become increasingly prevalent (Caffentzis, 2010). In "gated communities," a phenomenon especially common in the United States, entire residential areas are enclosed by tall fences, restricting access to public spaces

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exclusively to residents. "Architectural elements such as inconspicuous or inaccessible entrances, solid facades, or iron fence openings do not attract the potential user to approach the space" (Philippopoulou, 2014). Even architecturally attractive buildings and public areas can create an unintended sense of exclusion if their design is characterized by excessive scale or monumentality.

Hardt and Negri propose an alternative perspective on public space, arguing that the notion of "commons" extends beyond traditional community frameworks—which can sometimes impose limitations on individual freedoms—toward a model of open and free communication among individuals in a shared space that emerges through collaborative social processes (Daflos, 2014). A growing yet underexplored category within this concept is the "urban commons," which offers a new lens for rethinking both the management of public spaces and broader production processes (Karavasili, 2018). According to Hardt and Negri, cities should be viewed as hubs of collective resources, where individuals interact, share, and exchange goods, knowledge, and experiences (Daflos, 2014). From this viewpoint, the city itself functions as a dynamic arena for participation and collaboration, fostering social engagement and empowerment.

In contemporary discourse, numerous researchers emphasize the importance of inclusive design, which prioritizes accessibility for the widest range of users, regardless of age or ability. This philosophy, also known as universal or design-for-all, represents a shift towards a more equitable approach to spatial planning (Burton et al., 2006). Additionally, inclusive urbanism seeks to integrate diverse social groups, ensuring equal opportunities for participation in public life (Espino, 2015). Neal outlines key aspects of public space, emphasizing that public space is not confined to designated physical areas but can encompass any setting—physical or virtual—that facilitates interaction. He also states that public spaces should be universally open and free from material or symbolic barriers, while they must be available and relevant to all members of society. The practical ability to access and use public spaces is often impeded by poor design choices, including inadequate seating arrangements, lack of greenery, inappropriate construction materials, complex layouts, insufficient lighting, or explicit restrictions on access (Karavasili, 2018).

Historically, cities serve as hubs for socialization, leisure, and spontaneous encounters. Citizens engaged with the urban environment through leisurely strolls, informal gatherings, and the exploration of public spaces. The benefits of outdoor activities have been widely documented, with research indicating that exposure to green spaces can yield significant psychological, cognitive, social, and even spiritual benefits. Studies suggest that the presence of greenery in public areas encourages their use, fostering social interaction and cohesion (Coley, et al., 1997). However, recent trends indicate a shift away from these urban dynamics. The modern city is increasingly perceived as unwelcoming, with people moving predominantly between private spaces via private transportation, primarily cars. This transformation underscores the urgent need to reconsider the role of public space in contemporary urban life and to reimagine schools as integral components of the urban commons.

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### The Evolution of Educational Spaces

Over the past decades, European architects have shifted their focus from rigid, form-driven designs to more dynamic and interactive spaces. These contemporary models promote communication and social interaction among students, facilitating an educational atmosphere that extends beyond the traditional classroom setting. However, despite these advances, many schools remain physically and conceptually isolated, lacking direct connections to their socio-spatial environments (Tsoukala, 2017).

Especially the management of the boundary between the schoolyard and the urban landscape is an issue with pedagogical, architectural, and social dimensions. This relationship depends on the form and materiality of the school's spatial limits. This form can either lead to isolation and introversion or foster connection with the city and extroversion.

Modern education increasingly aligns with networked, interrelated systems that engage with the broader cityscape. Schools have the potential to function as open, adaptable spaces that encourage interaction between students, educators, and the wider community. This requires a reevaluation of the spatial and conceptual boundaries of secondary education institutions, examining how the interplay between indoor and outdoor spaces can create opportunities for extending learning beyond conventional classroom settings.

Since the late 1980s, the Organization of School Buildings in Greece (Organization of School Books S.A., 2008) has encouraged the expansion of the school's social environment, promoting the integration of community-accessible spaces within school premises. The multipurpose hall, courtyard theater, library, and event hall are some of the facilities that the Ministry recommends be available for community use.

According to current regulations:

- School courtyards should include areas for gatherings, relaxation, play, greenery, and events. If possible, an open-air theater with concrete seating (circular or semicircular) should be installed to host events for both the school and the community during warm seasons.
- The library should be located near administrative offices, be easily accessible from all school areas, and be available for community use outside school hours.
- The event or multipurpose hall should provide direct access for the community, have a covered extension area, and comply with fire safety regulations. It must also feature independent lighting, heating, and air-conditioning systems to function separately from school hours.
- The school canteen should be centrally located, serving students during breaks and, if possible, be linked to the multipurpose hall to support events.

These regulations reflect a broader vision of schools as community hubs, reinforcing social interaction and shared educational experiences beyond traditional school functions. However, despite these regulations and global advancements in this field, most of the school buildings in Greece remains inflexible and outdated, while Greek legislative framework governing school design remains rather restrictive. Current regulations impose rigid spatial structures that hinder architectural innovation and limit the potential for adaptive, interactive learning environments. The inability to dissolve traditional spatial boundaries results in



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schools failing to accommodate contemporary pedagogical approaches, such as flexibility, interactivity, and openness to public spaces.

The term adaptability refers to the ability of an object or organism to change, in order to adjust to the constantly evolving conditions of its environment. The broad scope of the term allows for various interpretations and definitions within the field of architecture. To understand and define adaptability for the design of school architecture, possible research needs to be approached through the lens of potentiality and systems theory, framing the designed space as a potential space, a node of problems. These problems are in a state of continuous transformation, and consequently, their solutions evolve at the same pace. Thus, the adaptation of space concerns the process through which a solution is activated, with the system serving as its tool.

Below are examples of remarkable school architecture in Greece, where architects made a significant effort to integrate these environments into the urban fabric of their surroundings with an adaptable design. They aimed to foster interaction with public spaces, as much as possible within the constraints of Greek legislation.

### **The round school, by T. Zenetos**

T. Zenetos (1926-1977) experiments with the existing Greek landscape and contemporary society. He challenges the perception of space and time of his era with proposals such as the “round” school in Agios Dimitrios. His technical and technological proposals are characterized by plasticity and a desire to harmonize with the landscape – not only the natural landscape but also the social, political, and economic one, which he sees as inevitably changing. His attempt to compose a multi-layered design led to a distinct, characteristic, open-ended architecture, rooted in the contemporary context while simultaneously projecting into a possible future state. D. Papalexopoulos and E. Kalafati (2006) describe Zenetos’ work as a continuous projection into the future, a detachment from the present. The fluidity and rapid change of conditions lead him to avoid static solutions – since there is no single spatial solution – but rather to design transitions from one state to another. Zenetos’ views and explorations were considered pioneering in his time and, by many, perhaps disconnected from reality. Specifically, he had, earlier on, described the new type of architect who “begins to become a collaborator with the residents, shaping the environment together with them” (Papalexopoulos, Kalafati, 2006). His inquiries regarding education follow a similar trajectory, as he actively seeks to contribute to shaping the “school of the future”. Notably, before designing the school in Agios Dimitrios, he conducted a six-month study on emerging educational trends in Europe. Through this research, he concluded that the school environment should not only keep pace with social and educational changes but also lead them. He believed that the educational process should be in direct and interactive dialogue with its social surroundings, expanding its boundaries to engage with the broader community, (Papalexopoulos, Kalafati, 2006).

The most well-known realized example of this approach is the round school (Zenetos, 1971). The unit was designed in 1969 for 1,500 students, with a planned gradual reduction to 750. Zenetos redefines the hierarchical relationship between teacher and student, aiming to

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create multiple layers of interaction that reflect the dynamics of social reality. Specifically, he proposes a structured and complex arrangement:

- Groups of 2-6 children
- Larger groups of 40 children
- Classes of 100-160 children
- School unit
- School complex



Images 1, 2. "He considers the building as a transition tool, whose specific form at any given time will reflect the balance of forces that define this transition toward the information society" (Papalexopoulos, Kalafati, 2006). Photo by K. Ploumpis ([www.mancodestyle.com--stronglylo-scholio-ston-agio-dimitrio](http://www.mancodestyle.com--stronglylo-scholio-ston-agio-dimitrio)).

Spatially, this intention is expressed through flexibility in design (Papalexopoulos, Kalafati, 2006). Although he was aware that the linear arrangement of classrooms connected by an external corridor was the only solution accepted by the Organization of School Buildings in Greece, he did not hesitate to propose a groundbreaking design for school facilities. After a lot of discussions with the Organization of School Buildings, his proposal was approved on the condition that it could also accommodate a traditional school. This design was implemented in the school complex of Agios Dimitrios, featuring a circular floor plan where multipurpose classrooms and workspaces are arranged along the perimeter, enclosing an open central space. The circular shape of the school is dynamic, innovative for its time, and remains distinctive even today. The circle signifies the school as the center of the

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community – a space that, in the future, would connect students, teachers, and the wider community through the internet. The school was built along the perimeter of the circle, leaving its center empty, awaiting future development. The architect's plan envisioned the gradual filling of this void with activity units such as an amphitheater, computer rooms, and holographic learning systems (Doumanis, 1978).

Each unit corresponded to potential future needs of the school, as envisioned by Takis Zenetos (Zenetos, 1971). Although the central space follows a plug-in logic, it does not include prefabricated units. The activity units appear as segments of the circular disc that can be added or removed, allowing the school environment to spatially adapt to the needs of students and their curriculum while maintaining structural and formal coherence. Comparing Zenetos' original designs with the building as it exists today, it becomes evident that the structure ultimately was used neither as a tool for transitioning into the digital age, nor as the center of the community. The building's flexibility was limited to the light partition walls of the classrooms. Although digital technologies play a crucial role in everyday life in the 21st century, and the educational system has evolved significantly, the appropriate framework for fully utilizing the school building, as Zenetos had envisioned, has yet to be established.

Zenetos' research within the Greek context and landscape provides a model for composing flexible and adaptable systems that respond to their surroundings and technical heritage. His strategic approach to designed, adaptable spaces, creates a flexible, open-ended system aimed at sustainability and establishing a foundation for future living, as envisioned in the 1960s. His proposals aim to free the environment from the permanence of construction so that it cannot only change function and properties but also disappear entirely, leaving no trace of its existence. Zenetos' strategy will form the core framework for developing the experimental design method, supplemented by contemporary tools such as algorithmic logic and robotic construction platforms.

### **The Gymnasium-Lyceum, by D. Fatouros**

D. Fatouros designed the Gymnasium-Lyceum building in Lagadas, Thessaloniki, in 1966, in collaboration with architect V. Giannakis, with the project being completed in 1970. Its location near the lake of Lagadas played a crucial role in shaping the architectural composition, with the complex aligning harmoniously with the horizontal landscape. The Organization of School Buildings program required the project to be completed in two phases, which significantly influenced the design process. The architects proposed a flexible solution that allowed for size modifications without making the complex appear unfinished. The design follows a center-oriented approach, fostering interaction around a large central courtyard with smaller outdoor areas along its perimeter.

The core concept of the design is based on the repetition of a modular unit, which forms the most quantitatively dominant and qualitatively characteristic element of the project. This module is the classroom, designed in an octagonal shape, which, when doubled or tripled, generates specialized rooms, such as laboratories. As D. Fatouros notes, "this school is probably the first implementation in Greece of a non-rectangular composition, with polygonal classrooms as fundamental units, creating a complex typological structure" (Papadopoulos (ed), 2009: p. 69).

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Dimitris Fatouros and his collaborators approached the design of the school in Lagadas with both originality and responsiveness to the evolving demands of educational reality, while simultaneously engaging with the most experimental and innovative trends in architecture and pedagogical theory. His deep interest in educational issues was rooted in a humanistic perspective, which is evident in his design philosophy. He placed the child and its needs at the center of his architectural concerns, drawing from the educational theories of Jean Piaget and the New Education movement (Papadopoulos (ed), 2009). He believed that designing a school should involve collaboration between architects, educators, and psychologists, ensuring that the spatial organization truly serves the child's development. His thinking was shaped by child psychology, leading him to integrate social dimensions into his educational design principles. He recognized that school spaces shape a child's personality, but he also argued that the architect's responsibility should extend beyond the school building to the broader environment (Fatouros, 2008).

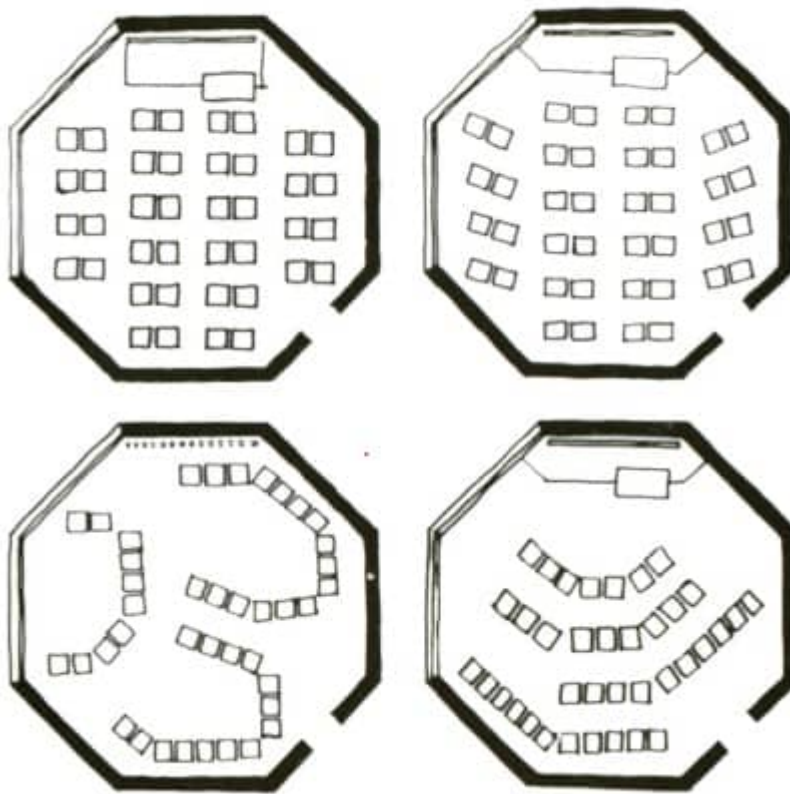


Image 3. Possible desk-board arrangements that foster a new teacher-student relationship (Fatouros, 2008).

The Lagadas Gymnasium-Lyceum embodies the fusion of theory and practice. The architects prioritized accessibility, designing the school with two entrances for students and the local community. The classroom layout was carefully chosen, combining the advantages

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of both the square and the circle, ensuring centrality, clarity, and defined boundaries. This design allowed for flexible desk and blackboard arrangements, fostering a new student-teacher relationship. Additionally, traditional hallways were replaced by communal gathering spaces, promoting interaction. The additive principle of modular classrooms enabled the creation of distinct groupings, adaptable to different educational needs. These features reflect Fatouros' pedagogical research, demonstrating his commitment to intervening in the educational process, despite the initial constraints set by the Organization of School Buildings (Fatouros, 2008).



Image 4, 5 Views of the classrooms in the school complex (Fatouros, 2008).

The final school building constructed by the Organization of School Buildings was not the preferred version among the alternative proposals submitted by the designers. Legal restrictions prevented the architects from supervising the project's execution, although they made limited efforts to ensure that key organizational principles were respected. A significant modification was the elimination of the second entrance, as delays in road construction prevented access to it. These alterations ultimately weakened the envisioned relationship between the school building and the educational program, as well as its integration with the city of Lagadas.

### **Redefining Boundaries: Architecture, Pedagogy, and Urban Planning**

The boundary between the school environment and the public spaces around it varies significantly, sometimes taking the form of solid, opaque materials that obstruct visual contact with the surrounding public space, while in other cases, it consists of perforated or lightweight materials or even remains rudimentary. The way this boundary is formed plays a decisive role in determining whether a school becomes an isolated and inward-looking entity or one that fosters openness and engagement with the city. Also, the relationship between the schoolyard and the urban landscape is largely shaped by the structure and materiality of this boundary. This connection profoundly influences the pedagogical and social aspects of educational experience. A boundary delineates the school from the rest of the public space while



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simultaneously defining points of entry and exit, regulating access as needed. Fencing serves as a defining feature of enclosed schoolyards, marking clear thresholds and reinforcing an inward-oriented approach. Such barriers hinder the relationship between the school building and the surrounding city. The ability to access public space extends beyond the physical realm to include visual and psychological or symbolic dimensions (Carr et al., 1992). This multifaceted inaccessibility reinforces the separation between schools and their urban surroundings, highlighting a disconnect that affects both the students inside and the broader community outside.

The benefits of spending time outdoors have been widely recognized, with research showing that exposure to outdoor environments can provide significant psychological, cognitive, social, and spiritual advantages (Irvine & Warber, 2002). Moreover, studies indicate that the presence of green spaces in public areas encourages their use and promotes social interaction, contributing to social cohesion (Coley et al., 1997). By integrating insights from architecture, education, and urban planning, it is possible to redefine the relationship between school spaces and their urban contexts. The dissolution of strict physical boundaries – between the classroom, schoolyard, and public spaces – encourages learning environments that are more inclusive, dynamic, and socially engaging. Schools can transform into active urban participants, where education transcends physical and conceptual limits, fostering stronger connections with the community.

## Conclusion

In recent years, homeschooling has gained significant traction, driven in part by a growing distrust in traditional schooling systems. Many parents opt for homeschooling due to concerns about educational quality, curriculum flexibility, safety, and individualized learning approaches. The rise of digital learning tools and online resources has further facilitated this shift, making personalized education more accessible. This trend raises debates about socialization, standardized assessments, and long-term academic outcomes. As this continues to expand, it challenges conventional educational models and prompts discussions on the future of learning.

The challenge of contemporary education and school architecture is about shaping environments that support both educational progress and social development. By rethinking school architecture as an open and adaptable system, schools can become vibrant hubs that enhance student learning while strengthening ties with the urban fabric. The future of education lies in spaces that are not confined by walls but enriched by the city itself, creating a seamless integration between learning and everyday life.

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### **THE ROLE OF MUNICIPAL OPEN FREE UNIVERSITY OF MUNICIPALITY OF NEW FILADELFIA-NEA CHALKIDONA: A SOCIAL FOOTPRINT AN ACCESS TO HIGH LEVEL EDUCATION**

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#### **Abstract**

The institution of Municipal Free Open University (MFOU) expresses the academic idea, an innovative idea, the way to fulfil the citizens requirements of a local community, the city of Neas Filadelfias- Neas Chalkidonas to react, to learn new academic approaches. It's an idea that seeks to improve the quality of citizens life, how to react and solve daily problems through different approaches. New approaches such as the use of new digital means, to learn the history of the cultural heritage, the tradition and the history of their city. These approaches simplify the way of living of public services makes better their life. Statistically, the attendances are in growing number. For the implementation of the Municipal Free Open University (MFOU) took the approval of the Municipality of Council Board of Municipality of Neas Filadelfias-N. Chalkidonas.

The present paper investigates the way of how make better the municipality life, to develop their interests through interaction, while the academic teachers participate under the solidarity's impact as a new tool and practice to learn citizens to activate more, to think better, to acquire and obtain new knowledge and skills, to come into contact with new fields of knowledge and new scientific subjects in order to broaden their horizons. These issues are updated aiming at dealing with the modern life requirements. It's important to obtain the Scientific Committee's agreement too, as well as to receive Municipality's which is also responsible for the form of structuring of lectures that seek to cover intellectual pursuits of the era such as the digital transition to a smart green policy, the elimination of violence from schools, the reduction of marginalization, the preservation and revival of tradition, the culture of the place, as well as any action to expand and develop the various cognitive subjects of both theoretical and positive sciences.

To sum up, this interaction of this solidarity idea has positive results as the interest of citizens is constantly increasing and creates a social footprint of local action. It is understood that the (active) citizen is interested in improving the lifestyle by enriching his knowledge for dealing with and managing everyday problems-crises as has been proven.

**Key words:** use the establishment of World Cultural Foundation of Diaspora Hellenism of Municipality of New Filadelfia-N. Chalkidona, the Municipal Free Open University (MFOU), academic knowledge, new digital era

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### **STUDENTS AS AGENTS OF CHANGE IN URBAN STUDIES OF PRIMARY EDUCATION IN THE CONTEXT OF THE NEW NATIONAL CURRICULUM: ‘ACTIONS FOR ACTIVE CITIZENSHIP’**

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#### **Abstract**

The aim of this paper is to present the contribution of the Pilot Study of the new curriculum of primary education ‘Environmental Studies’ (ES) to the implementation of the new Greek National Curriculum ‘Actions for Active Citizenship’. The Pilot Implementation of the ES and its formative evaluation was implemented through educational action research and the creation of Professional Learning Communities during the school years 2021-22 and 2022-23. The main outcomes of this study were that: a) Most of the in-service teachers who were involved in the study emphasized the need of additional time in terms of teaching hours for each thematic unit in order to develop and implement action plans for the achievement of attainment targets. b) A distinction also is raised between those who developed lessons for the learning of citizenship concepts (minimal/soft citizenship education) and those who developed action plans for students’ engagements in citizenship actions (maximal/critical citizenship education). The findings of the action research are fundamental for the overall pedagogy and the teaching strategies of the teaching of ES subject as a requirement of the implementation of the national curriculum ‘Actions for Active Citizenship’. First of all, in a sort of maximal approach of urban education, studies of the natural and social environment in the context of ES subject are combined in what J. Lemke calls an ecosocial system in which a human social community is taken together with the material (human made and natural) ecosystem that enables, supports, and constrains it. For that purpose, education for active citizenship and sustainability cannot be constrained within the teaching of a single subject but it has to be part of the school practice in a sort of a whole school approach. Teaching practices such as place-based education, challenge based and inquiry based are valuable especially for dealing with the complexity of issues related with sustainability and citizenship. Finally, an adoption of critical, active citizenship is the fundamental requirement towards a transformative education for the purpose that educators and students will be agents of change.

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**Key words:** sustainability, active citizenship, national curriculum, urban education

### 1. Introduction

Education has increasingly been recognized as a catalyst for fostering sustainability and active citizenship (UNESCO, 2022). In an era of complex socio-environmental challenges, the role of education extends beyond traditional barriers between curriculum subjects to the development of engaged, responsible, and proactive citizens. As it was announced in the Transforming Education Summit (TES) at UN Headquarters in New York on 16-17 and 19 September 2022 (UN, 2023) educational systems are still far from reaching the goals of SDG4 as captured in the 2030 Agenda and are confronted with a crisis of relevance, because many of them are not equipping the new generations with the values, knowledge, and skills they need to cope with the complexities of today's world. Educational institutions are now expected to equip students with the competencies, knowledge, skills and values necessary to address global issues such as climate change, urbanization, and social justice.

In recent years (UNESCO, 2024b), there is an alarming demand for the transformation of education systems towards holistic approaches that integrate sustainability into curricula rather than treating it as an isolated subject. This shift reflects the growing acknowledgment that sustainability cannot be compartmentalized but must be embedded within broader educational frameworks (Chinn, 2012, 325). The Greek National Curriculum ‘Actions for Active Citizenship’ (Law, 2024) initiative exemplifies this paradigm shift, aiming to empower students as agents of change by fostering participatory learning and critical thinking.

A core aspect of this approach is the integration of urban studies within primary education through the subject of ‘Environmental Studies’ (ES) which is an essential part of the primary curriculum for the first four years of the primary education. The urban environment presents unique challenges and opportunities for sustainability education, as it encompasses issues related to resource management, biodiversity conservation, public space usage, and social justice. Students growing up in urban areas must develop an understanding of their surroundings as interconnected social-ecological systems in which human activities and natural processes interact (Woodhouse et al, 2001).

This paper studies the findings of a Pilot Study that examined the implementation of ES in alignment with active citizenship education. It explores how students can become active participants in their communities through place-based learning and sustainability action plans. Drawing on ecosocial systems theory (Lemke, 2001), urban environmental education (Russ & et al, 2015), and transformative learning (Sterling, 2002), this study argues that Education for Sustainability (EfS) must adopt an action-oriented, place-based, and participatory pedagogy to be effective. By focusing on real-world authentic learning, inquiry-based learning, and collaborative projects, students can move beyond theoretical knowledge to engage in meaningful sustainability practices that benefit both their local and global communities.

Furthermore, this paper addresses the role of teachers and educational policymakers in supporting this transition. Effective implementation of active citizenship initiatives requires not only curriculum reform but also teacher training, institutional support, and community engagement. By examining the successes and challenges encountered during the Pilot Study,

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the present study contributes to the broader discourse on how primary education can foster sustainability literacy, civic responsibility, and transformative learning outcomes.

### ***1.1. The Need for a Green Curriculum***

In the face of recent environmental challenges, there is a growing imperative to integrate sustainability education into formal curricula worldwide. Despite increasing international emphasis on sustainability, many educational systems still fail to provide comprehensive coverage of climate change and sustainability-related issues. A recent UNESCO (2024a, 21) review highlights that in a study of over 530 Grade 9 science and social science curricula from 85 countries worldwide while 77% of national curricula make reference to environmental or sustainability topics at least once, only 31% explicitly address climate change. Also, while 69% of surveyed teachers from eight of the countries studied reported that environment, sustainability and climate change topics were included in the science and social science curricula in their schools only 50% included them in their teaching. This gap and the in-balance between environmental education and education for sustainable development underscores the need for a systemic and structured approach for embedding sustainability into the entire school curriculum. In particular, UNESCO (2024c) suggests that more education systems need to be taking a whole institution approach to tackling sustainability issues within school subject curricula. Including indigenous and local knowledge in relation to environment, sustainability and climate change in school subject curricula recognizes the oneness of all things, rather than a dualistic worldview that sees the world in terms of binary opposition between human beings and nature (UNESCO, 2024b). Education on environment & sustainability should include action oriented, place-based and participatory teaching and learning methods within school subject curricula to empower students and teachers to act individually and collectively and take responsibility on sustainability issues.

Due to these findings just six years before the completion of the AGENDA 2030 the Greening Education Partnership (UNESCO 2024d) has set ambitious global targets, aiming to incorporate sustainability into 90% of curricula by 2030 and transform 50% of schools into sustainable learning environments (UNESCO 2024b,c). Achieving these objectives necessitates a multifaceted approach that includes curriculum reform, targeted teacher training, and the fostering of stronger school-community partnerships by establishing communities of practice. A ‘green’ curriculum should not only integrate sustainability as a cross-cutting theme but also encourage interdisciplinary learning, critical thinking, and real-world application of sustainability principles.

Furthermore, a shift towards competency-based sustainability education is required, wherein students develop the skills and mindsets necessary to address complex ecological and socio-economic challenges. For the accomplishment of that purpose the European Sustainability Competence Framework (Bianchi, et al, 2022), as announced in the European Green Deal has addressed the importance of political agency that means the capacity to positively influence the collective future, by mobilising those at political level to take action for change (Bianchi, et al, 2022, 26). Such an approach aligns with the EfS framework, which



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advocates for participatory, transformative, and action-oriented learning experiences (UNESCO, 2020).

### ***1.2. Active Citizenship in Education***

Education for active citizenship extends beyond the transmission of theoretical knowledge to actively engaging students in civic participation and democratic processes. According to UNESCO (2021), students and educators should be regarded as agents of change, capable of driving sustainability-oriented transformations at the local, national, and global levels. A core tenet of active citizenship education is participatory learning, which enables students to critically engage with societal issues and collaboratively develop solutions.

In alignment with these principles, the Greek National Curriculum has incorporated an ecosocial systems perspective, linking human societies with material and ecological environments. This approach underscores the interdependencies between social structures and environmental sustainability, encouraging a holistic understanding of sustainability challenges.

Scholars differentiate (UNESCO, 2018, 18; Noola, 2014, 21) between two primary forms of citizenship education:

1. Minimal or so-called “soft” Citizenship Education, which primarily focuses on conceptual understanding of national, social identities, the discourse of human rights and the dissemination of civic knowledge.
2. Maximal, Critical Citizenship Education, which emphasizes student-led initiatives, participatory democracy, and direct civic engagement towards citizenship literacy and competencies.

The Pilot Implementation of the ES and its formative evaluation was implemented through educational action research and the creation of Professional Learning Communities during the school years 2021-22 and 2022-23 (Ntoka, et al, 2024, 441). The main outcomes of this study were that: a) most of the in-service teachers who were involved in the study emphasized the need of additional time in terms of teaching hours for each thematic unit in order to develop and implement action plans for the achievement of attainment targets which deal with citizenship, inclusion and values, b) a distinction also is raised between those who developed lessons for the learning of citizenship concepts (minimal/soft citizenship education) and those who developed action plans for students’ engagements in citizenship actions (maximal/critical citizenship education). The ES Pilot Study revealed that educators implementing critical citizenship education faced challenges related to instructional time constraints, as facilitating student-driven civic action plans required extended periods of classroom engagement. These findings suggest the necessity for curriculum adjustments that allow greater flexibility for project-based and experiential learning in sustainability education (Rizaki, et al, 2024) beyond the limits of a single subject towards the direction of a school practices.

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## 2. Sustainable citizenship and urban education

### 2.1. Overcoming Climate Anxiety and Fostering Resilience

As awareness of climate change increases, so does the prevalence of eco-anxiety among young learners. The Programme for International Student Assessment (PISA, 2022) reports that Students’ satisfaction with life, more generally, declined in many countries and economies over recent years. In 2022, 19% of students in Greece reported that they were not satisfied with their lives: they rated their satisfaction with life between 0 and 4 on a scale ranging from 0 to 10. In 2018, fewer students were not satisfied with life (15%). On average across OECD countries, the proportion of students who are not satisfied with life increased from 11% in 2015 to 16% in 2018 and 18% in 2022.

An increasing number of studies (Pihkala, 2020) show recently that a rising environmental consciousness has led to heightened psychological distress mostly among 15 to 30 year olds, often manifesting as ecological anxiety, grief, guilt and anger—a profound emotional responses to uncertainty because of extensive environmental degradation and loss.

To mitigate these effects, sustainability education should incorporate strategies aimed at building emotional resilience. Antonovsky’s Sense of Coherence (SOC) theory (1987) provides a relevant framework, suggesting that resilience is cultivated through three key dimensions (Mittelmark, et al, 2022):

- **Comprehensibility:** a belief that challenges are understood and that you can understand events in your life. That means ensuring that students can make sense of environmental changes through clear and accessible information.
- **Manageability:** a belief that resources to act are available and that things are manageable and within your control. Therefore, equipping students with the tools and resources needed to take constructive action.
- **Meaningfulness:** a belief that things in life are interesting, motivating, and a source of satisfaction. So, encouraging personal investment and emotional connection to sustainability challenges.

By embedding these principles within sustainability education, students can develop a greater sense of agency and optimism, enabling them to navigate complex environmental issues with confidence and purpose.

### 2.2. Urban Education and Place-Based Learning

Socioecological issues now days often pose wicked problems, because they involve interlinked complex systems, such as the natural systems and the social systems including technological, political and economic systems (Bianchi, et al, 2022, 17). Urban environments present unique sustainability challenges, necessitating educational approaches that address the socio-ecological complexities of cities (Chinn, 2012, 330). Urban environmental education provides a framework for integrating sustainability learning within the urban context, focusing on issues such as air pollution, waste management, biodiversity loss, and social justice.

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A particularly effective approach in this regard is place-based education, as proposed by Woodhouse & Knapp (2001a,b). This pedagogical approach emphasizes the importance of situating learning within local contexts, enabling students to explore sustainability issues within their immediate environments. Place-based learning fosters situated cognition, wherein students gain knowledge through direct engagement with real-world sustainability challenges.

Williams & Agyeman (1999) further argue that urban environmental education should promote environmental stewardship, encouraging students to take an active role in improving the sustainability and social coherence of their communities. This aligns with the broader goal of empowering students as agents of change who are capable of implementing localized solutions to urban sustainability problems.

### ***2.3. Transformative Learning and Sustainability***

Achieving sustainability requires a fundamental shift in educational paradigms, moving beyond traditional transmissive models towards transformative learning (Mezirow, 1997). Transformative learning theory posits that education should challenge existing worldviews, encouraging learners to critically reflect on dominant socio-economic models and explore alternative sustainability pathways.

Baumgartner (2001) and Sterling (2002) emphasize that transformative learning is particularly relevant in sustainability education, as it fosters critical consciousness and the ability to question unsustainable practices. A whole-school approach to EfS is crucial in this transformation, as it encourages collective action among students, educators, and communities. This approach necessitates:

- Interdisciplinary curriculum design, integrating ecological, social, and economic perspectives.
- Experiential and inquiry-based learning, allowing students to develop practical solutions to sustainability challenges.
- Institutional sustainability practices, ensuring that schools serve as models for sustainable operations.

By adopting transformative learning models, schools can serve as incubators for sustainability innovation, equipping students with the knowledge, skills, and ethical frameworks necessary for leading the transition towards a sustainable future.

### **3. Sustainability and citizenship in the context of the new National Curriculum ‘Actions for Active Citizenship’**

Since the 1st of November 2024 the New Greek National Curriculum “Actions for Active Citizenship” (Government Gazette 6048/2024, Issue B) for kindergartens, primary and secondary schools provides guidelines for the implementation of action plans towards the accomplishment of the 17 goals of sustainable development. Each thematic unit of the Curriculum is focused on one of the targets of sustainable development. The attainment targets of each thematic unit are grouped in four age groups: a) nursery, 1st’, 2nd’ and 3rd’ classes of lower primary education, b) 4th’, 5th’ & 6th’ classes of upper primary education, c) 1st’, 2nd’ and 3rd’ classes of lower secondary education and d) 1st’, 2nd’ and 3rd’ classes of

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upper secondary education. The range of actions according to age groups varies from school community and neighborhood up to the national state and global scale also with the use of digital world. A Teachers' Guide for Active Citizenship consists of examples of 24 complete structured action plans, 6 action plans for each age group and additionally 48 proposals for action plans. Each action plan is focused on certain attainment targets in accordance with the 17 SDGs.

The National Curriculum Actions for Active citizenship and Teachers' Guide for actions of active citizenship develop an ecosocial educational system which is simultaneously a material and a social-semiotic system. An ecosocial system is simultaneously a material and a social-semiotic system (Lemke, 1993). Ecosocial systems show ecosystem organization in both their cultural-semiotic and their material-ecophysical dynamics. Sustainability and citizenship in this ecosocial system are complementary, one presupposes the other and at the same time one refers to the other. Actions of active citizenship supply this ecosocial system with material entities (for example the reconstruction of a local park) and/or social practices (the creation of educational materials, an internet campaign, etc.) and in return the system generates new actions (<https://iep.edu.gr/el/aeiforia-energospoliteiotita>). The methodological approach of each action plan has five stages:

- a) students' decision of what they want to do in order to resolve problems and respond to challenges, presuppose their collaboration for decision making,
- b) the design of action's implementation means that students carry on research in order to decide the most relevant and effective action plan and conceptualize the issue from different points of view depending on the various stakeholders and groups of interest,
- c) the action itself which has to be done as an intervention to the real world and not as a 'think as if...' practice,
- d) the dissemination of the action and its outcomes, and
- e) teachers' and students' reflection on the entire process.

Students are called as agents of change to envision sustainable futures for the purpose of SDGs achievements. Actions are implemented during teaching hours of specific subjects which are suggested by a Ministerial Decision 146472/ΓΔ4/06-12-2024 even though it is at the discretion of teachers' decisions to use any subject of the entire curriculum.

The National Curriculum (2024) 'Actions for active citizenship' meets the objectives of the Agenda 2030 with regard to the interlinkages, interdependencies and synergies required across sectors and policies, as well as for partnerships and collaboration to meet "horizontal" and win-win objectives for: a) local environments (e.g. neighbourhood, town, etc.), b) biodiversity, c) ecosystems, d) safety protocols and procedures in terms of prevention of and preparedness for natural disasters; also, in respect to: a) understanding and adopting whole system approaches for school management so as to be transformed into eco-schools, b) analyzing the interconnections and interdependencies of the natural, social and economic environments in relation to overconsumption and the adverse impacts of intensive and unsustainable agriculture, fishing and tourism practices on natural resources. Students are called to imagine and describe their actions as citizens in their local community in terms of a sustainable future. They are also called to think about the values, attitudes and principles that have to be adopted in a sustainable future. In terms of adaptability, they learn how to directly link waste production with consumption, value approaches which are based on rethinking,

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reducing, reusing, repairing and recycling processes in their everyday lifestyle decisions, understand and apply circular economy principles based on products' life-cycle analysis, learn and apply safety procedures for their protection from natural disasters and epidemics. Finally, at a more political level, they understand how to adopt and adapt the 17 SDGs and act against the current planetary crises of climate change, pollution and biodiversity loss, food insecurity, poverty and inequalities.

The overall objective of the new national curriculum is the envisioning of the transformation of schools towards the direction of sustainable schools through Whole School Approach practices. Ideally, teachers will identify with a concept of transformed sustainable school because it offers something strong and inspiring with which to identify. According to the new national curriculum, a view of education is developed for a paradigm shift which demonstrates how our education systems can create new levels of awareness and work towards a sustainable future. Students are expected to change their behaviors toward climate change and the protection of their local environment. It is also expected that their behavioral change will be directly linked with their modified lifestyle choices and a new social identity.

In terms of the way (platforms, networks, etc.) curriculum materials are accessible to those who are interesting: educators, students, stakeholders, etc., it is anticipated that available resources will be accessible in the most efficient, productive and convenient way, avoiding mistakes, irrelevant information, repetitions and time-consuming efforts via a new digital platform: <https://act.digitalschool.gov.gr/>. Getting information, experience and good practices from those who work in the same or similar issues, projects, in what we use to call communities of practice for the purpose of 'bottom – up' reforms may work in parallel with 'top – down' initiatives.

Partnership networks between educators, scientists and stakeholders, accompanied by databased communication platforms are expected to provide expertise knowledge in training activities and initiatives. Bottom - up approaches of best educational practices of action plans for local history and local geography and experiences which are shared by schools are expected to bring together pupils and teachers from various places, such as urban areas, coastal regions and remote continental areas. School knowledge and experiences developed from participating partnership are expected to support cross curricula implementations mainly in terms of skills/competencies and reforms of the national curriculum for sustainable development.

#### **4. Recommendations for Enhancing Education for Sustainability (EfS) and citizenship in Primary Education**

Integration of active citizenship approaches, embedding participatory, action-oriented learning methodologies within the curriculum are all crucial practices for fostering a sense of agency among students. By incorporating hands-on projects, collaborative decision-making, and problem-solving activities, students can be empowered as sustainability advocates. Encouraging student-led initiatives, such as eco-clubs and sustainability campaigns, will help them develop a deeper understanding of their role in shaping a sustainable future.

Urban-focused curriculum design, given the unique socio-economic and environmental challenges of urban environments, should be part of the primary education curricula in order

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to address issues such as pollution, resource management, social equity, and urban resilience (Rus et al, 2015, 20). Through localized case studies, place-based learning, and interdisciplinary approaches, students can develop practical solutions to real-world urban challenges while gaining a deeper appreciation of their communities (Sturrock, et al, 2023, 98).

Adoption of transformative learning models, implementing experiential, inquiry-based, and reflective pedagogies can significantly enhance critical sustainability thinking. Experiential learning through field trips, nature-based education, and hands-on environmental projects can cultivate a strong connection with ecological and social systems (Chinn, 2012, 327). Encouraging inquiry-based learning fosters curiosity and problem-solving skills, while reflective practices—such as journaling, discussions, and ethical debates—help students critically engage with sustainability issues.

Strengthening school-community collaborations, establishing strong partnerships between schools and local stakeholders—including municipalities, NGOs, businesses, and community leaders—can create opportunities for real-world engagement. Schools can collaborate with local environmental organizations on projects such as urban gardening, waste reduction programs, and clean-up initiatives. These partnerships can also support service-learning projects where students actively contribute to their communities while applying sustainability principles (Sturrock, et al, 2023, 111).

Teacher training is essential for the successful implementation of EfS strategies. Providing professional development workshops, access to up-to-date sustainability education materials, and opportunities for interdisciplinary collaboration can enhance teachers' ability to integrate sustainability concepts into their teaching. Additionally, fostering a culture of continuous learning and peer exchange among educators can strengthen their confidence and effectiveness in promoting sustainability education.

Empowering students as agents of change is essential for advancing sustainability education. By integrating active citizenship, place-based learning, and transformative pedagogies, primary education can foster responsible and engaged citizens. Future research should focus on evaluating the long-term impact of EfS initiatives on student engagement and community participation.

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### **yOUR 2030. A MULTIDISCIPLINARY EDUCATIONAL PROJECT TO PROMOTE THE THEME OF SUSTAINABILITY**

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#### **Abstract**

The yOUR2030 project originated from the awareness that the Sustainable Development Agenda, signed in September 2015 by the governments of the 193 UN member countries, is an action program that invites individuals to reflect on the relationships between personal behaviours and the resources available on our planet.

The guiding idea of the project is that the theme of sustainability should be presented as an educational subject adaptable to the characteristics of the students/audiences.

The work began in 2021 with the consideration that there is no universally recognized communication strategy deemed effective for discussing sustainability. However, there are key concepts that can be used in general terms to convey to different audiences a clear and distinctive characterization of the topic to focus attention on specific communication themes that are widely recognized as strategic.

Experience conducted with audiences of varying ages and engaged in diverse educational activities identified four "key themes" that are essential for effectively conveying the concept of sustainability across different contexts.

**Key words:** SDG's 2030; Education system, vision of sustainability, sustainability practices.

#### **Introduction**

The reflections presented here were inspired by the research we undertook at the Politecnico di Milano, Mantua Campus, starting in 2016. We have offered students a Laurea (equivalent to Bachelor of Science) programme in Architectural Design at the Mantova Campus since the early 2000s and it was joined by a master's degree in "Architectural Design and History" in 2015.

Starting with the introduction of the master's degree, we decided to promote specific research activities to integrate sustainability-related topics in our teaching. To do so, we initiated a research laboratory called Land Repair Lab, which was inspired by the desire to test teaching paths and innovative research while strengthening research methods useful for providing design-oriented responses that do not refer to an individual project, but aim to gather the series of relationships that each project develops with the fundamental resources in the surrounding environment (Lennon, Douglas & Scott, 2017).

The guiding conviction is that to do so, it is necessary to change the approach to the project: start with the existing elements, reading their history, understanding their

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relationships, and gathering their collocation within the different systems and networks that structure the urban and territorial space; and work towards progressive reactivation capable of reading the distinctive characteristics and addressing the pre-existing interwoven environmental and urban relationships in coherent terms.

Following this approach, a reading of the territorial morphology, recovery of the urban fabric, and discovery of human settlements may contribute explicitly not only to building knowledge, but also to forming a project with an awareness of the future of a territory (Angelillo & Peraboni, 2022).

These are topics and questions that have arisen in recent years, highlighting the weaknesses and limits of urban planning as they mainly relate to the changing contextual conditions and a radical reorientation of the discipline. Such topics constitute a perspective for anchoring city transformations, which are often affected by regeneration involving central urban areas and very distinctive functions.

The idea of promoting a “repair” approach stems from a desire to activate - in terms of the landscape and territory - the strategy of “mending” indicated by Renzo Piano in an article published on 26 January 2014, entitled “Il rammendo delle periferie”.

The reflections presented here begin with an extraordinary request: “... We are an extraordinary, beautiful country, but one that is also very fragile. The landscape is fragile, as are the cities, particularly the peripheries, where no one has spent time or money on maintenance. But the peripheries are precisely the city of the future, where human energy is concentrated, and which will be left as a legacy to our children. Both extensive mending and ideas are needed...” (Piano, 2014).

The focus of our activities starts with the search for these ideas, which moves in three directions:

- organising a workshop entitled “ReActive Strategies. Idee, progetti e azioni per la città”, the goal of which was to test new forms of teaching and promote initiatives that could complete the teaching path while presenting students with an overview of the problems related to sustainability. The goal was to test project forms to express a specific awareness of sustainability issues;
- conducting systematic reconnaissance relating to the ways in which sustainability is inserted and can be read within the programmes we teach. The goal was to verify the means through which the teaching project in the Laurea (equivalent to Bachelor of Science) programme explicitly expresses its awareness of different aspects and the different scales of work that link sustainability to architectural projects;
- investigating via a questionnaire administered systematically to all students. The goal was to verify the level of knowledge and awareness of the issues in “sustainable design” and elicit the common features and different meanings of “sustainability” recognised by the students.

The third activity shed light on the most interesting results, which then oriented our activities. Through the examination, we were able to understand how our students have a different level of sensitivity and awareness of sustainability, different levels of knowledge, and a limited view of the relationship between sustainability and the project in certain senses. Essentially, they related sustainability to the capacity to ensure good energy efficiency for the

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building being designed. The result of this investigation suggested the start of a project aimed at bringing the topic of sustainability “into” our teaching activities. The idea was to make sustainability become a topic of work and research structurally connected to the different teaching activities, thereby eliciting all the different implications generated by “the project”, even in relation to the different scales of development.

### Research

One clear consideration emerged from this initial reconnaissance: the need to configure a research project capable of meeting the different emerging needs along with the need to radically change the way we think about the relationship between our different educational activities and the topic of sustainability.

The yOUR 2030 project began in spring 2018 with the objective of interrelating the 17 Sustainability Goals contained in the Resolution adopted by the United Nations General Assembly on 25 September 2015. The document, entitled “Transforming our world: the 2030 Agenda for Sustainable Development”, identifies five priorities that act as drivers to reach the objectives: people, planet, prosperity, peace, partnership. This document also underlines that the construction of interlinkages among the Sustainable Development Goals should be understood as a strategic action to ensure that the objectives of the Agenda are realised. Indeed, it emphasises that “... if we realize our ambitions across the full extent of the Agenda, the lives of all will be profoundly improved and our world will be transformed for the better.” (UN, 2015).

Today we look at this initial phase of the yOUR 2030 project with an awareness that much of what has occurred in recent years has profoundly changed our way of perceiving sustainability, starting with the pandemic, the evidence of events related to climate change, the awareness of needing to undertake an energy transition, and last but not least, the emerging need to expand awareness and a shared sensitivity.

The guiding idea of the project is that in educational terms, sustainability should be conceived as an educational subject adaptable to the characteristics of different students and, in general, the various people involved in the process. In 2018, when we presented this project to our colleagues and students on campus, we highlighted two aspects of yOUR 2030: the “container” and the “interface”. As a container, it encompasses heterogeneous initiatives, a container that can hold different experiences, connecting, blending, relating thoughts and proposals without imagining disciplinary boundaries. As an interface, we have decided to use the topics proposed by the 17 Sustainability Goals as an opportunity to connect the different activities conducted at the university to different companies around it.

We have verified that this approach is consistent with the broad organisation found in international initiatives (Giovannini & Riccaboni, 2021). In this sense, the debate that enlivened the first part of the 21st century regarded three main aspects:

- the progressively confirmed awareness of the need to take on the issues and questions posed by environmental challenges in increasingly “inclusive” educational experiences pertaining to different problems emerging from the territories;

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- the need to present students with an integrated model of knowledge oriented around training on an interpretational framework that focuses on different aspects of knowledge, pursuing a multidisciplinary and systematic approach;
- researching new tools of communication that can look at transformations in communities and territories and enhance them as a function of the effectiveness of real processes being activated.

Based on the activities conducted in these initial years and the numerous experiences with people of different ages and in various educational settings, we identified four “key topics” that we believe may be used effectively to better communicate the general concept of sustainability as implied by the 2030 Goals. The four “pillars” we identified are:

- the role of “OUR” in contrast to “YOUR”. This topic immediately marked our communicative approach. The two pronouns are merged to foster attention and engender a sense of collective responsibility towards a shared direction;
- the concept of COMMITMENT entailed by the pursuit of sustainability, along with shared understanding in seeking new forms of sustainable action, requires defining our habits anew and challenging the development of new lifestyles;
- the value of an ARTICULATED (and complex) VISION of sustainability, in which the term has varying meanings depending on the context of application. This emphasises the uniqueness of sustainability, which cannot be reduced to achieving partial goals;
- the importance of TESTIMONY, tied to promoting innovative sustainability practices, which fosters awareness that a new dimension of sustainable living and action can be achieved.

Each of these pillars, which are analysed in detail below, is essential for effective education in sustainability, promoting community cohesion, improving integration between the university and the territory, and, in general, improving awareness about the future of our planet.

### **The Role of “OUR” in Contrast to “YOUR”**

This is of course a founding topic for describing our experience and we gathered three suggestions during our work that guided us in the design and progress of our activities.

The first element is an extraordinarily effective image for summarising this concept: the first image of Earth taken from lunar orbit (see Figure 1). The image brings us face to face with the evidence that the Earth can and should be considered a “finite” planet. The photograph entered the collective heritage on 24 December 1968 when the team of the Apollo 8 space mission immortalised Earthrise, the image of our planet “rising” amid the lunar landscape. We have seen the image hundreds of times, but every time, it transmits this striking sense of finiteness in an extraordinary way.

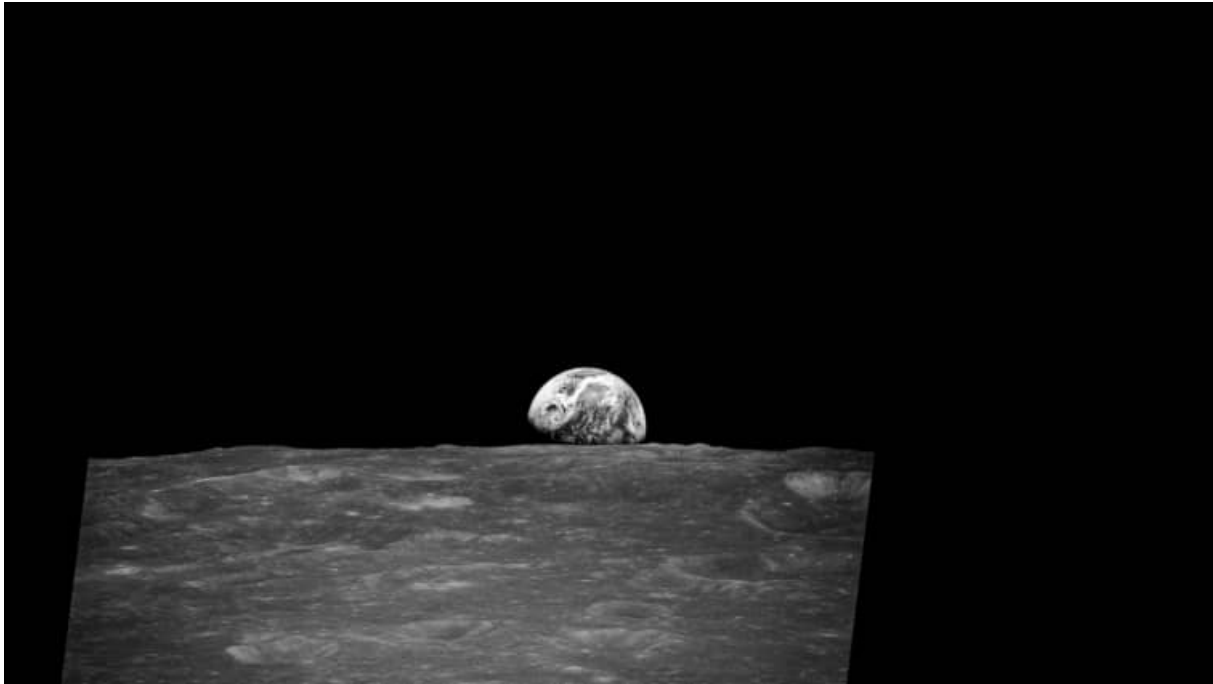


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**Fig. 1:** On December 24, 1968, Apollo 8 astronauts Frank Borman, James Lovell, and William Anders were coming around from the far side of the Moon on their fourth orbit.  
Source: <https://earthobservatory.nasa.gov/images/82693/>



The limits of the planet were spoken of explicitly a few years later, in 1972, by the authors of the study “The Limits to Growth”, a research project commissioned to understand the possible long-term consequences of the current model of growth, a model that the authors state is inevitably destined to contrast with the natural limits of development and capacity to regenerate the Earth’s resources. At the end of the report, the authors remind us that: “Our present situation is so complex and is so much a reflection of man’s multiple activities, however, that no combination of purely technical, economic, or legal measures and devices can bring substantial improvement. Entirely new approaches are required to redirect society toward goals of equilibrium rather than growth. ... This supreme effort is a challenge for our generation. It cannot be passed on to the next. The effort must be resolutely undertaken without delay, and significant redirection must be achieved during this decade” (Meadows et al., 1972).

There is only one, finite, limited Earth. We are the Earth, and no one can imagine being anything “other” than it. This is the profound sense that we wanted to transmit through our project, gathering a message from long ago, but which is undoubtedly and extraordinarily modern!

We gathered a third element of awareness from the research report entitled “Our Common Future”, or “Brundtland Report”, produced by the World Commission on Environment and Development in 1987. The report reflects on the possible conditions for realising development that refrains from continuing to erode the planet’s resources, ensuring future perspectives for humanity to meet “the needs of the present without compromising the

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ability of future generations to meet their own needs”, and introducing profound thought on the intergenerational aspect of sustainability-related issues.

In the section entitled “Sustainable Development”, the document reminds us that “...humanity has the ability to make development sustainable to ensure that it meets the needs of the present without compromising the ability of future generations to meet their own needs. The concept of sustainable development does imply limits - not absolute limits but limitations imposed by the present state of technology and social organization on environmental resources and by the ability of the biosphere to absorb the effects of human activities. But technology and social organization can be both managed and improved to make way for a new era of economic growth” (Brundtland, 1987).

The message we recognised relates to the legacy that our actions leave in relation to what we would be capable of doing. Thirty-five years have passed since the report was published, and never have we been so aware of reaching a “turning point for people and the planet”, as we have come to call this moment that is extraordinarily important in defining our future.

### **The Concept of COMMITMENT**

The choice to include sustainability-related issues in educational strategies has raised numerous questions on the teaching objectives to pursue in relation to the students’ different ages, and which content, forms, and teaching methods to use in the various teaching paths. In recent years, schools around the world have addressed this challenge and focused on the need to situate sustainability within a broader interdisciplinary framework.

In exploring the relationship between education and sustainable development, an interesting contribution is provided by Paul Vare and William Scott (2007), who underline the importance of viewing sustainable development as a social learning process (in contrast to a set of predetermined behaviours) that relate to building a capacity to think critically and explore problems and contradictions inherent in sustainable transformation.

Continuing in this direction, Johan Öhman e Louise Sund (2021) underlined how development of this new sensitivity is a key objective in schools. They also highlighted the way in which, in terms of promoting a culture of sustainability, the schools’ goal could be understood as the capacity to stimulate the development of awareness and young people’s interest in living sustainably. We are certain that this could lead to social participation that would contribute, for example, to reinforcing the overall resilience of different ecological systems.

In the experiences conducted over the years, our strategy to meet the challenge of sustainability was translated into two different strategic directions:

- reinforcing the interlinkages and related combinations of specific skills to fully understand the topics related to sustainable development. The path to define the new necessary skills is far from finished. Nonetheless, its configuration allowed us to gather an initial series of results with respect to recognising students’ abilities and knowledge and determining a possible future role for them as “change agents” and “transition managers” in the sense implied by Arnim Wiek, Lauren Withycombe e Charles Redman (2011);

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- our work found an important reference in the reflections made by UNESCO in relation to the eight key cross-cutting competencies for sustainability that are particularly important for thinking and acting in favour of sustainable development: systems thinking, anticipatory, normative, strategic, collaboration, critical thinking, self-awareness, and integrated problem-solving (UNESCO, 2017).

Both cases represent an explicit call to a commitment that must see universities and other educational/training institutions called to contributed to a transition that has currently only just begun. As Irina Bokova, former Director-General of UNESCO reminds us: “A fundamental change is needed in the way we think about education’s role in global development, because it has a catalytic impact on the well-being of individuals and the future of our planet. Now, more than ever, education has a responsibility to be in gear with 21st century challenges and aspirations and foster the right types of values and skills that will lead to sustainable and inclusive growth, and peaceful living together” (UNESCO, 2015).

Considering these considerations, a key role contained in our initiatives was to develop the concept of “commitment to action”, intended as a multifaceted educational concept substantially associated with the idea that participation in an educational activity relying on sustainability as the reference means being ready to leave a qualified mark of one’s commitment to the educational activity. The approach recalls the need to leave a contribution (different in consistency and nature depending on the participants’ age) to prove the participant’s commitment to the teaching activity.

This has become a rule of our teaching activities: participants must share a thought, drawing, map, photograph, etc., leaving “something” that speaks to their commitment. These materials are later used in communication and distribution initiatives relating to sustainability and represent a wealth of resources that grows due to the commitment of all the participants in our initiatives.

**Fig. 2:** Demonstrating our commitment to sustainability with work moments.

Source: Author



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### **The Value of an ARTICULATED (and complex) VISION of Sustainability**

“Sustainable development” is defined in a variety of ways, and such variety is viewed by various authors as a problem. Multiple parties have stated that this may represent a limit to developing policies that are meaningfully oriented around sustainability, and a limit to an adequate conceptualisation of the meaning of sustainable development itself (Rees, 1989; Fien, 2002).

However, when we deal with complex systems and detailed questions, it is not always easy to reach an effective and universally recognisable concept, as would be appropriate. The definition of sustainable development as per the Brundtland Commission (1987), which indicates sustainability as behaviour that “meets the needs of the present without compromising the ability of future generations to meet their own needs”, was purposely left vague to create room to work towards building common ground where experts in different disciplines could be recognised.

Others maintain that it is precisely due to this vagueness that a broad, constructive scientific discussion opened on the definition of sustainable development, leading to the quick, consistent evolution of the concept of sustainability (Dale, 2001) as indicated for the first time by the Brundtland Report. The result of this discussion produced a variety of definitions of sustainable development that tended to find grounds for reconciliation between three different points of view: the ecological point of view, aimed at ensuring the capacity of biophysical resources to regenerate and biodiversity to be maintained; the social point of view, aimed at guaranteeing the development of democratic systems of government capable of effectively supporting social values deemed adequate for the needs expressed by the communities living in different areas; and the economic point of view, aimed at guaranteeing that basic needs are met around the world (Dale, 2001; Robinson & Tinker, 1997). This definition, however, remains sufficiently broad to allow for different interpretations of the concept of sustainable development in relation to specific socio-geographic situations and in the face of unexpected scenarios marked by uncertainty, therefore becoming a shared field of work.

This consideration, which guided our initiatives, relates to the need to recognise the interlinkages between human society and ecological systems. Such relationships make different systems co-adaptive, reacting interactively and producing reactions in progressive feedback network Jickling (2000).

In this respect, we adopted a broad, complex, transdisciplinary approach to sustainable development education. An explicit reference along these lines is found in the 2030 Agenda, point 55 of which says: “The Sustainable Development Goals and targets are integrated and indivisible, global in nature and universally applicable, taking into account different national realities, capacities and levels of development and respecting national policies and priorities. Targets are defined as aspirational and global, with each Government setting its own national targets guided by the global level of ambition but considering national circumstances. Each Government will also decide how these aspirational and global targets should be incorporated into national planning processes, policies and strategies. It is important to recognize the link between sustainable development and other relevant ongoing processes in the economic, social and environmental fields” (UNESCO, 2015).

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“Integrated and indivisible” have become two key concepts that we laid at the basis of our communication strategy. Our objective was that building knowledge around sustainable development cannot be measured exclusively in terms of acquiring a series of skills but must reflect the complex nature of socio-ecological reactions. Every event must therefore convey the idea of collective attention to the issues of sustainable development and lead to reflection on how an interdisciplinary vision is indispensable in the search for sustainable development (see Figure 3).

For each proposed event, we therefore develop a code of communication that highlights three different levels of relationships: the reference objective, the interconnected levels, and the levels of reference. Our idea is that no initiative may be communicated without highlighting this complex system of integrated and indivisible relationships.

**Fig. 3:** How we communicate the values of “integrity and indivisibility”. Source: Author



### The Importance of TESTIMONY

Our experience began with the considerations expressed by John Dewey (1986), according to which each experience changes us and, in a certain sense, redefines our perception of the world around us. The author recalls that when individuals participate in a learning experience, the experiences must compel them to question and change their previous customary behaviour and feel and think in a different way; above all, they need to verify that this can be a feasible path.

Testimonies are an important source of knowledge in many contexts, including education, where the reliability of the testimony lends the experience important value in recognising the practicability of a path, its feasibility, the possibility of translating the thought (or often a dream) underlying the initiative into concrete fulfilment.

The reliability of the testimony may refer to a combination of expertise and sincerity, both of which are usually elevated when someone testifies to their own experience. The task we have assumed is to bring to our university classrooms testimonials and experiences capable of depicting situations in which the witnesses' expertise and authenticity can be recognised in their paths towards greater sustainability in their lives. In this sense, we



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immediately deemed it important for these experiences to give students an awareness of the context and value of the testimony.

While it is commonly believed that sustainability education should stimulate students to become informed experts in the different phenomena affecting the world and promote new visions relating to the effects of changes in social communities, it is also true that sustainability education relates to conserving practices, processes, and beneficial relationships. This focuses on living communities, but it does not represent either an apology for the status quo or nostalgia for a previous state of things. Rather, innovation serves conservation. In this sense, promoting sustainability implies management aimed at change, but it is also capable of enhancing practices and relationships that were important and relevant in the past (Thiele, 2013). In other words, it is necessary to understand and conserve the memory of values, relationships, and skills that make adaptive innovation possible in a changing world looking for practical experiences in sustainability.

This experiential approach to sustainability learning means considering student learning not exclusively as a mental process through which information is acquired and processed as a function of the specific condition (perception, imagination, symbolisation, concept formation, problem identification, etc.), but a process strongly referring to testing practices or gaining awareness regarding the feasibility of solutions, verified through testimonies (see Figure 4).

Starting with our teaching experiences and drawing on John Dewey's ideas of experience and learning, we have recognised three fundamental (and correlated) aspects that testimonies can provide with respect to the possibility that students develop a solid commitment to sustainability:

- gaining knowledge on sustainability-related issues and relating (positioning/locating) themselves with respect to this knowledge, developing their intellectual potential;
- articulating their emotional response and relating themselves positively to the questions of sustainability, redefining their own ethical standards and convictions. This allows them to strengthen the emotional aspect;
- developing their capacity, motivation, and desire to play an active role in the search for solutions to the problems of sustainability, allowing them to enhance their practical knowledge.

The goal we have pursued - getting our students acquainted with the figures of our time who have realised sustainability projects - is therefore twofold, relating to both content and method. The people who have realised sustainability can provide us with an awareness and solid anchoring stemming from the concrete experience of people who have known how to reinterpret what they experienced, correcting and modifying imperfections and errors. In addition, in encountering these figures, even from a distance, the students can understand how they can carry (and promote) their own “idea of sustainability” through their history and integrate it in their behaviours, choices, and the passion that they dedicate to realising their own projects.

Each student can draw inspiration from these figures not only regarding the content and attention they have spoken about but may also discover the original calling of the different projects that are often based on a capacity to accommodate commitments and responsibilities, recognising and overcoming their own natural imperfections.



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**Fig.4 - Meet people who can demonstrate their commitment to sustainability**



## Conclusion

As we have described, the activities conducted in these initial years and the numerous experiences with people of different ages and in various educational settings led to the identification of four “key topics” that we believe may be used effectively to better communicate the general concept of sustainability as implied by the 2030 Goals. Today, it is necessary to reflect on how to face the last period separating us from the target set by the SDGs. We have five years to complete an initial part of the path, which is certainly not conclusive with respect to the ambitions expressed by the 193 countries that signed the working topics and commitments contained in the Agenda 2030.

Some lines of work emerge as important for promoting and improving our capacity to communicate the value of sustainability. The task that the school should assume is to mobilise its energy, promoting the sharing of knowledge, skills, and perspectives to help students learn the value of a sustainable lifestyle while reorienting educational programmes to include a clear and explicit focus on developing values tied to sustainability.

Over the years, we have seen great changes around the world that have led to expanding learning opportunities for everyone. Nonetheless, we should reflect on the experiences and define new paths of work. We have long understood that access to education is not enough. It is also necessary to focus on the quality of the education and its pertinence, on what children, youths, and adults are learning with respect to sustainability.

Over the years, we have understood that no force for change is more powerful than education in promoting sustainability in society. To build a better future for all, we need to think about (and rethink) the role of sustainability education and associated issues, placing ourselves in relation to a world undergoing continuous change.

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# **BUILDING A SUSTAINABLE FUTURE: THE INTERPLAY OF QUALITY EDUCATION AND TEACHER WELL-BEING IN SUSTAINABLE DEVELOPMENT**

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### **Abstract**

The paper examines the pivotal role of education in advancing sustainable development, with a special focus on ensuring the well-being of teachers. Quality education is fundamental to achieving the United Nations' Sustainable Development Goals (SDGs), particularly in addressing environmental, social and economic challenges. However, the paper underscores that the success of education systems in fulfilling these objectives relies significantly on the well-being of educators.

As the cornerstone of educational systems, teachers directly influence the quality of learning they deliver. Ensuring their well-being through job satisfaction, professional development, mental health support and equitable compensation is essential for empowering them. Supported teachers are better equipped to employ innovative teaching methods, create impactful learning experiences and foster the comprehensive development of students, equipping them to confront global issues like climate change, poverty and inequality.

The paper highlights that improving teacher well-being is not only advantageous for educators but also has profound benefits for students and society as a whole. By cultivating a nurturing and supportive work environment for teachers, educational institutions can generate a cascading effect that advances sustainability, equity and prosperity on a larger scale. Additionally, the paper explores how governments, schools and communities can collaborate to develop policies and initiatives that prioritize teacher support while aligning with sustainability objectives.

In conclusion, the study asserts that building a sustainable future demands a holistic approach that recognizes and invests in teachers. Pairing quality education with the well-being of educators creates a robust foundation for fostering a more inclusive, equitable and sustainable world.

**Key words:** Sustainable Development, Quality Education, Teacher Well-Being, Educational Sustainability, Professional Development, Environmental Awareness

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### EVALUATION OF SUSTAINABLE DEVELOPMENT PROGRAMMES BY SECONDARY SCHOOL TEACHERS

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#### **Abstract**

The scientific community has been drawing the attention over the last decades about the necessity of introducing Environmental Education (E.E.) and Education for Sustainable Development (EfS) in secondary schools in Greece. It is therefore considered necessary to train teachers throughout the Greek territory on environmental and sustainable development issues. It is about time to take immediate action as a country and give our young people, as teachers and educators, the guarantees of how they can live sustainably. Climate change and ecological crisis are apparent and it seems we no longer have time for theories; but, this is the time for all teachers to be trained in sustainable development and environmental education. During the study and writing of the literature review, a large learning knowledge gap was observed by the teachers themselves on topics related to EfS/EE. There are many times that the phenomenon of assigning courses to teachers who are not related to the subject of Environmental Education and Education for Sustainable Development has been observed. The latter, however, is due to insufficient teaching staff trained in environmental issues.

However, we take a note at this point, as was also evident from the first thirty questionnaires given as a pilot survey in this case study, that many teachers are already starting to be trained in environmental education and sustainable development issues. This article aims to share with its readers the inventory of the attitudes, knowledge and behaviors of secondary school teachers in relation to environmental issues. We conclude that the present research aims to "close" gaps that have been noticed in the evaluation of environmental programs in secondary education. This article, which is part of the PhD thesis, presents the first 270/500 results of the research samples. The statistical program spss was used for the analysis of the latter. The results of the survey showed that teachers have a good relationship with issues related to environmental protection and coping with the environment and the zeal they show in learning about environmental education and sustainable development. In conclusion, it is observed that the respondents' years of teaching service played an important role in terms of the inductive analysis of the survey results. In conclusion, EfS/EE can offer many benefits in the field of EfS/EE.

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**Keywords:** Environmental education, Sustainable development, Primary research, Secondary education, SPSS.

### Introduction

The environment is a continuous, open and dynamic system, which is constantly changing (Dimitropoulos, 2005). Nowadays, more than ever, issues related to its quality and protection are of great importance. The term environment is used to highlight the natural place where the human species grows and reproduces and the functions that take place in it. (Flogaiti, 1998). According to the U.N.E.S.C.O.: "The environment is a complex set of physical, biological, social, cultural and political conditions that surround a human being or an organism and determine the form and nature of its survival".

Environmental Education, refers to the local education that students receive in the society in which they live and develop. All environmental programs that are created have as their main focus the protection and preservation of the environment (Trikalitis, 2005). Their ultimate goal is to pass on the subject matter to future generations and to activate students' motivation to become active, well informed citizens. The teacher is called upon to instill in pupils the spirit of environmental awareness from pre-school education. He or she has the opportunity to study extensively the elements of Environmental Education in order to be fully qualified.

The dual dimension of environmental education is what distinguishes it from other, general forms of education (Papadimitriou, 1998). The usefulness of EE as a subject for all citizens of our country is in fact what underlines the need for its inclusion in the already existing curricula of formal education. The way and methods in which many teachers frame it varies from place to place. Art, culture and the values embraced by each teacher, starting from kindergarten to university, play an equally important role (Soos & Kovacs, 2008). To motivate students to become familiar with experiential experiences, to get in touch with Ecological and Environmental Science, to create active citizens, to transmit the values of life, such as that nature is a gift and that we must pass it on to future generations, just as it has been given to us by our Creator.

Many times, we use the term 'Environmental Education' without knowing its deeper and conceptual meaning. Historically, the World Conservation Union, (I.U.C.N., 1970) defined P.E. as follows: "Environmental Education is the process of identifying values and clarifying concepts in order to develop skills and attitudes necessary to understand and appreciate the interrelationship of man, culture and the biophysical environment.

It requires practical involvement in decision-making and the development of a code of conduct on issues relating to the quality of the environment." (I.U.C.N.,1970). One definition of EE is that of the U.N.E.S.C.O., as formulated at the Tbilisi Conference in 1977: "Environmental education promotes the development of a clear understanding of and interest in economic, social, political and ecological interdependence in urban and rural areas. It contributes to the creation of new patterns of behavior of individuals, groups and societies towards the environment" (U.N.E.S.C.O., 1977).

Hungerford, Peyton & Wilke, as environmental researchers, defined PE as: "the process of helping citizens to become knowledgeable about the environment, and above all to become



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able and determined to be willing to work individually and collectively to achieve and maintain a dynamic balance between quality of life and the environment" (Wilke et al, In the 21st century, the concept of Environmental Education is now beginning to be aligned with that of Education for Sustainable Development, co-signed in the U.N.E.S.C.O. International Declaration on Environment and Development, held in Rio, Brazil in 1992 (Kalaitzidis & Ouzounis, 1999).

### *Environmental Education and Communication*

Environmental Communication is a new broader term than Environmental Education. Harrison in 1993 defines P.E.C. as "an open, two-way exchange of information between groups of the population interested in a particular environmental issue". Fichter and Loew in 1997 propose a similar definition, as follows: "E.I.P. is the transmission and exchange of information related to the environment. It therefore represents a mutual learning process'.

A third definition characterizes E.I.P. as the strategically planned use of the communication process and products of the mass media (media) to effectively support policy making, citizen participation and the implementation of environmental sustainability-oriented programs (O.E.C.D., 1995). The definitions mentioned above share common features, but there are important differences. The first two emphasize the imperative of the two-way dimension of E.I.P., i.e. the interaction between the parties involved in communication, although this is not always possible on a practical level (Zingales, 2000). These definitions also give a holistic perspective to ECCE, unlike the latter, in which ECCE is limited to a specific and organized process with the ultimate goal of sustainability and the mobilization of students at all levels of schooling to become actively involved in the problems of the environment.

Environmental Education is considered the most effective method of dealing with the ecological crisis, as it forms citizens with a universal perception and attitude towards the environment (Flogoiti, 1998). However, having first been taught, trained and sensitized to the subject of environmental education and education for sustainable development (Athanasakis & Koussouris, 1987), teachers themselves are called upon to understand, cultivate and utilize the necessary skills of Environmental Communication in order to serve it.

### **Methodology**

The tool used to conduct this research was the questionnaire. The questionnaire consisted of three sections. The first part asked for the demographic data of the respondents such as: age, gender, marital status, studies and educational level and the related. The second part consisted of open and closed questions about their knowledge of E.E./ EfS, how many programs they have implemented in their school if they have been prepared and how much success they had. The third part of the questionnaire investigated the knowledge, attitudes and behaviors of teachers and how much they believe that environmental education and education for sustainable development affects the wider awareness of students. The research started in 2023 and ended in 2025.



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The questionnaires were distributed to secondary school teachers throughout the country. Before starting the main survey, a pilot survey took part in our country to the teachers of secondary institutions without filter selection such as rural, semi-rural and urban. The purpose was to clarify possible points of ambiguity or ignorance or misunderstanding in the questionnaire so that we can be sure of the correctness and confidence index of the questionnaire. The results of the pilot study showed that there was no need for any correction of the questionnaire. In our research we collected 270 questionnaires. The total number of samples we have is 270 secondary school teachers from various faculties from all over Greece. This is something we desire as we are interested in an interdisciplinary and multidisciplinary subject. For the needs of the present work, research was conducted regarding teachers from secondary education level. The aim was to write the behavior, postures and knowledge about environmental education, communication and awareness. The questionnaire included multiple-choice questions and was anonymous and answered by 270 teachers. The survey was conducted in December 2023- December 2025.

### Survey Results

According to the demographic results, 31,8% of the respondents were men and 68,2% were women. In terms of age, 15,5% were 22-30 years old, 22,1% were 31-40 years old, 31,5% were 41-50 years old, > 51 years old were 28,8 %.

In the question about the marital status of the respondents we had the following results: 55% were married with children, 33,4% were single and 11,6% were married without children. To the question of the employment status of the respondents, they answered: 63,6% that they were permanent, 27% substitutes and only 9,4% were hourly workers.

On the question of previous employment, we would have the following statistical answers on statistical evidence: 0 - 5 years 36.1%, 6 -12 years , 15.2%, followed by 13 -25 years with a percentage of 33.3% then 26 -35 with a percentage of 12.1% and finally with over 36 years of seniority only 3.3%.

In the question of respondents' education, we had the following results: 45.87% had an undergraduate degree, 62,7% had a master's degree, 9,4% had a doctorate, 5,2% had a master's degree on E.E./ EfS, 1,5% were PhDs on E.E./ EfS, 7,9% had a Special Education diploma, 15,8% humanities & Social Sciences, 11,5% Natural Sciences, only 0,3% were post doctorates or something like that.

We asked respondents to list the first five words that come to mind when they hear the term Environmental Issues. This question was quite interesting as we got many answers but quite the same as they already knew the serious and basic environmental problems and they listed the following for us: Environmental Pollution, Environmental Contamination, Acid Rain, Ozone Layer Depletion, Climate Change, Renewable Energy Sources, Extinction of Biodiversity, extinction, desertification, energy crisis, unequal distribution of natural resources, globalization, Greenhouse Effect, etc. We asked them to list the first five words that came to their mind when they hear the term E.E./EfS and if this question was of any interest to them. We collected the following responses: Environmental Communication, Environmental Behavior, Awareness, School, Field Actions, Utilization of Natural Resources, Sustainable Development Goals, Climate, Change, Economy etc.

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Next, the respondents had to answer the question whether the subject they teach at school is related to E.E./ EfS: 59.6% have nothing to do with the subject and 40.4% combine the concept of E.E./ EfS with their course.

To the question "Have you attended seminars or training programs regarding E.E./ EfS they answered accordingly: 40.3% that they had not attended while there was an impressive percentage of 59.7% who had attended a program or seminar.

The questionnaire continues at this point with the second part consisting of questions using the Linkert scale. Respondents were asked to indicate the degree of agreement or disagreement with a series of statements and situations. Following are, both the proposals and the percentage-wise answers of the respondents.

E.E./ EfS contribute to improving the quality of life: 2% answered that they strongly disagree, 5% that they disagree, 5% that neither disagree nor agree, 10% agree and a 80% strongly agree.

Next state, E.E./ EfS is a key pillar of sustainable development. 3% answered that they strongly disagree, 2% that they disagree, 15% that neither disagree nor agree, 30% agree and a 50% strongly agree.

The next situation followed on whether E.E./ EfS should be gradually integrated into all subjects of school programs in both primary and secondary education: 2% answered that they strongly disagree, 8% that they disagree, 6 % that neither disagree nor agree, 54% agree and a 30% completely agree. Then, E.E./ EfS is a separate compulsory subject in Grade A and Grade B education. 3% answered that they strongly disagree, 12% that they disagree, 20% that they neither disagree nor agree, 25% agree and a 40% strongly agree.

Does E.E./ EfS contribute to the creation of environmentally conscious citizens? 3% answered that they strongly disagree, 3% that they disagree, 20% that neither disagree nor agree, 30% agree and a 44% strongly agree. The penultimate situation where they had to answer whether they agreed or disagreed was the following: E.E./ EfS at school improves students' lives as adults. 2% answered that they strongly disagree, 4% that they disagree, 6% that neither disagree nor agree, 30% agree and a 58% strongly agree. Finally, E.E./ EfS increases environmental knowledge and contributes to the collection of attitudes, knowledge and behaviors regarding environmental protection: 0.5% answered that they strongly disagree, 2.5% that they disagree, 15% that neither disagree nor agree, 32% agree and 50% strongly agree.

One more question which found it important to ask respondents was: how many E.E./ EfS programs they have participated in. The answers we received because it was a question where the respondent could write they wrote to us a minimum of 0, that they have not yet participated, and this is reasonable because they may have just started their educational career up to 30 which seems to be an experienced staff.

In the next question we posed propositions of situations and collected the respondents' degree of disagreement and agreement. As in the first question for example which read: The evaluation process of E.E./ EfS programs is an important stage of implementation of EfS programs.: 3% answered that strongly disagree, 2% disagree, 15% neither disagree nor agree, 50% agree and a 30% strongly agree.

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The Planning of an E.E./ EfS program should also include the final evaluation of the achievement of the objectives: 2% answered that they completely disagree, 4% that they disagree, 14% that they neither disagree nor agree, 50% agree and a 30% strongly agree.

The evaluation of an E.E./ EfS program aims exclusively at improving learning outcomes: 8% answered that they strongly disagree, 25% that they disagree, 27% that neither disagree nor agree, 10% agree and 30% strongly agree.

In the next question Can teachers create reliable evaluation tools for E.E./ EfS programs: 4% answered that they strongly disagree, 20% that they disagree, 16% that they neither disagree nor agree, 20% agree and 40% strongly agree. Next state: Environmental Education seminars improve environmental knowledge: 1% responded that they strongly disagree, 3% that they disagree, 11% that neither disagree nor agree, 40% agree and a 45% strongly agree. E.E./ EfS 1% answered that they strongly disagree, 5% that they disagree, 24% that neither disagree nor agree, 40% agree and a 30% strongly agree.

The evaluation of an E.E. EfS program includes the achievement of the cognitive/learning/psychomotor as well as emotional goals of the program: 2% answered that they completely disagree, 6% that they disagree, 22% that neither disagree nor agree, 30% agree and a 40% completely agree.

Finally, the respondents were asked to answer the last sub-question of this question as to whether you believe that the evaluation process of an E.E./ EfS program aims exclusively at forming a cooperative spirit: 5% answered that they strongly disagree, 25 % disagree, 25% neither disagree nor agree, 27% agree and 18% strongly agree. As for the question of whether you think it is difficult to build reliable evaluation tools for E.E./ EfS programs by teachers: 5% answered that they strongly disagree, 15% that they disagree, 40% that they neither disagree neither agree, 25% agree and a 15% strongly agree.

The visits to Environmental Education Center with a percentage of 90% positive, 9% negative and only 1% did not know can they be considered a necessary element of an independent program of environmental education and sustainable development? Actions on global days with a positive percentage of 80% negative 18% and neutral 2% is or should it be part of an independent program of environmental education and sustainable development? The workshops of environmental thematic units with a positive percentage of 92% negative 6% and neutral 2% as they probably do not know is or should be part of an independent program of environmental education and sustainable development?

And the last sentence they were asked to mark whether they agreed or not, was whether an environmental education and sustainable development program needs to be equal to one school year in length to be a feature of a stand-alone program? They answered 80% yes, 10% no and a 10% don't know.

In the last question of the questionnaire, the respondents had to answer an open-ended question on how many and titled environmental education and sustainable development programs they have noted as a school. We were registered by the following programs: Life in Water, Life on Land, I Care for the Environment, Less Inequalities, Sustainable Waste Management, Sustainable School, Sustainable Utilization of ICT Tools, Environment and Communication, School Garden, Solar Radiation, Human rights.

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### Conclusions

This study attempted to analyze the environmental knowledge, attitudes and behavior of secondary school teachers. Factors affecting environmental knowledge, attitudes and behavior were also identified. Furthermore, the importance that teachers give to Environmental Education (E.E.) in their lessons was analyzed. This research involved the use of both quantitative and qualitative modes of inquiry. Two hundred seventy questionnaire respondents took part in the research. Statistical and thematic analysis of the data obtained from the questionnaires was carried out respectively. Triangulation of data was also done. The analysis revealed that secondary school teachers have an overall good level of environmental knowledge, although lacking some details and they do have an overall positive attitude and behavior towards the environment.

A significant relationship between the environmental attitudes and behavior as well as the environmental knowledge and behavior was identified. The implementation of E.E. by secondary school teachers was characterized by a strong influence of the curriculum. In addition, they also incorporate E.E. through pro-environmental behavior, particularly concerning waste issues. The main restrictions that limit secondary school teachers from including E.E. are time constraints and the negative feedback they receive. With regards to the grounding offered to teachers related to E.E., secondary school teachers described the teacher training courses as being more theoretical rather than focusing on practical applications. In light of these findings, this research puts forward suggestions for a better structure of teacher training courses.

This study aims at investigating secondary school students' knowledge of and attitudes towards environment on different variables. The study was conducted with 300 secondary school teachers through the descriptive survey model. 'Environmental Knowledge Test' and 'Environmental Attitude Scale' were used to collect data for the study. The results showed that secondary school teachers' knowledge of and attitudes towards environment did not differ on gender. Finally, some suggestions based on results were included in the study. It is also interesting that all the teachers who completed this questionnaire, whether their background was related to the subject or not, wanted to include and combine the subject of E.E./ EfS in their course. The contribution of education to the promotion of the principles of education for sustainability has been of major concern in the international bibliography resulting to form an area of special scientific interest that focuses both on initial education and on the continuing professional development of teachers in the subjects of E.E./ EfS.

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### **BLENDED INTENSIVE PROGRAMS: BRIDGING THEORY AND PRACTICE OF ENVIRONMENTAL EDUCATION?**

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#### **Abstract**

The presentation introduces the formula of Erasmus+ Blended Intensive Programs. According to the characteristics presented on the European Commission website, BIPs are “short, intensive programmes that use innovative ways of learning and teaching, including the use of online cooperation. The programmes may include challenge-based learning where transnational and transdisciplinary teams work together to tackle challenges for example those linked to the United Nations’ sustainable development goals or other societal challenges identified by regions, cities or companies. The intensive programme should have added value compared to existing courses or trainings offered by the participating HEIs and can be multiannual. By enabling new and more flexible mobility formats that combine physical mobility with a virtual part, blended intensive programmes aim at reaching all types of students from all backgrounds, study fields and cycles.”

Among selected educational results related to the application of BIPs are the following: a) acquainting students with communication challenges in the context of multimedia development in the 21st century, b) widening students’ multimedia knowledge, skills, and competencies, c) applying students’ multimedia knowledge, skills, and competencies (interviews, podcasts, audiovisual relations), d) developing students’ sensitivity and interpersonal solidarity in the context of a highly advanced technological civilization, e) facilitating dialogue among representatives of different media cultures, f) practicing the art of dialogue and combining various communication codes.

In the paper, we are going to ask about the usefulness of BIPs in environmental education. We will consider the opportunities the BIP formula offers in combining theoretical and practical aspects of developing pro-environmental attitudes among young people. In particular, we will focus on how BIPs can support the implementation of new technologies in learning processes and everyday activities regarding sustainable development and environmentally friendly way of life.

**Key words:** Erasmus+, Blended Intensive Programs, environmental education, participatory education, digital education, ecology and intercultural learning



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### **EUROPEAN UNION AND SUSTAINABILITY: THE MODERN POLITICAL DIRECTIONS AND ITS INCORPORATION IN EDUCATION AND THE GREEK EDUCATIONAL SYSTEM**

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#### **Abstract**

The subject of Sustainable Development- Sustainability is the cornerstone for the well-being of people's lives. This is explicitly mentioned in the 17 Global Goals that should be implemented from 2015 to 2030, as established by the United Nations and concerning future international development. The main pillars of this are the Economy, the Environment and the Society, with the necessary interaction and interconnection between them for the good quality of people's lives, in order to achieve continuous development and progress thanks to the spiritual evolution of individual and the rapid development of technology.

In this specific paper, given that environmental problems are increasingly getting huge at the local and global level, it is considered necessary to educate pupils as future useful citizens of society. Therefore, the basic foundation of the 17 Global Goals are the modern political directions, which the European Union has set regarding the principles of Sustainable Development and Sustainability and the way they are adopted and integrated in the field of education in a wider context. At the same time, a brief description of these is attempted to the extent that they exist in the Greek educational system and the priority, which they have been set by Greece, in terms of their integration into education.

The results that will be extracted will answer the exploratory questions to be examined regarding whether there is a clear reference to Sustainable Development in the educational material. The way of collecting the research material will include the study of the literature

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and its recording regarding the subject under investigation in terms of the theoretical basis, in order to confirm or refute the aforementioned research questions.

**Keywords:** European Union, Sustainability, Education, Global Goals, Greece

### European Union and Sustainability

For the first time in its history, the European Union introduced the concept of “Sustainable Development” into its legal system with the Treaty of Amsterdam (Irin, 1998), which was later added to subsequent treaties, one of which was the Treaty of Lisbon (Communication, 2009). The term “Sustainable Development” appeared there, which made the European Union an active member of global events (Kenig- Witkowska, 2017). Scholars continue their research, given the rapid development of technology and the constantly changing situations in both Society, Economy and Environment - that is, in the three main pillars of Sustainable Development - and report that at the 2001 Summit in Gothenburg, the European Union developed a strategic plan for its actions related to addressing the problems. Typical problems of the times are the climate crisis, overconsumption and overproduction of products, health problems and inequality (Kenig- Witkowska, 2017).

In 2003, the European Commission identified three (3) major categories consisting of the necessary solutions for the contemporary problems of the time. The first category is the enforceability of legislation on the environment, the second category concerns European Union measures that should have the environment as their objective and of course, the third category is the aforementioned having an international dimension (COM/2003/745 final).

All of these have been published and should be implemented by 2020, while the 17 Global Goals should be implemented by 2030, which are also those directly related to securing resources, in order to achieve Europe's expectations. A necessary condition is the respect for the unique characteristics of each country and each institution, so that they have incentives and by extension the education sector is strengthened ([https://commission.europa.eu/system/files/2020-04/political-guidelines-next-commission\\_el.pdf](https://commission.europa.eu/system/files/2020-04/political-guidelines-next-commission_el.pdf)).

### Modern political directions of the European Union for Sustainability

In December 2019, the European Commission spoke about the “European Green Deal” (EGD), the goal of which will be zero greenhouse gas emissions by 2050 (COM/2019/640 final). In order to achieve this goal, there must be respect for the environment and people, anticipating a viable and sustainable future with all initiatives and actions oriented towards climate, energy, industry, tourism, the sea, the economy and innovation, in general. The European Investment Bank contributed to this with public and private resources (Sikora, 2021). Of course, the use of all digital and technological means cannot be overlooked, which was necessary - as history has shown - during the COVID-19 pandemic. Furthermore, the Commission presented the “Digital Compass” to the European Council in March 2021, as an opportunity to digitize the means required for new possibilities in learning and work

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([https://commission.europa.eu/strategy-and-policy/priorities-2019-2024/europe-fit-digital-age/europes-digital-decade-digital-targets-2030\\_en](https://commission.europa.eu/strategy-and-policy/priorities-2019-2024/europe-fit-digital-age/europes-digital-decade-digital-targets-2030_en)).

The human need for equality in their working and social environment, for finding a job, equal treatment in taxation, underlining the change of an economic system to one more accessible to the individual ([https://commission.europa.eu/system/files/2020-04/political-guidelines-next-commission\\_el.pdf](https://commission.europa.eu/system/files/2020-04/political-guidelines-next-commission_el.pdf)) were just some of the reasons that led the European Union to establish the term "European Semester" (European Semester) in 2010 (<https://www.consilium.europa.eu/el/policies/european-semester/how-european-semester-works/>). This enables the countries that are members of the European Union to better plan and continuously monitor progress throughout the year.

It should not be overlooked that Asia, Africa and the USA can help the European continent through humanitarian interventions, friendly relations and ensuring stability and security, after recognizing its need for a better European way of life. It is increasingly understood that these superpowers are directly related to Europe, as many people migrate to them under the fear of discrimination, lack of education, health, social and economic crisis, in the light of the regime of democracy and a better future ([https://commission.europa.eu/system/files/2020-04/political-guidelines-next-commission\\_el.pdf](https://commission.europa.eu/system/files/2020-04/political-guidelines-next-commission_el.pdf)). Europeans are asking to have a more active role and for this, in December 2020, the European Action Plan (European Democracy Plan) (COM/2020/790 final) for democracy was put into effect. This plan mentions, among other things, the prevention of over-information and disinformation, their suppression, the promotion and the assurance of fair electoral processes. Unfortunately, however, it was revealed that the possibility for a better green future is only in the "hand" of the European Union, so that a smooth transition to the new era can be made and of course, within the framework of competitiveness in the global society.

### **The integration of European policies into education**

By definition, the concept and role of education presuppose its reduction to a good of the highest importance, worldwide. The European Union understood this and therefore integrated it into its policy line, setting it as a primary objective for the climate neutrality of European countries. This is clearly seen from the references made to educational programs and actions, within the framework of the European Green Deal, as well as in the fact that education presupposes holisticity. Characteristic is the initiative of the European Union to formulate the special "European Climate Pact" through which the need for harmonious cooperation of various bodies is clearly defined, in order to take action on the climate (COM/2020/788 final). Therefore, they will make the behavior of countries and citizens more sustainable by changing people's mindset and ideology. It goes without saying that a necessary condition is the proper cooperation between both the regions of local government and consequently society, as well as industrial and school units, in order to achieve the proper exchange of information regarding the negatives of the climate crisis, but also the positives that can be changed. A typical example is the involvement of scientists on these issues, such as being able to carry out actions, visits to schools or other projects to improve and achieve the maximum possible result for the good quality of life of citizens (Duetal., 2021).

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Particular mention is made of the primary development sector of each country. According to the European Green Deal, farmers can actively participate with the Agricultural Knowledge and Innovation System (AKIS), with training related to issues of pollution, circular economy, fisheries and what these entail ([https://ec.europa.eu/info/strategy/priorities-2019-2024/european-green-deal/agriculture-and-green-deal\\_en](https://ec.europa.eu/info/strategy/priorities-2019-2024/european-green-deal/agriculture-and-green-deal_en)).

Regarding the industrial sector, it should evolve through the ecological and digital transition, which requires its involvement in new technologies, innovations and investments (COM/2020/102 final). This has a direct link to the European Education Area, because it is a new "Skills Pact" (PactforSkills) which is part of the European Skills Agenda (EuropeanSkillsAgenda) (COM/2020/102 final), as presented in July 2020, on the specialisation and re-skilling of the workforce in lifelong learning in the sciences (COM/2020/274 final) (<https://eur-lex.europa.eu/legal-content/EL/TXT/PDF/?uri=CELEX:52020DC0274&from=EN>).

In contrast to the fact that the Skills Pact is not a pure tool, research has shown that there is a clear link with policy-making and education. The European Council Resolution (2021/ C 66/01) on the implementation of the European Education Area (EEA) by 2025 is the strategic plan for education and training from early childhood to adult education. The above is the "Trojan horse" that will ensure and safeguard good quality and equity in education, the involvement of Sustainability in it and give it an active role in green education by strengthening higher education. The Digital Education Action Plan 2021-2027 (Digital EducationActionPlan) comes as a result of the initial 2018-2020 plan (COM/2018/22 final) for the teaching and learning of digital competences and skills, digital transformation through data-driven plans and forecasts.

In conclusion, the European Union supports and relies on mobility in institutions, the encouragement to strengthen and upgrade skills in teachers, researchers and of course, in pupils and students, with the typical example of the Erasmus + program. This program has started from 2021 to 2027 (Erasmus + Guide, 2022) and refers to the fields of education, youth training and sport. In addition, it connects universities and not only institutions inside and outside the European Union, helps in the development of formal and non-formal learning, giving teachers another tool in their hands, so that they can implement new teaching methods or improve older ones. Including the concept and actors of Sustainability, teachers at all levels must follow the holistic approach to the environment, within the framework of the curriculum, because they are the ones who will determine tomorrow's citizen of society, culture, economy and their interactions (UNESCO, 2014).

### Education for Sustainable Development

Sustainability education comes as a result of environmental education, in the context of the evolution or universal change of previous behaviors, skills, attitudes and perceptions that an individual has, so that Sustainability and justice in society begin to be established. Sustainable Development aims at the future, being based on the present with the necessary condition of transmitting to current generations the knowledge that will be useful to them for a quality life in the future (Leicht et al., 2018).

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The European Union attaches importance to economic, social and environmental issues that concern citizens in order to be able to satisfy their needs. Hence, it sets as a basic foundation the cultivation of environmental awareness and consciousness from an early age, especially in kindergarten and primary school through lessons and other programs. It acts with the aim of promoting and motivating students to make decisions and actions regarding the environment, the economy and equality in society. The UN, establishing the “Decade of Education” (UNDESD) (Combes, 2005) based on the “Global Action Plan for Sustainable Development” (GAP) (WHO, 2022), speaks of new educational policies, school curricula in the timetable, provided that teachers have received the appropriate education for Sustainable Development (Leichtetal., 2018).

All of the above depend on the state, society and government. The categories that UNESCO, in 2012, established are the following seventeen (17) that have to do with the 17 Global Goals: 1) agriculture, 2) atmosphere, 3) biodiversity, 4) changing consumption patterns, 5) climate change, 6) deforestation, 7) desertification and drought, 8) water, 9) gender equality, 10) human settlement, 11) indigenous peoples, 12) land use, 13) oceans, 14) population growth, 15) poverty, 16) protection and promotion of human health and 17) hazardous waste.

UNESCO (2012, 2014) defined the principles on which 17 Global Goals for Sustainability are based on:

- 1) elimination of ageism regarding the acquisition of knowledge and skills for Sustainable Development
- 2) implementation of pupil -centered teaching methods
- 3) justice and inclusion
- 4) changing the mentality of all societies
- 5) holism and actions based on the four pillars of Sustainability (Environment, Society, Economy, Culture)
- 6) application in formal and non-formal learning environments

The ultimate goal is for the person who will receive this education to acquire knowledge regarding the natural environment, human society, culture and to be able to communicate, having critical thinking skills. Furthermore, to act and plan the future in the light of cooperation and basic values such as empathy, recognition of the value of others and respect for diversity (UNESCO, 2012; UNESCO, 2014).

### **Sustainability education in the European Union and Greece**

The problems of modern times, which extend to all areas of people's daily lives, such as economic, social, political, cultural, are the factors that contributed to the creation of the 2030 Agenda for Sustainable Development and by extension the European Green Deal. Emphasizing the need for proper education on Sustainability issues, as explicitly stated in the UNESCO book (2020), those responsible should integrate the principles of Sustainable Development into their educational methods both in the daily timetable and more broadly in the Curricula, in teacher training and in the assessment of students. The assessment carried out in various European countries in the field of education, as published in the European Commission (2022), following recommendations from the UN and UNESCO, is characteristic.



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The results revealed the need to change the existing education system and modernize it, based on the needs of Sustainability, starting with the pre-kindergarten - kindergarten educational level, reaching up to vocational training and adult education.

Thus, the creation of a holistic and transformative education regarding Sustainability is a one-way street as defined in “Education for Environmental Sustainability” (Education for Environmental Sustainability).forEnvironmentalSustainability - EES) (<https://education.ec.europa.eu/el/focus-topics/green-education/learning-for-environmental-sustainability>). This implies changes in educational strategies with the background of the principles of Sustainability, with most issues arising due to the climate crisis, the overconsumption of goods and resources and the increase in natural disasters. The European Commission (2022) strongly underlines the importance of modernizing and enriching the entire teaching process with more creative strategies in a pupil-centered and not teacher-centered framework as is the case today (UNESCO, 2012; 2014). The role of the pupil will be intensified to a more active role and not the more passive one that he has known all these years, through role-playing, design, music, painting, art lessons, etc. The long-term goal is for the pupil to be the one who will design the best future for his life, as he will be the active and aware citizen that society needs with a sense of social justice and self-efficacy. It is obvious that the content and goal setting of the current Curriculum and the learning objectives of the European Union member states are not rejected. However, teachers should enjoy the freedom to choose their teaching methods, depending on the needs of their class, in the light of critical thinking, cooperation and teamwork for the possibility of taking initiatives by pupils and their inclusion in experiential activities (UNESCO, 2005; UNESCO, 2012; UNESCO, 2020).

In a report published by the European Commission (2022), Greece is one of two (2) of the twenty-seven (27) countries of the European Union that in the field of education of children (aged 5 to 16) appears to cultivate no competence-skill of "Education for Environmental Sustainability" (European Commission Directorate General of Education Youth Sport and Culture, 2022). The weird common is that in the same report it is apparent that Greece, while not having an autonomous educational policy for Sustainability, nevertheless integrates it into other existing situations, such as for example in the Skills Workshops, which appeared in 2020 by the Institute of Educational Policy (IEP). According to them, teachers, without exception, are trained in life, mind and technology skills in issues related to environmental, social and other study topics (<https://education.ec.europa.eu/el/focus-topics/teachers-trainers-and-school-leaders/teaching-professions>).

The government in Greece, with the Ministry of Education as the competent body, submitted Ministerial Decision No. 66152/GD4/2022, in June 2022, defining a new strategy regarding Sustainability. It calls for a change in the vision of the Greek school, in order to be able to meet the demands of today. For this reason, it has developed a new Curriculum from kindergarten, primary school to high school, entitled “Environment and Education for Sustainable Development”. Henceforth, therefore, the country’s Primary and Secondary Education incorporates the principles of Sustainable Development into its bases and across the entire range of courses in the curriculum. Unfortunately, this does not imply its institutionalization as a pure subject, but in a separate article of the Ministerial Decision it is stated that the purpose of this program is to cultivate critical thinking, to investigate issues



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concerning the daily lives of citizens and to acquire skills through sustainability, elements that are not cultivated in the country's educational system, as mentioned above. Finally, it emphasizes that this specific Curriculum *"serves education for sustainability vertically in all levels of education and horizontally in all subjects of each grade."*

### **Obstacles to the integration of Sustainable Development**

As mentioned above, the European Union considered it necessary to integrate Education for Sustainable Development into the school system of each country. UNESCO (2007), aiming to ensure a better future for countries, set out this ambitious plan, which, however, also involves obstacles until its final achievement, the most important of which is that it must make the work of the teacher easier by resolving the lack of resources, appropriate infrastructure and the requirements of the curriculum.

Palmer (1998) and Sterling (2013) demonstrate in their research that the older traditional methods that prevail in education are a hindrance, as the holistic approach to the issue regarding the environment, society, economy and culture is not clearly foreseen in pedagogy.

It is a fact that depending on the age of each teacher and the period of his/her studies as a pupil at a Pedagogical Academy (in the past) or at a Pedagogical Department of Primary Education (in recent years), it is a natural consequence that he/she uses the corresponding method in his/her teaching, such as, for example, the pragmatic, the normative or the pluralistic. In contrast to the fact that teachers must be trained throughout life, there is a risk that the method they use will function as an obstacle to the implementation of Sustainable Development Education in schools (Borg et al., 2012). In a study by Evans et al. (2012) demonstrate three (3) types of obstacles that exist in schools today. First, obstacles that relate to the daily conduct of the lesson, second, obstacles of the structure and third, conceptual obstacles. More specifically, the first category of obstacles includes the relationships between teachers - which does not mean that they will always be harmonious -, the second category contains obstacles that directly depend on the type and amount of funding that schools receive and the requirements that the curricula entail and the third category clearly shows the gap in opinions between the theory of Sustainability and the practices followed in schools.

Focusing on Borg research et al. (2012) demonstrates the positive attitude that most teachers had towards integrating the principles of Sustainability into their teaching. However, they faced certain difficulties, as it is characteristically stated that they did not have the appropriate bibliography, technological assistance, they had little time to be able to integrate them into their lesson and unfortunately, not the necessary support from the management of each school. Undoubtedly, there was also the percentage of teachers who considered that Sustainability education could not be integrated into their lesson, as it is an irrelevant subject.

Similar results were also obtained in the research of Sagdic and Sahin (2016) conducted in Turkey, with similar obstacles. In 2002, Mouzaki and Stachtari stated that Sustainability Education *"should activate new behaviors, perceptions and practices that will allow teachers to disseminate innovative teaching activities in their classroom to achieve the goals of Sustainability by connecting them with all the thematic areas they teach"*. This quotation of their words confirms the need for continuous training of teachers. Finally, in a study by Spiropoulou et al. (2007) states that the primary step is environmental education, which alone

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will gradually lead to education for Sustainable Development. It goes without saying that it must be integrated into the framework of existing courses with teaching methods that promote critical thinking, problem-solving skills, so that these lead to a change in the individual's behavior from an early age, contributing to the goal of Sustainability at a later time.

### **Greece's priority in terms of integrating the Sustainable Development Goals (SDGs)**

A major priority for Greece is the implementation of the strategic plans of the 2030 Agenda and the Sustainable Development Goals (SDGs). If these plans are implemented in the right way, they will provide Greece with a development path, with a clear balance in economic issues, social cohesion, a sense of justice and environmental protection. The Greek government aims in the short and long term to transform the state into a strong mechanism of national scope. For this reason, the General Secretariat of the Government (GGG), which is also the structure responsible for the planning, coordination, monitoring and implementation of the UN Sustainable Development Goals, created an Inter-Ministerial Coordination Network (article 43 of Law 440/2016). A year later, in 2017, a thorough analysis and briefing of all government agencies and, by extension, the members involved regarding the SDGs and their achievement was carried out. A comprehensive national strategic plan was established in order to properly implement what the Greek government set, classifying them into eight (8) priorities.

1st) Creating a pioneering economic development based on Sustainability and successfully competitive with other countries.

2nd) Possibility of finding full - time employment for all with dignity.

3rd) Possibility of solving problems of the lower economic classes and eliminating their social exclusion, with access to healthcare services for all citizens.

4th) Reducing inequalities between societies, whether in big cities or in regions, and equal opportunities for all.

5th) Provision of high-quality education without discrimination, aiming at the well-being of society as a whole.

6th) Strengthening the protection and proper management of natural capital, in order to achieve the reduction of carbon dioxide emissions.

7th) Institutionalization of competent bodies, which will be responsible for working effectively and with full transparency for the good of all.

8th) Based on democratic processes, strengthening and supporting partnerships ([https://hellenicaid.mfa.gr/media/images/docs/Agenda\\_2030.pdf](https://hellenicaid.mfa.gr/media/images/docs/Agenda_2030.pdf)).

## RESEARCH METHODOLOGY

This paper presents specific limitations, as a natural consequence, initially, of the lack of historical data for the study of such a modern international phenomenon as Sustainable Development and then, of the demanding specialized research for the promotion of its 17 Global Goals in Primary Education. The causes of these limitations stem from the gradation of historical information that, probably, has been delayed in becoming more widely known in the scientific community. Also, the paper concerns entirely the theoretical background of the

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research as a bibliographic review of it, where the studies that were deemed relevant to the research questions (Kitchenham, 2012) and can lead to reliable research results (Petersen, Feldt, Mujtaba & Mattson, 2008) were searched, evaluated and analyzed.

## RESULTS OF THE SURVEY

In the international bibliography, the main problems of the times are disclosed, e.g. the climate crisis, overconsumption and overproduction of products, health problems and inequality (Kenig-Witkowska, 2017), which will be addressed with the strategic plan of the European Union's actions, as defined at the 2001 Summit in Gothenburg. These plans should be implemented by 2020, while the 17 Global Goals should be implemented by 2030 with the necessary condition of respecting the individual characteristics of each country and each institution, so that they have incentives and, by extension, the education sector can be strengthened ([https://commission.europa.eu/system/files/2020-04/political-guidelines-next-commission\\_el.pdf](https://commission.europa.eu/system/files/2020-04/political-guidelines-next-commission_el.pdf)). As a first step, the “European Green Deal” (EGD) was signed, aiming for net-zero greenhouse gas emissions by 2050 (COM/2019/640 final) with the European Investment Bank contributing public and private resources (Sikora, 2021). The next step was the “Digital Compass”, in March 2021, as an opportunity to digitize the tools required for new opportunities in learning and work ([https://commission.europa.eu/strategy-and-policy/priorities-2019-2024/europe-fit-digital-age/europes-digital-decade-digital-targets-2030\\_en](https://commission.europa.eu/strategy-and-policy/priorities-2019-2024/europe-fit-digital-age/europes-digital-decade-digital-targets-2030_en)). Also, the “European Semester” (EuropeanSemester) in 2010 (<https://www.consilium.europa.eu/el/policies/european-semester/how-european-semester-works/>) enabled the countries that are members of the European Union to better plan and continuously monitor progress during the year.

The European Action Plan (EuropeanDemocracyPlan) (COM/2020/790 final). According to the “European Climate Pact” (COM/2020/788 final), special mention was made of the primary development sector of each country, because farmers can actively participate with the Agricultural Knowledge and Innovation System (AKIS), with training related to issues of pollution, circular economy, fisheries and what they entail ([https://ec.europa.eu/info/strategy/priorities-2019-2024/european-green-deal/agriculture-and-green-deal\\_en](https://ec.europa.eu/info/strategy/priorities-2019-2024/european-green-deal/agriculture-and-green-deal_en)). In the industrial sector, a new “Skills Pact” ( PactforSkills ) which is part of the European Skills Agenda (EuropeanSkillsAgenda) (COM/2020/102 final), as presented in July 2020 and requiring the specialization and re-skilling of the workforce in lifelong learning in the sciences (COM/2020/274 final) (<https://eur-lex.europa.eu/legal-content/EL/TXT/PDF/?uri=CELEX:52020DC0274&from=EN>).

Continuing the research, the European Union has realized the importance of education and integrated it into its policy line. It has created the European Education Area (EEA) by 2025 which will ensure good quality and equity in education, the involvement of Sustainability in it and will give it an active role in green education by strengthening higher education. The Action Plan for Digital Education 2021-2027 (DigitalEducationActionPlan) comes as a result of the initial 2018-2020 plan (COM/2018/22 final) for the teaching and learning of digital competences and skills, digital transformation through plans with data analysis and forecasts. The results of the research show that the European continent relies on mobility in institutions, the encouragement to strengthen and upgrade skills in teachers,

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researchers and of course, in pupils and pupils, with the typical example of the Erasmus + program (Erasmus + Guide, 2022). In addition, teachers at all levels must follow the holistic approach to the environment, within the framework of the curriculum (UNESCO, 2014) and transmit to current generations the knowledge that will be useful to them for a quality life in the future (Leichtetal., 2018). The UN established the “Decade of Education” (UNDESD) (Combes, 2005) based on the “Global Agenda for Sustainable Development” (GAP) (WHO, 2022) for new educational policies, school curricula in the curriculum, provided that teachers have received appropriate education for Sustainable Development (Leichtetal., 2018) and UNESCO, in 2012, defined the 17 Global Sustainable Development Goals. In conclusion, the ultimate goal is for humans to acquire knowledge regarding the natural environment, human society, culture and to be able to communicate, having critical thinking skills with empathy (UNESCO, 2012; UNESCO, 2014).

Unfortunately, however, the results of the European Commission (2022) demonstrated the need to change the existing education system and modernize it, based on the needs of Sustainability, starting with the educational level of pre-school - kindergarten and reaching up to vocational training and adult education, as defined in "Education for Environmental Sustainability" (EducationforEnvironmentalSustainability - EES) <https://education.ec.europa.eu/el/focus-topics/green-education/learning-for-environmental-sustainability> ) in a pupil -centered framework (UNESCO, 2012; 2014). It is obvious that the content and objectives of the current Curriculum and the learning objectives of the European Union member states are not rejected. However, teachers should enjoy the freedom to choose their teaching methods in the light of critical thinking, collaboration and teamwork for the possibility of pupils taking initiatives and their inclusion in experiential activities (UNESCO, 2005; UNESCO, 2012; UNECSO, 2020). Following the new Curriculum from kindergarten, primary to high school, entitled "Environment and Education for Sustainable Development". The dysfunctional aspect of the subject is that it does not imply its institutionalization as a pure subject. The main obstacle is the older traditional methods, as shown in the research of Palmer (1998) and Sterling (2013), while Evansetal. (2012) demonstrate three (3) types of obstacles that exist in schools today in the daily conduct of the lesson, in the obstacles of the structure and in the conceptual obstacles. The Borg speak of good development etal. (2012) with the positive attitude that most teachers had towards integrating the principles of Sustainability into their teaching.

In summary, if these plans are implemented in the right way, they will give Greece a development path, with a clear balance in economic issues, social cohesion, a sense of justice and environmental protection. The Greek government aims in the short and long term to transform the state into a strong mechanism of national scope with a responsible structure for the planning, coordination, monitoring and implementation of the UN Global Sustainable Development Goals, the General Secretariat of the Government (GGS).

## CONCLUSIONS – PROPOSALS

The educational plans adopted by each school around the world depend on the state and its priorities in education. Only in specific points of the Curricula is there any reference to Sustainable Development, while overall it occupies a very small part.

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Teachers are the ones responsible for instilling in pupils, through their knowledge, perceptions and opinions, an interest in sustainability issues through their lessons and pedagogical approach. The same applies to the broader social relationships that children develop, whether among themselves or with adults. This is, therefore, a comprehensive restructuring of the Curricula that will concern today's children, being tomorrow's parents, who, through their skills and knowledge, will safeguard or not the sustainability of the future.

Pedagogical approaches to Sustainability should shift the focus from teacher to pupils and from rote memorization to child-centered learning. This will lead to positive change and help children develop feelings of social justice and self-efficacy as members of society.

The questions that are now being raised are regarding the suitability of the older Curricula for current parents and educators and their willingness to change their behavior through lifelong learning and the methods to be used with children. These are just some of the binding factors for starting a common process of education and learning in Sustainable Development.

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**“Alternative Tourism and Sustainable Development”**

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# FOSTERING TOURISM WHILE NEUTRALIZING CULTURAL HERITAGE. THE PARADOXAL URBAN DEVELOPMENT OF TIRANE (ALBANIA).

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## Abstract

The relationship between cultural heritage and tourism in urban development - and even more so in sustainable development - is complex and strategic. While cultural heritage can act as a catalyst for tourism and economic development in cities, it is essential to adopt sustainable approaches to ensure that this development does not compromise the historical and cultural values of communities.

This is not the case in Tirana, as reported in the survey of human rights activist groups:

1. The demolition of large urban areas adjacent to the city center. Self-built spontaneous settlements reflecting the Mediterranean traditions of urban communities, representing critical pages of social history, such as the years after the fall of communism (Stacioni I Trenit Area).
2. The demolition of the Teatro Nazionale. An exceptional example of modern Italian architecture from the 1930s, demolished despite the efforts of citizens, activists, students, heritage specialists and intellectuals of all kinds to protect it.
3. The radical architectural interventions that formally and symbolically transformed some of the city's most historic monuments, such as the Pyramid, the Stadium and the Old Bazaar.
4. The hyper-commodification of historical sites transformed into commercial spaces, such as the medieval Tirana Castle.
5. A broad process of gentrification, perceived even in the aesthetic enhancement strategies of the facades of the Soviet buildings, visibly lacking a proper urban renewal, that is socially impacting on the already fragile tissue and capturing the cultural and financial capital of the place from its communities.
6. The use of religious buildings for touristic purposes such as Namazgja's Mosque.

Bridging the fields of cultural heritage and urban development through historical research, interviews and participant observation, the paper aims to discuss the process of turistification of the city and the paradox expressed by unsustainable strategies that threaten Albania's material and immaterial cultural heritage.

**Key words (7):** Cultural Heritage, Gentrification, Turistification, Urban Communities, Urban transformation, Historical monuments, Commodification of culture.

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### **SUSTAINABLE CULTURAL TOURISM IN THE GREEK ISLANDS. CASE STUDY: THE ISLAND OF SANTORINI**

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#### **Abstract**

Tourism is the primary source of Greece’s income, and its development is mainly seen on the Cycladic, Dodecanese, and Ionian islands and the island of Crete; this study is focused a) on the type of tourism that is known as Sustainable Cultural tourism, b) on how this type of tourism is promoted in Greece and c) by using the island of Santorini as a case- study for the over- tourism problem we will investigate the options of sustainable cultural tourism as an “antidote”.

The islands have been popular tourist destinations since the post-war tourism development in Greece. Crete receives the most tourists because it is a big island with many beautiful and historically significant places.

Sustainable cultural tourism is a type of tourism that is growing worldwide among tourists who want more from the destinations they visit. On the other hand, it puts local communities “at the center of the decision-making process,” as the European Union suggests. However, climatic change, globalization, and the recent pandemic have directed this growth toward sustainability since it provides alternative ways of tourism in an unstable world.

Greece is a world-renowned tourist destination that mainly promotes the sea, beaches, and ancient civilizations. Only lately have things seemed to evolve towards appreciating modern culture and intangible cultural heritage.

The development of tourism in the Greek islands is unavoidable since they have many beaches, but the islands can offer more of their culture to visitors by using ancient and modern Greek culture, intangible cultural heritage, wine-cultivating methods, and culinary habits.

Santorini successfully combines its historical and archaeological importance with the amazing caldera view, unique wine production, and volcanic ground agricultural products, which together make a substantial cultural product and can attract the “visitor’s gaze.”

**Keywords:** Sustainability, Cultural Heritage, Intangible cultural heritage, Santorini

**CORRELATION BETWEEN THE DEGREE OF PRESERVATION AND  
PROMOTION OF CULTURAL HERITAGE AND THE LEVEL  
TOURIST ACTIVITY IN THE CITY OF LAMIA**

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**Abstract**

The present study has as its object the Municipal Community of Lamia (Figure 1), the old city of Lamia (until 1999, when the corresponding Kapodistian Municipality of Lamia was created), current center of the Kallikrates' Municipality of Lamia (since 2011). It is a city located approximately in the center of the map of Greece, it is easily accessible, it has a long history, remarkable examples of ancient, Byzantine and neoclassical architecture, pleasant surrounding landscape and interesting tradition. Nevertheless, the city is characterized by limited visitation, something that makes it introverted and contributes to the decrease in the satisfaction of its citizens with daily life in it. Its inhabitants themselves, as can be seen from a survey carried out in the context of this study, notice problems in aesthetics, urban planning, cultural activity and the way of preserving and promoting their cultural heritage. This research seeks to draw the conclusion of whether and to what extent the more systematic utilization and promotion of the architectural and general cultural heritage of this place could contribute to a reasonable increase in its visitation by Greek or even foreign travelers, resulting in the improvement of the economic and social conditions of his daily life. It seems that the answer is positive and that various measures could be implemented, which gradually, over time, with persistence and patience, would manage to contribute to the improvement of Lamia's position on the cultural and touristic map of Greece.

**Key words:** Lamia, Phthiotida, Central Greece, Cultural Heritage, Architectural Heritage, Tourism



**Figure 1:** The city of Lamia seen from its castle. (1)



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### 1) INTRODUCTION

The awareness of the impact of a place's cultural heritage on the development of various sectors of its economy is not new. It is known that since the 1980s, many provincial cities in Western Europe have moved very successfully towards revitalizing themselves and improving their image by strengthening their cultural sector. Bilbao, Montpellier, Nîmes, Grenoble, Rennes, Hamburg, Cologne, Barcelona and Bologna are some of them. Coming to the very recent past and specifically to 1919, ESPON's study entitled: "Material Cultural Heritage as a Strategic Territorial Development Resource: Mapping Impacts Through a Set of Common European Socio-economic Indicators" was prepared. According to this survey, which was of course based on certain assumptions, the material cultural heritage of a place seems to positively influence the development of professional activities in it, such as archaeology, architecture, museums, libraries, tourism, construction, brokerage, IT and insurance. In fact, the overwhelmingly stronger effect of the existence and promotion of the monumental wealth is received by the tourism sector. (2)

Taking into account the above, in the context of the present study, an attempt is made to investigate the case of Lamia, a European city located in the passage from the north to the south of Greece (Figures 2 – 3). It seems that although the city has a rich history and monumental wealth, these characteristics have not been sufficiently exploited, as a result of which the tourist traffic in it is moderate and ranks 30th among those of the 51 prefectures of the country. At the same time, the unemployment rate in the city reaches 15.16%, being the 32nd highest among the 51 prefectures of the country. Undoubtedly, the more systematic utilization of the city's cultural potential could contribute enough to a reasonable increase in its visitation, to the development of new jobs in various sectors and to the general extroversion and prosperity of the place. (3)



**Figure 2:** Lamia's geographical position. (4)



**Figure 3:** Lamia's map. (5)

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The following sections present the historical and monumental wealth of the Municipal Community of Lamia, as well as the image it gives today through visual observation and a relevant survey conducted. Next, the presentation and processing of quantitative data, based on information from ELSTAT (Hellenic Statistical Authority) and EUROSTAT, concerning the incomes of the tourism sector, the number of workers in it, the visitation of museums and archaeological sites in Lamia and in the wider region of Phthiotida's prefecture as well as other characteristics is carried out, always in comparison with the corresponding data of the capital cities of the other 4 largest in area Greek prefectures or of 4 other Greek cities with a similar population. The aim is to examine whether Lamia is characterized by insufficient utilization of its cultural potential in relation to other Greek cities and to give food for thought on new tactics that could ideally be followed, so that the city can improve its position on a cultural, economic and social level. In addition to this, the existing correlation between cultural heritage and tourism in Greece is proven with the appropriate process of DATA deriving from ELSTAT justifying the probable contribution of the better management of cultural heritage to the increase of prosperity in the city of Lamia.

## 2) BRIEF REFERENCE TO THE HISTORY OF LAMIA

The history of Lamia (today: Municipal Community of Lamia of the Municipality of Lamia) begins with the end of the Persian Wars, in the 5th BC century. During antiquity, it was a city of limited power, which experienced the zenith of its prosperity from the mid-4th to the mid-3rd BC century, and then passed under the influence of various Greek city-states. The most important event in its ancient history was the Lamia's War (323/322 BC), during which the Athenians clashed with the Macedonians. (6-7, 8, 9, 10)

The medieval archaeological findings of the city are limited. However, it is known that, in the 6th AD century, it took the name "Zitouni", a word that might have come from the Greek word "sitoni" which means wheat market. During the 7th-9th AD century the city was temporarily deserted. It reappears in historical sources of the 12th century AD as one of the commercial centers of the Byzantine Empire. In 1204 it was captured by the Crusaders and then successively annexed to the Despotate of Epirus and the state of Great Wallachia. The Catalans occupied it (1318) while from 1394 onwards the city passed successively many times from the hands of the Ottomans to those of the Byzantines to end in its final enslavement to the Ottomans in 1446. (6, 11-14)

During the Ottoman occupation, Zitouni became the seat of many Turkish officers (Figure 4). At that time, Greeks, Turks, Bulgarians, Latins and Armenians coexisted in it and were mainly engaged in agriculture and trade. Already in 1673 the city's bazaar gained Pan-Balkan prominence. (13, 15-16)

The final liberation of Zitouni from the Turks took place in 1833 but was unfortunately followed by the unpleasant phenomenon of banditry. Nevertheless, at the same time,

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important steps towards the development of the city began to be taken. Thus, by 1867 it gradually acquired a Greek school, a printing house, a bank, a high school, a Turkish consulate and a hospital. In 1836 the weekly Saturday wheat bazaar began to take place (Figure 5), in 1858 the city's streets acquired Greek names and in 1886 the city took its ancient name again: Lamia. Finally, in 1911 it was electrified. (13, 15, 18)



**Figure 4:** Lamia in 1805.(17)



**Figure 5:** Lamia's bazaar (beginning of the 20<sup>th</sup> century). (17)

During the period 1941-1944 Lamia was under German occupation. In 1967, the Panhellenic Exhibition of Lamia was opened for the first time. (13, 19-20)

In 1999, within the framework of the “Kapodistrias” programme, Lamia was merged with its 20 neighboring communities, forming the new (Kapodistrian) Municipality of Lamia. Finally, in 2011, the last one was merged with those of Gorgopotamos, Lianokladi, Ypati, as well as the community of Pavliani, creating the enlarged (Callicratic) Municipality of Lamia with 75,315 inhabitants. (21 – 22)

### **3) TOWN PLANNING AND ARCHITECTURE OF THE SUCCESSIVE HISTORICAL PERIODS OF LAMIA.**

From the genesis of Lamia, in ancient times, until today, when the Municipal Community of the same name has 47,529 inhabitants, the city has demonstrated many characteristic urban planning phases and various architectural works of different historical periods, which are preserved in the form of relics or intact buildings. Next, a brief presentation of the town planning and architecture of Lamia during the successive phases of its life is attempted. (3)

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### *3a) Antiquity*

As many archaeological findings show, the urban fabric of ancient Lamia stretched between the hill of its castle and that of Agios Loukas. Its center was on the slopes of the hill of Agios Loukas. There were public buildings, crafts and a market. Some notable buildings, among those that have been excavated, are a Hellenistic memorial structure in Enianon Street and a fountain, in the basement of the Bank of Greece, in Diakou Square. Particularly noteworthy is the ancient Gymnasium, which was located outside the south-eastern gate of the city and the remains of which have been excavated on today's Thermopylon street (Figure 6). Its palaestra had a platform, a dressing room, a bath, an olive grove and an inner courtyard with a covered portico. Traces of an ancient sanctuary within the city of Lamia have not been found to date. However, from the coins found there it becomes clear that the god who was mainly worshiped in it was Dionysus. Certainly, near the city, remains of a temple dedicated to Demeter (in Anthili) and another dedicated to Poseidon have been discovered. In the first of these, in fact, Amphictyonic conferences took place. (7, 10, 23-25)

The buildings of ancient Lamia were built on artificial stilts, supported by strong retaining walls due to the steep slope of the hill of Agios Loukas towards the east. (23)

The defense of the city was ensured by its fortified castle and by the walls that surrounded the entire residential area. From the way the castle's masonry is structured, it appears that it presents various building phases. However, the oldest parts of it date back to the 5th B.C. century. It is also evident that the shape of the ground plan of the castle enclosure during ancient times does not differ much from today's. In modern times this is a right-angled triangle about 600 meters in perimeter. The walls of the enclosure end high in jagged ramparts with a perimeter corridor. Their maximum height is 13 meters in their northwest corner while their width is on average 1.35 meters. Also, the castle has two gates with arched lintels in its northeast and southeast. From the south-east gate a stone staircase leads to the perimeter corridor. In addition, towers are erected along the perimeter of the walls, at the corners and near the gates. The interior of the castle is divided into three parts by transverse walls, which were built at a much later time either by the Franks or the Catalans. The northernmost of these, the citadel, is accessible through a third, inner gate, which also has an arched lintel (Figure 7). (8,12, 24 – 29)

To the south of the castle of Lamia, remains of Hellenistic baths, made of terracotta, have also been excavated. (27)

As for the remains of the fortification walls of ancient Lamia, at the current corner of Vyronos and Eslin streets, those of a Hellenistic fortress with a four-sided plan are preserved. (26 – 27)

Apart from the aforementioned infrastructures, ancient Lamia had three cemeteries outside its walls, in the southwest, southeast and northeast of them. Their tombs were



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sometimes box-shaped and sometimes chamber-shaped. Two of them were Macedonian-style vaulted (in the southeast cemetery). (7 – 8, 23, 26, 30)



**Figure 6:** Ruins of the ancient gymnasium on Thermopylon street. (1)



**Figure 7:** Partial view of Lamia's ancient castle. (1)

### **3b) Middle Ages**

The few and most important medieval architectural finds that have been excavated in Lamia include, first of all, the remains of an early Christian basilica with a mosaic floor in today's Diakou Square. Also, Byzantine architectural elements are found embedded in churches to the south of the hill of the city's castle and more specifically, in those of Agios Minas (Figure 8), Panagia Archontiki, Panagia Despina and Agios Nikolaos. There are also findings on the ring road of the Castle but also in the Castle itself (Figure 9). In fact, excavations carried out in its eastern part, at the end of the 20th century, show that it was inhabited during the Late Byzantine period. (6, 12)



**Figure 8:** Medieval marble element in the chapel of Saint Minas. (6)



**Figure 9:** Remains of a Byzantine frescoed chapel on the ring road of the castle. (1)

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### *3c) Period of Turkish rule*

During the times of the Turkish occupation, it seems that Zitouni was a welcoming and well-groomed city that inspired the Turks respect. During the 17th century, it consisted of thirteen Turkish mahals and eight "infidels" ones (Greeks', Bulgarians', Armenians', and Latins') The city had about 2,500 tile-roofed, luxurious residences, surrounded by gardens and located at some distance from each other. Among them were both famous seraglios (Figure 10), often with private hammams, and huts. In fact, the houses of the Turks were located on the slope of the hill of Agios Loukas, among the houses of the "infidels", while at the foot of the Castle there were exclusively Greek, Bulgarian, Armenian and Latin residences. The streets between the buildings were made of hard cobblestones. There were also houses on the banks of the river that crossed the city at the time (on today's Ypsilantou street). In fact, five stone bridges were built over it. The castle of Zitouni at that time had fifty residences inside it, as well as warehouses of military material. (16, 31–32)

As for the religious buildings of the city, it had eight Muslim mosques. One of its most famous mosques to date was the "Molyvdoskepasto" (=lead-sheated) or Kurshoum Mosque (Figure 11), which was located in the place occupied today by the 6th High School of Lamia. Another memorable mosque was Sultan Mehmet Khan's with a tiled roof, built in 1488 and featuring a courtyard with broad-leaved, shady trees. Besides these, there were three mosques in the most distant mahals, madrasahs for students of the interpretation of the divine word, mekteps for the younger children to study, and tekkes of dervishes. Finally, there was a large number of Muslim pilgrimages. (16)



**Figure 10:** The residence of Zitouni's pasha. (17)



**Figure 11:** Kurshum Mosque (1897).(17)

Other types of buildings in Turkish-occupied Lamia were inns for merchants, a hammam, and an imaret that provided daily alms. There were also about two hundred shops and a marketplace. It is worth noting that the city has had a sewage system since then. (16)



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In general, during the times of the Turkish occupation, the folk architecture of the city flourished and contrasted with the ancient and Byzantine tradition but displayed remarkable structures built by skilled masons. (29)

### **3d) Modern times**

During the reign of Otho, Lamia, which then had about 4,000 inhabitants, acquired its first urban plan. This was done in 1834 by Emmanuel Manitakis, who belonged to the Architectural Department of the Ministry of the Interior. (33)

The new buildings of Lamia were built at a rapid pace around its squares, all over the slope of the hill of Agios Loukas, on the hill of the castle and on the plain. These were usually single-storey or two-storey with external masonry walls and wooden, hipped roofs. The interior walls were made of bricks or of chatma. The floors were wooden and the balconies marble or rarely concrete (from the interwar period onwards). (33–34)

In this historical period, in the now free Greek state, the neoclassical rhythm in architecture, which had already flourished in Europe, reached the city of Lamia. Thus the wealthiest citizens of Lamia acquired neoclassical residences according to Athenian standards. These were built around the four squares of the city. The oldest confirmed date of construction of a neoclassical house in Lamia is 1865. This is inscribed on the lintel of the house of doctor Vakalopoulos on Satovriandou Street (Figure 12). (31, 35)

The neoclassical buildings of Lamia were built with a combination of local materials, as well as materials and entire structural elements from Athens and Volos. At the same time, the facades of many old houses were renovated, obtaining neoclassical morphological characteristics, while the interior of the houses in question kept its folk character. (34)

Today, a few dozen neoclassical houses are preserved in the historic center of the city. An excellent example is the house of Christos Elassonas in Diakou Square (1890), designed by the architect T.H. Helmis, which was classified as a work of art by the Ministry of Culture in 1991 (Figure 13). (31, 35)



**Figure 12:** Vakalopoulos' neoclassical building on Satovriandou street.(1)



**Figure 13:** Christos Elassonas' neoclassical building on Diakou Square. (1)

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Other notable buildings of this style are the Courthouse at 10 Kapodistriou street (Figure 14), the building of the Region of Eastern Central Greece (originally the National Bank of Greece, 1924 – 1928) at 1 Ypsilanti street (Figure 15), the building of the Bank of Greece at Diakou Square (old Dyovouniotis' house) (Figure 16) and the stone school on Ypsilanti Street (1911 – 1914) (Figure 17). The last one initially housed the "Girls' School" (primary school for girls), then it became a high school for boys (1938 - 1978), while from 1978 until today it functions as the 6th High School of Lamia. (31, 35)



**Figure 14:** Lamia's Courthouse.(1)



**Figure 15:** The building of the region of East Central Greece.(1)



**Figure 16:** The Bank of Greece in Diakou Square. (1)



**Figure 17:** The 6<sup>th</sup> High School of Lamia on Ypsilanti street. (1)

Of course, apart from the above-mentioned neoclassical buildings of Lamia, which fortunately have been preserved until modern times, in the past there were more very remarkable constructions of the same style, which are now known only from photographs or other historical sources. Noteworthy are four hotels ("Hotel of England", "Hotel of Europe",

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"Achillion" (figure 18) and "Akteon"), three of which were located in Eleftheria's Square, as well as the building of the "Elassonion" Hospital at 36, Athinon street (Figure 19).(31, 36 – 37)



**Figure 18:** Achilleion Hotel (Interwar period).(17)



**Figure 19:** “Elassonion” Hospital (1922). (17)

In more recent times the city acquired a railway station (1902 – 1904) with neoclassical buildings designed by French engineers (Figure 20). However, in addition to the neoclassical buildings, Lamia's architecture of recent times also includes other remarkable examples. One of them is the Krokou-Muzeli mills at the end of Eslin Street (Figure 21). They were probably built in 1901 and the equipment they acquired during the interwar period made them particularly productive. After the Second World War they ceased to be used. (12, 31)

For the architecture of Lamia during the 20th century, some interesting conclusions can be drawn through the observation of relevant tables of the Hellenic Statistical Authority. It seems, therefore, that until 1960 the main structural material of the masonry of the buildings was stone, while they were usually covered with hipped ceramic roofs. Entering the 1960s, the trend reversed and reinforced concrete became commonly used in structures covered by flat slabs. It is also observed that in the time period 1919 – 1960 a great increase in construction activity took place in the city. The reasons could have been many. Certainly, however, in 1922 the city accepted Asia Minor refugees, who built their settlement, Nea Magnesia, in its eastern part. In addition, the optimism and tendency for revival that followed the end of the civil war in 1949 also contributed to the increase in construction activity in the city. From the 1960s onwards, new buildings were built but at a slower pace compared to the post-war period. There is no doubt that all this building activity of the second half of the 20th century contributed to the destruction of several traditional and neoclassical constructions of Lamia, which were replaced by high-rise, concrete and often inelegant apartment buildings that significantly degraded the aesthetic quality of its urban environment. (3)



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**Figure 20:** Lamia's railway station (1900-1910).(17)



**Figure 21:** Krokou – Mouzelli mills.(1)

### 4) THE IMAGE OF LAMIA TODAY

At the beginning of the 21st century, the Municipal Community of Lamia of the (Callicratic) Municipality of Lamia is a modern Greek city of 47,529 inhabitants, where all the necessary activities for the orderly daily life of its inhabitants take place. These include administration, work, housing, education, (primary, secondary and tertiary/public and private), health services, commerce, sports, religious services and entertainment. The main productive sector on which Lamia supports its economy is commerce. Agriculture and small industries follow in succession. (3)

As far as the architecture of Lamia is concerned, the image that is presented unfortunately lags aesthetically (Figure 22). The majority of the old traditional houses were demolished during the post-war decades until today. Their place was taken by buildings without particular aesthetic value and character, the vast majority of which were not designed by architects. This contributes to the somewhat bleak image and the absence of a pleasant and attractive urban environment.

Among the inelegant buildings of recent decades, fortunately some pre-war traditional or neoclassical ones have been preserved. Some of them are kept in good condition and used while others are in ruins. (Figure 23)

Examples of noteworthy modern architecture in the city are rare. A typical case of them is the DEYAL building on Papapostolou Street, which was built in recent years according to the designs of the distinguished local architect Vasilios Triantafyllou. (Figure 24)

A notable characteristic of the city, like of many other Greek cities, is the existence of many remains of ancient structures in its subsoil. There are, therefore, specific cases of parts of ancient buildings in the urban fabric, for which it was rightly decided to remain in public view. Nevertheless, modern, unsightly constructions, without architectural virtues, were erected over them, which greatly degrade their projection. The case of an apartment building on Karaiskaki street, which dominates gracelessly over ancient findings, is typical. (Figure 25)

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As for the urban planning of Lamia, it's center is characterized by relatively narrow streets, where traffic congestion often occurs due to the very large number of vehicles that now move in the urban fabric. Pedestrian streets in the city are rare, almost non-existent. Very important for the benefit of daily life was the pedestrianization of Riga Fereou Street, which connects the two busiest squares, Eleftheria's and Parkou and was implemented in the 2000s.



**Figure 22:** Modern Lamia's graceless buildings. (1)



**Figure 23:** Traditional architecture abandoned in the mercy of time.(1)



**Figure 24:** A remarkable example of quality contemporary architecture in Lamia: DEYAL's building, designed by V. Triantafyllou.(1)



**Figure 25:** The graceless way of projection of Lamia's architectural heritage. (1)

In this point, it must be mentioned that in recent decades the urban fabric of Lamia has expanded visibly in all directions. In fact, in 2007 the municipality approved the new extension of the city plan, based on a study by the Athenian urban design office of Martha Housianakou. The years of the country's economic crisis, however, that have intervened since then contributed to the non-start of the implementation of the study in question until today.

Daily life in the center of the city largely takes place around its four squares, Laou (Figure 26), Eleftheria's (Figure 27), Parkou and Diakou, which are the main socializing spaces for its citizens. In general, the city center is only busy during working hours of the day.

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Conversely, on days and hours when shops are closed, traffic on the streets is extremely limited. Exceptions are Friday and Saturday evenings, as well as Sunday mornings. Finally, during the summer season, the reduction of citizens' activity in the city's public spaces becomes even more limited to a minimum.

All the above-mentioned characteristics summarize the image of modern Lamia, a city which functions quite well and at a low pace in terms of daily life, but which presents a few problems in terms of the aesthetics of its architecture, its urban planning, the promotion of its centuries-old history and the variety of cultural activities, so that it is absolutely not a pole of attraction and a popular destination for Greek and foreign travelers.



**Figure 26:** Laou Square.(1)



**Figure 27:** Eleftheria's Square.(1)

In order to investigate more thoroughly, quantitatively and in real time all the aforementioned issues of the city, a relevant survey was conducted from October 2024 until January 2025, in which 100 Lamia's residents, 100 Greeks from other regions and 50 foreign respondents participated. Those were randomly selected, ranged in age from 12 to 84, were of both sexes and had varying levels of education. The opinions of the Lamia's residents about their city are presented in Table 1(38):

**Table 1.** Average rating given by 100 residents of Lamia to various characteristics of their city.

|                                               |                                           |                                   |                                                                             |                                                       |                                                              |
|-----------------------------------------------|-------------------------------------------|-----------------------------------|-----------------------------------------------------------------------------|-------------------------------------------------------|--------------------------------------------------------------|
| 1.Aesthetic level of the city's architecture: | 2.Level of picturesqueness of the city:   | 3. Number and quality of museums: | 4. Quality of way of highlighting archaeological finds in the urban fabric: | 5. Number and quality of cultural events in the city: | 6. Quantity and quality of infrastructure works of the city: |
| 4.85/10                                       | 5.54/10                                   | 6.09/10                           | 4.29/10                                                                     | 5.51/10                                               | 4.77/10                                                      |
| 7. Level of accessibility for people with     | 8. Level of tourist activity in the city: | 9. Number and quality of tourist  | 10. Quality of service in food services:                                    | 11. Degree of satisfaction                            |                                                              |



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|                                                         |                |                        |                |                                     |  |
|---------------------------------------------------------|----------------|------------------------|----------------|-------------------------------------|--|
| <i>mobility disabilities in the urban environ-ment:</i> |                | <i>accommoda-tion:</i> |                | <i>with daily life in the city:</i> |  |
| <b>3.81/10</b>                                          | <b>3.55/10</b> | <b>5.37/10</b>         | <b>7.30/10</b> | <b>5.95/10</b>                      |  |

As it can be seen, therefore, from the first table, the view of Lamia's citizens on the aesthetics of their city's architecture, the ways of highlighting its archaeological findings, the quality and quantity of its infrastructure works and the level of service for citizens with mobility disabilities is expressed with an average score below baseline. The tourist activity of the city is given a grade of 3.55/10. The picturesqueness of Lamia, the quantity and quality of its cultural events and the quantity and quality of its tourist accommodations receive an average score that just exceeds the base. The quality of the city's few museums is rated by its residents with a more satisfactory 6.09/10. The food services satisfy them enough since they rate them with 7.30/10. Finally, the level of pleasure from everyday life in their city is according to Lamia's citizens at 5.95/10.

The same citizens, again, judged as the most attractive characteristic of their city its castle (percentage: 34.71% of the responses) while as the most unfavorable, in their opinion, its unsatisfactory streetscape and maintenance of its infrastructure (percentage: 19.27% of responses). As the most beautiful architectural work of the city, they again consider its ancient castle (percentage: 52% of the respondents), while second in their preferences comes the building of the Region of Central Greece in Eleftheria's Square (percentage: 13% of the respondents).

It is impressive, however, that 42% of Lamia's residents are not even aware of the existence of ancient structural elements that the excavations have brought to light, in various parts of the urban fabric. On the other hand, 96% of Lamia residents are convinced that better utilization of the cultural heritage of their city could contribute to the increase of tourism in it.

Regarding the adequacy of the city's cultural spaces, 62% of residents argued that they are not enough. More specifically, 33.87% of citizens could not imagine what more could be done, 12.90% said that they would like more museums, 11.29% would prefer there to be more theaters and cinemas and 11.29% would like the creation of a cultural multi-venue. On the question of the general changes that the residents would like to see in their city, first in their preference come urban planning changes, such as for example the creation of more green recreational areas (43.24% of the respondents).

At this point, it may be interesting to note the areas that the people of Lamia place first in their preference as travel destinations. These are Attica and Magnisia. Certainly in Attica they find a large number of cultural and entertainment places and activities, which, as can be seen from the survey that was conducted, are missing from Lamia. Magnisia, from its part, has picturesqueness and beautiful nature, including the charming element of water. Finally, both

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prefectures have many more monuments and museums of all historical periods compared to Lamia. As an example, it can be mentioned that Magnisia has approximately three times the number of old preserved buildings (before 1919) compared to Phthiotida. Of course, one should not overlook the fact that both Attica and Magnesia are very close to Lamia, which makes them more accessible.

Moving to the Greeks from other regions, as it can be seen in Table 2, they rate Lamia's architecture with an average score below baseline, its museums' quality and its city planning/infrastructures with a score that just exceeds the base and finally, the quality of food services of the city with a satisfactory 7.48/10. Also, 28% of the Greek respondents categorically stated that they do not wish to visit Lamia or Phthiotida, since they have not heard anything so interesting about it. However, comparing the views of Lamia's citizens with those of the rest of the Greeks regarding the city of Lamia, it seems that they are similar.

As for the 50 foreigners who participated in the survey, the city was known to only 1 citizen of neighboring Albania, who stated that he was quite satisfied with his visit at it. Among all foreign respondents, however, 8% answered with certainty that they are not interested in visiting Lamia.

Finally, only 0.85% of respondents, whether Greek or foreigners, considered some parts of Phthiotida as their first preference as tourist destinations. Additionally, Phthiotida was indirectly stated once as a place that one would like to visit, through the more specific mention of Mount Parnassos, which Phthiotida shares with Phocis and Boeotia.

**Table 2.** Average score of 100 Greeks who are not Lamia residents which they give to various characteristics of Lamia.

| 1. Aesthetic level of the city's architecture: | 2. Number and quality of museums: | 3. Number and quality of infrastructure works of the city: | 4. Quality of service in food services: |
|------------------------------------------------|-----------------------------------|------------------------------------------------------------|-----------------------------------------|
| 4,62/10                                        | 5,18/10                           | 5,58/10                                                    | 7,48/10                                 |

## 5) WORK, CULTURE, TOURISM AND MOVEMENT IN THE ARCHAEOLOGICAL SITES OF LAMIA DURING THE MODERN ERA, BASED ON ELSTAT AND EUROSTAT DATA

The prefecture of Phthiotida is the fourth in area and twelfth in population among the 51 prefectures into which Greece was administratively divided until 2011. Its capital, the Municipality of Lamia (after the application of Callicrates Programme in 2011), is the 18th in population among the 445 cities of the country, while the Municipal Community of Lamia alone occupies the 41st place. At the same time, as already presented, the city has a historical and monumental heritage dating from antiquity to the modern era. That is why it is worth

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investigating the reason why it holds a moderate position in terms of tourist traffic and a low revenue from visits to monuments and museums in Greece. It is also interesting to consider whether this situation could or should be improved. (30 – 40)

Therefore, by carefully studying the data of the Greek Statistical Authority and EUROSTAT for the city of Lamia or the prefecture of Phthiotida, one can observe the following:

**a) Comparison of the situation of Lamia, the capital of the 4th largest Greek prefecture in terms of area, with those of the capitals of the rest of the 5 largest Greek prefectures in area:**



**Figures 28 a-e)** The capital cities of the 5 largest in area Greek prefectures.

From ELSTAT's 2023 data on work and unemployment in the cities of Messolonghi, Larissa, Ioannina, Lamia and Tripoli, capitals of the largest in terms of area prefectures in Greece, it becomes clear that almost all of them base their economies mostly on commerce. An exception is Messolonghi, which is mainly based on the primary production sector. Lamia, however, seems to have the second highest unemployment rate among them, after Messolonghi, which, although it is the capital, is not the economic center of Aetoloacarnania. (3, 46)

On the question of the employment rate of citizens in cultural and creative sectors, it can be said that according to ELSTAT data of the year 2021, Lamia presents a percentage of 1.1% of its total workforce, which belongs to the lowest of the four EUROSTAT categories. This indicator is 0.8% for Mesolonghi, 1.3% for Larissa, 1.4% for Ioannina and 1,5% for Tripoli. (3, 47)

Regarding the percentage of preserved old buildings (constructed before 1919) in the total of existing buildings, Lamia ranks last among the five examined cities, with a percentage of only 1.06%. It is followed successively by Ioannina with a percentage of 2.27%, Messolonghi with a percentage of 3.26%, Larissa with a percentage of 3.65% and finally, Tripoli with a percentage of 12.82%. (47)

Regarding the revenues of the five largest prefectures in terms of area from tourist activity, it seems that Phthiotida is penultimate, before Arcadia. For 2023 the annual revenue of its related businesses was 9,443,040 euros. In addition, the percentage of its workforce employed in the sector of tourism is 8.96% based on the 2021 census. Also, among the total

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of 67 Greek regional units of today's Greece, Phthiotida ranks 21st in terms of the percentage of workers in this sector. Nevertheless, this regional unit, during the period January 2019 to April 2024, had the 49th position among the 67 regional units of the country in terms of tourism business income. Specifically, it earned 0.93 per thousand of the total income earned by all tourism businesses in the country, i.e. a very small percentage. Conclusively, a large set of workers in the prefecture produces a disproportionately small percentage of the country's tourism profits.

The above-mentioned data from ELSTAT are in agreement with the recent poll carried out in the context of this study, according to which the prefecture of Ioannina is one of the most popular Greek destinations of the respondents, while Arcadia and Phthiotida are among the least popular or not at all popular.

Regarding the origin of the tourists of Phthiotida, from the data of EUROSTAT, it appears that they are mainly Greeks. The same happens with the tourists of Aetoloacarnania, Ioannina and Larissa. On the contrary, Arcadia attracts a mix of Greek and foreign tourists. The fact that Ioannina is the most popular destination for Greeks was also confirmed by the recent poll of October 2024. (48)

Also, based on 2021 EUROSTAT data, Phthiotida hosts more tourists per inhabitant compared to Aetoloacarnania or Larissa but fewer compared to Ioannina and Arcadia. Additionally, Eastern Central Greece in general accepts the fewest short-term stays, booked through relevant online applications, being in last place compared to Aetoloacarnania, Ioannina, Larissa and Arcadia. (48)

Regarding the visitation of the archaeological sites of the five largest Greek prefectures in area, according to ELSTAT, Phthiotida (with 2 visitable archaeological sites) is in the middle position. In fact, Aetoloacarnania (with 8 archaeological sites that can be visited) and Ioannina (with 1 archaeological site that can be visited, the one of Dodoni) present a multiple number of visitors.

Studying the data of visitors to the museums of the five largest prefectures, it is easily observed that Phthiotida (with 4 museums) was in the last place in 2023, with an incomparably lower number of visits compared to that of the museums of Ioannina (with 3 museums), located in first class. Consequently, the prefecture also ranks last in museum ticket receipts among the 5 largest prefectures, as well as 43rd among the 49 prefectures of Greece. In fact, its income from these is only 3.5% of that of Ioannina and 23.9% of that of Aetoloacarnania (with 4 museums). (49)

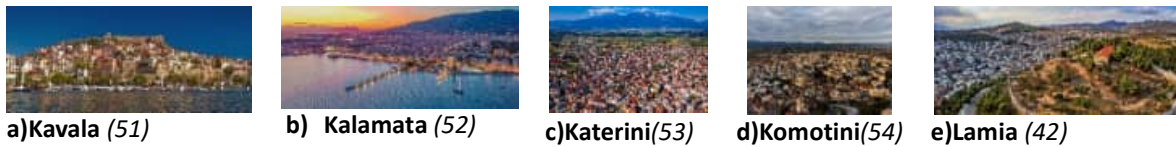
Finally, based on a EUROSTAT study, the residents of Phthiotida, Larissa and Ioannina have one of the lowest indicators in the European Union ( $<5.5/10$  = last of 6 levels) in terms of life satisfaction in their country. Aetoloacarnania and Arcadia, for their part, are one stage higher ( $5.5-6/10$  = 5th of six levels). However, based on the short poll that took place as part of this study, **it seems that the satisfaction rate of Lamia's residents with daily life in their city reaches 5.95/10.** (50)

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### **b) Comparison of the situation of Lamia with those of four other, almost equal in population, Greek cities.**



**Figures 29 a-e)** Lamia and 4 more Greek cities of about the same population.

In this sub-section, the tourist activity and movement in cultural sites of Lamia is attempted to be compared with the conditions prevailing in Katerini, Kavala, Kalamata and Komotini, cities of mainland Greece that have approximately the same population as that of Lamia. As it can be seen again from the related graphic representations, all five Greek cities under study base their economies mainly on commerce. Lamia shows a lower level of unemployment than Katerini and Komotini, while higher than Kavala and Kalamata.

About employees in cultural and creative sectors, ELSTAT data (2021) show that they are 1.1% of the total workforce in Lamia, 0.9% in Komotini and 1.2% in Kavala, Kalamata and Katerini. (3, 50)

Regarding the building potential of the prefectures where the cities belong, the percentage of buildings older than 1919 is 3.13% for Komotini, 1.52% for Kavala, 0.16% for Katerini, 1.06% for Lamia and 7.7% for Kalamata. It seems, that is, that Lamia occupies the penultimate position in the number of preserved old buildings. (47)

Revenues from tourism are much higher in Pieria and Messinia, while Phthiotida occupies the penultimate position before the border region of Rhodopi. Also, Lamia comes second to last, before Komotini, in terms of number and percentage of workers in tourism businesses.

EUROSTAT data also show that tourists in Lamia and Komotini are mostly Greeks, in Kalamata both Greeks and foreigners, while in Katerini and Kavala mainly foreigners. Additionally, Phthiotida hosts more tourists per inhabitant than Rhodope but fewer than Pieria, Kavala and Messinia. Furthermore, Phthiotida is last in number of short-term stays that are booked via the internet. (48)

Regarding the monthly number of visits to archaeological sites, Phthiotida again occupies the penultimate position among the five Greek cities under study, during the period January 2019 – March 2024. In fact, visits to sites of archaeological interest are overwhelmingly fewer both in Phthiotida and in Rhodopi.

For the year 2023, again, Phthiotida and its capital, Lamia, are in the last positions among the five aforementioned prefectures and their capitals, in terms of the monthly number of visits to their museums. As a consequence, the receipts of the museums in question in

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Phthiotida are submultiples compared to those of the museums of the rest of the regions under study.

Finally, on the issue of citizens' satisfaction with life in their place, according to a 2022 EUROSTAT survey, it can be said that the residents of Kavala, Rhodopi and Messinia are more satisfied than those of Phthiotida or Pieria. (50)

### **6) CONCLUSIONS FROM THE ANALYSIS OF THE STATISTICAL DATA ON THE QUESTION OF THE CORRELATION BETWEEN THE PROMOTION OF THE CULTURAL HERITAGE OF LAMIA AND ITS TOURIST ACTIVITY**

#### **a) Lamia among the capitals of the 5 largest Greek prefectures**

By making a first, qualitative assessment of the data comparing the capitals of the 5 largest Greek prefectures in area, the following conclusion can be drawn: Lamia at the beginning of the 21st century is in an unfavorable position compared to other capitals of large prefectures, in terms of both management and promotion of its cultural heritage and tourist activity. Not directly adjacent to the most attractive natural element of water, with only 1.06% of historic buildings (before 1919) in its area and an infinitesimal percentage of residents engaged in creative activities, it shows low tourist activity, caused almost exclusively by Greek visitors. This, together with other factors, implies the last place among the five cities Messolonghi, Larissa, Ioannina, Tripoli, Lamia in terms of the visitation and income of its museums and the highest unemployment rate of its inhabitants after Messolonghi.

*In these conditions, the level of satisfaction of its citizens with their life in their city reaches 5.95/10.*

#### **b) Lamia among 5 Greek cities of similar population.**

Proceeding, now, to conclusions from the comparison of Lamia with other cities of mainland Greece of a similar population, the following first qualitative conclusions are drawn:

Lamia is in the penultimate position, before Katerini, in terms of the percentage of historical buildings (older than 1919) in its urban fabric. It is also in the last category of citizen engagement with creative professions. It also holds the penultimate position, before Komotini, in terms of revenues of businesses that fall under the tourism sector. In addition, the prefecture of Phthiotida comes last in terms of visitors to its museums and income from visits to them. Lamia also presents higher unemployment rates compared to Kalamata, Kavala and Katerini. However, the reduced number of tourists visiting Lamia may be due, among other things, to the fact that Lamia, like Komotini, is not directly adjacent to the charming natural element of water, unlike Kavala, Kalamata and Katerini.



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### **c) Does the cultural heritage of a region finally contribute to the increase of its tourist activity?**

It has already been mentioned that, as part of this research, a survey was conducted in October 2024, which provided the following information. It is noted that 250 people of various genders, ages, origins and educational levels participated in it, more specifically 100 citizens of Lamia, 100 Greeks from other regions and 50 foreigners.

It seems, then, that what mainly attracts travelers to a place is its **cultural heritage in general** (according to 18.38% of respondents), followed by **nature** (15.44%) and **the low cost of travel** (14.71%). **Architecture, museums and monuments** in particular come in fourth place (with a percentage of 10.29%).

Regarding the two most attractive Greek travel destinations of the respondents, these are **the Cyclades** (14.69%) and **Crete** (9.04%). The reasons that contribute to the choice of these 2 destinations are first of all their **natural beauty** (according to 27.91% of respondents) and then their **architecture and monuments** (according to 16.28% of respondents).

From the above it can be seen that one of the strongest factors that can make a place sought after by travelers is its natural beauty. It is also noteworthy that in the nature of the two above-mentioned prevailing destination preferences **the extremely charming element of water dominates**. However, **architecture, monuments and cultural heritage in general also play a significant role** in travelers' choices.

In order to have some additional quantitative indications of whether and to what extent the cultural heritage of a place ultimately contributes to the increase of its tourist activity, all the Greek prefectures were studied through ELSTAT and EUROSTAT data.

i) First, a graph was created of **the correlation of the number of museum tickets sold in each prefecture with the income of its tourism businesses** in the year 2023. Indeed, the graph shows that, in general, prefectures with a much higher number of museum ticket sales, also have a much larger tourist income, thus tourist activity. In fact, there seems to be **a very strong linear correlation** between the examined quantities with a **Spearman coefficient  $R=0.889$** .

It is obvious, of course, that the regions mentioned above as the most preferred by travelers (Cyclades and Crete) are islands which, in addition to culture, offer beautiful natural landscapes, a wonderful climate, relaxation, marine activities and entertainment. In fact, according to a poll carried out on the island of Crete by INEMY-EΣΕΕ (The Institute of Trade and Services of the Hellenic Confederation of Commerce and Entrepreneurship –2014), it was confirmed that the main factor attracting foreigners to the island is its natural beauty. Nevertheless, 55% of travelers made the decision to visit it considering its cultural heritage as well. Thus, based on the same statistical survey, among the most common activities of foreign visitors to this destination is visiting museums and archaeological sites. (47 – 48, 55)

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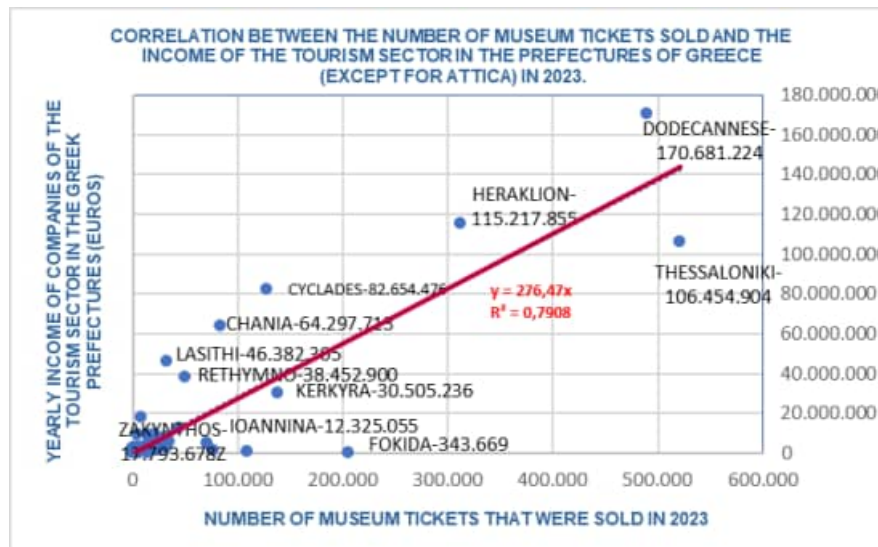


**Figure 30:** Graph presenting the correlation between the number of museum tickets that were sold with the yearly income of the companies of the tourism sector in the Greek prefectures in 2023.

ii) The second graph created *relates*, similarly to the previous case, the number of entrance tickets to archaeological sites with the revenue of tourist businesses in all prefectures of Greece, except for Attica, in the year 2023. In this case, too, there seems to be a **high linear correlation**, with a lower *Spearman coefficient* this time (compared to the previous case) and **equal to 0.58**. In other words, the indication that is given once again is that the existence of a utilized and displayed cultural heritage contributes to the economic well-being of a place.

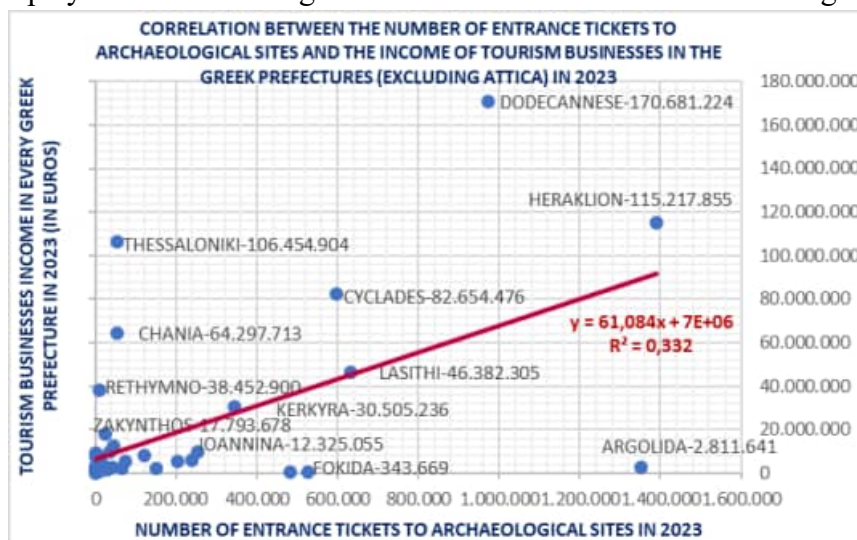


**Figure 31:** Graph presenting the correlation between the number of entrance tickets to archaeological sites with yearly income of the companies of the tourism sector in the Greek prefectures in 2023.

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iii) In the third graph made, the number of museum tickets that were sold is correlated with the unemployment level of a prefecture. In this case there is a *low negative linear correlation* with a *Spearman coefficient of about 0.30*. In other words, increased museum visitor traffic has a little effect on reducing a place's unemployment rate.

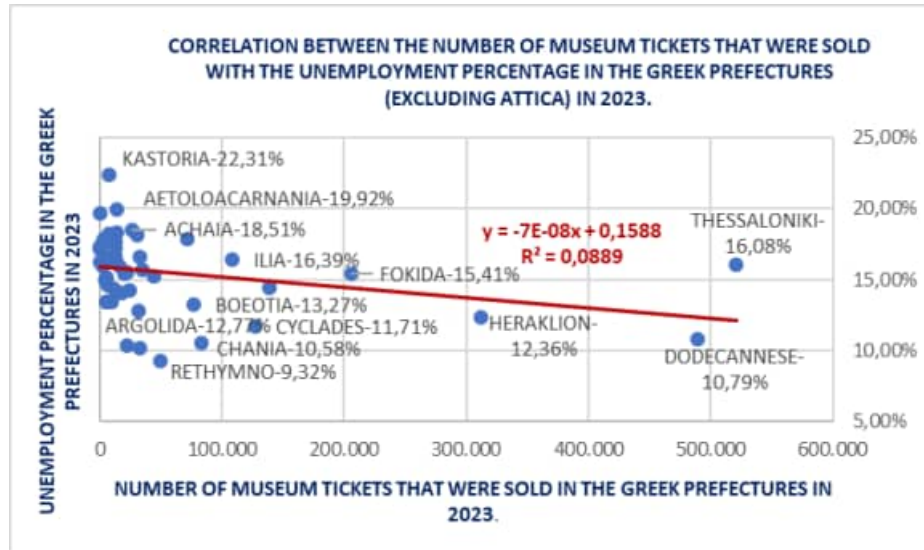


**Figure 32:** Graph presenting the correlation between the number of museum tickets that were sold with the unemployment level in the Greek prefectures in 2023.

v)

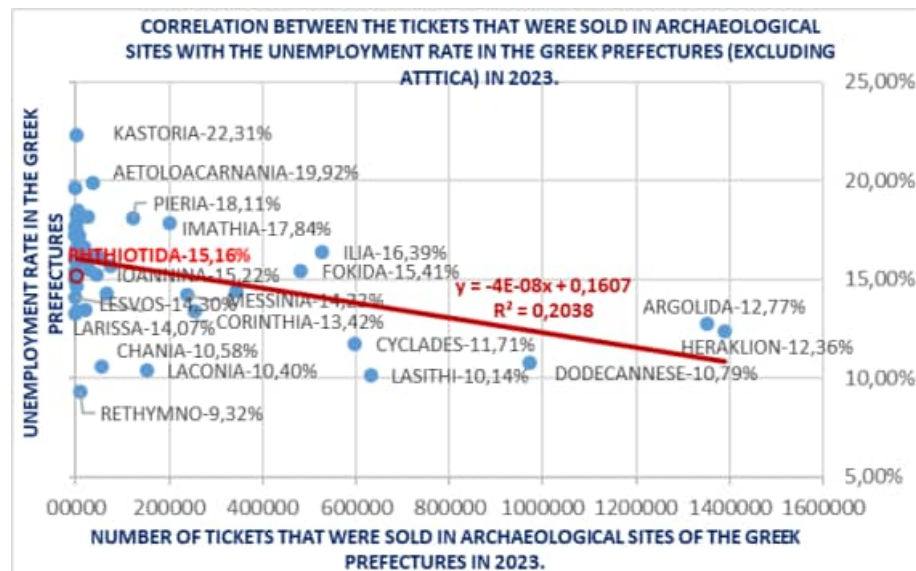


**Figure 33:** Graph presenting the correlation between the number of entrance tickets to archaeological sites with the unemployment level in the Greek prefectures in 2023.

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This was followed by the correlation graph of the number of ticket sales of archaeological sites with the unemployment rate of the prefectures where they are located. In this case there is *an intermediate negative linear correlation*, with a *Spearman coefficient*  $R = 0.45$ . That is, the increase in the number of visitors to the archaeological sites of a place contributes moderately to the reduction of its unemployment.

One more graph that was created is the one that shows the correlation of the existence of old buildings with the income of the tourism businesses of the prefectures of Greece. It follows that there is *a moderate, linear correlation* between the aforementioned quantities, with a *Spearman coefficient* of 0.4. Consequently, the existence of preserved, old, traditional buildings in a place seems to positively affect its economic situation to some extent.

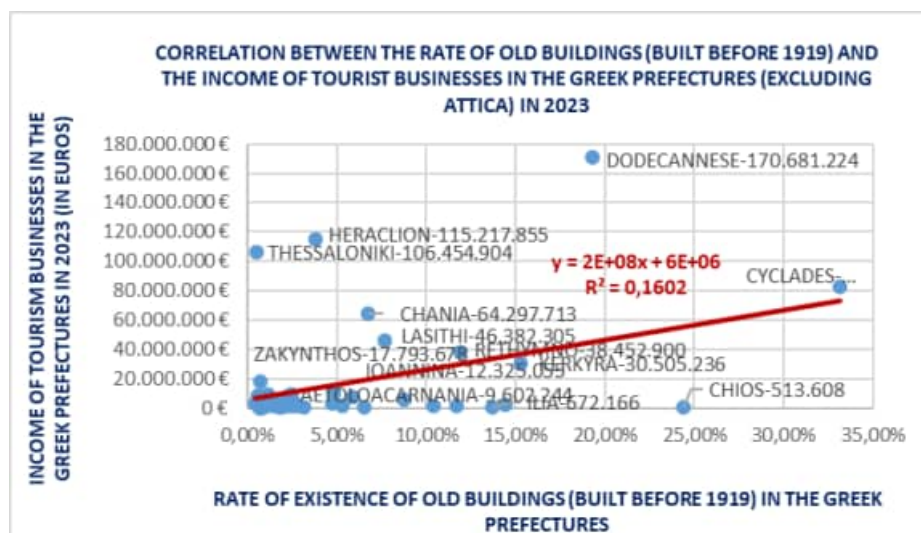


**Figure 34:** Graph presenting the correlation between the number of preserved old buildings with the income of tourist businesses in the Greek prefectures in 2023.

As a result, no matter how important the factor of natural beauty (and especially the presence of water) of a place is, the aforementioned prove that, without a doubt, the existence and promotion of its cultural heritage contributes moderately to a lot to the increase of its tourist activity. At the same time, it has a moderate effect on dealing with unemployment.

## 8) PROPOSALS FOR IMPROVING THE CULTURAL POSITION AND TOURIST ACTIVITY IN LAMIA

Following the previous quantitative indications that the exploited cultural heritage of the various prefectures of Greece seems to have a positive effect on their tourism development, some thoughts arise about what should change in Lamia, so as to improve the situation of both

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its cultural and tourism sectors within the context of its general urban development. The latter, as is known, aims at the quality of local life and the local environment, the efficiency of the local economy and the environmental sustainability of the city and its entire region. Of course, achieving a balance between the goals of cultural and tourism development, the other development goals of the city and the economic interests of many citizens is usually very difficult. (56)

However, it should be emphasized that the protection and preservation of world cultural heritage is in any case one of the 17 sustainable development goals of the “2030 Agenda”, which was drafted at the 2015 Conference in New York. In addition, it is noted that the city of Lamia has already been included in one of the thirteen Regional Operational Programmes (ROPs) for the period 2021-2027 with the aim of Sustainable Urban Development (SUD) which includes the promotion of culture, cultural heritage and the social economy. (58)

Thus, within the framework of these programmes, some actions that could be proposed are the following:

**a)** Pursuit of local policies for greater funding from the government, the European Union or any other relevant authority with the aim of more intensive execution of excavation, restoration, maintenance and promotion projects of the archaeological sites and monuments of the city as well as of the areas of Phthiotida around it. It is known that in Phthiotida there are 14 archaeological sites, 5 museums and at least 15 monuments of the modern era that are under the responsibility of the Ministry of Culture. All these must be highlighted, made known and accessible. (57 – 58)

At this point, it should be emphasized that beyond the importance that these sites, monuments and museums have for experts and tourists, they are mainly of interest for the region itself in which they are located, since they constitute didactic documents of its history. (59)

**b)** Special attention to the way of highlighting the archaeological finds, in a way that contributes both to their promotion and to the beautification of the urban fabric. Architectural committees and archaeological councils must always have a say in any case of highlighting historic architectural remains.

**c)** A strict ban on the demolition of any of the few old buildings left in the city, as well as incentives and sufficient financial support from the state for their restoration and reuse.

**d)** Carrying out architectural competitions with the aim of regenerating various areas of the city's urban fabric. Their objectives should certainly include ensuring sustainable urban mobility, given that one of the most important problems of the city center is that of vehicle and pedestrian traffic. The concept of sustainable urban mobility presupposes, among other things, the reduction of the use of private vehicles, especially in the city center, the strengthening of the urban transport system, which unfortunately is crippling, and the increase in the number of pedestrian routes and bicycle lanes. Especially the case of pedestrian streets offers many advantages, such as protecting pedestrians from vehicles, their comfortable and



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pleasant movement, reducing air pollution, protecting the acoustic environment, improving the aesthetics of the city and the economic development and prosperity of the region. (56, 60)

Regarding the case of Lamia's squares, in 2021, an architectural competition was held with the aim of studying the regeneration of three of them. The next competitions and studies should, therefore, include more pedestrian routes and probably a ban on vehicle traffic in the entire area between the imaginary quadrilateral that has as its vertices the four central squares of the city, as well as in a zone around it. It would also be interesting to create clearly visible and signposted pedestrian cultural routes that would connect remarkable archaeological finds, architectural works from various periods, museums and monuments of the city. Finally, in all these reconstructions, unhindered accessibility for people with mobility disabilities must always be ensured.

These measures are likely to initially provoke reactions from citizens, whose daily lives have been connected for many decades with almost exclusive movement by car. However, as has been shown in the past, in cases of other European cities, such as Copenhagen, the results of their implementation are for the most part extremely positive for the sustainable development of cities. (56)

Finally, the city's residents' demand for more aesthetically pleasing, architecturally surprising green parks should be met in order to increase their enjoyment and combat the boredom of their daily life in the city.

e) It would be interesting, if not utopian, if somehow it were possible to secure state or European funding for the regeneration of at least the facades of the indifferent and unattractive buildings that dominate some critical parts of the city (e.g. its squares). In this case, as well, the renovations should take place after architectural competitions.

f) Creation of more cultural spaces (e.g. thematic museums) within the historic city center and expansion projects of the existing ones, so that all their modern needs are covered. These spaces will participate in the history of the city and rewrite it. The implementation of construction or reuse/extension of public buildings that serve a cultural use must always be done after architectural competitions. (61)

g) Study and construction of new public buildings exclusively after architectural competitions, so that they ensure the establishment of new, high quality architecture in the city that has been so aesthetically damaged by the inelegant buildings that replaced the old traditional ones. These buildings could be a magnet for fans of modern architecture in Lamia. Let us mention as an argument for the aesthetic requirement at this point the view of J. P. Kleinhues: "The downgrading of the requirement for aesthetic quality, with the justification of giving priority to the principled treatment of social demands, has as an effect the reduction of the effectiveness of this same social role of architecture." (62 – 63)

h) Strengthening the preservation and promotion of the intangible cultural heritage of the city.



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i) Sustainable development and promotion of the entire natural and man-made landscape that surrounds the Municipal Community of Lamia and belongs to the Municipality of Lamia.

j) Development and promotion of various forms of alternative tourism, which do not alter the environment that is highly desirable, since the foundation of tourism activity is the search for a "different" natural and man-made environment. These forms of tourism are vital for the development of areas that have an attractive environment and seek to improve their position in the tourism market. Agritourism could belong to them in the first place, since in Phthiotida the primary production sector dominates. Also, religious tourism could flourish, since Lamia and Phthiotida in general include remarkable old churches, with integrated Byzantine relics on the hill of the castle, but also well-known monasteries (e.g. Agathonos Monastery) in areas near it. Naturist tourism would be another alternative form of tourist activity that could be developed in the city, which could be a starting point for excursions to the mountains that surround it. Finally, given that Lamia is a city known for its delicious traditional cuisine, food tourism could well develop. These types of tourist activity, in turn, could be causes for the even more systematic preservation and promotion of the various material monuments of the place. Development and promotion of various forms of alternative tourism. Agritourism could belong to them in the first place, since in Phthiotida the primary production sector dominates. Also, religious tourism could flourish, since Lamia includes remarkable old churches, with integrated Byzantine relics on the hill of the castle, but also well-known monasteries (e.g. Agathonos Monastery) in areas near it. Naturist tourism would be another alternative form of tourist activity that could be developed in the city, which could be a starting point for excursions to the mountains that surround it. Finally, given that Lamia is a city known for its delicious traditional cuisine, food tourism could well develop. These types of tourist activity, in turn, could be causes for the even more systematic preservation and promotion of the various material monuments of the place. (64)

k) Systematic promotion and advertising of the historical, monumental, architectural, natural and general cultural environment of Lamia through every modern way, including information technology.

## 8) CONCLUSIONS

In the beginning of 2025 Lamia is an introverted city focused on the productive sectors of commerce and agriculture, which seem to be doing quite well. On the contrary, in the areas of preservation, highlighting and utilization of its archaeological and architectural heritage, promotion of its history and culture as well as management of the modern urban environment within the context of functionality and aesthetics, less effort seems to have been devoted for the time being than could or should have been. Thus, Lamia is shown to be lagging behind capitals of other equally large Greek prefectures or to Greek cities approximately the same size as it.

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However, the strengthening of the above-mentioned sectors of activity, mainly through the financing of the relevant Regional Operational Program, could contribute to the development, to some extent, of the tourist sector, which, according to ELSTAT's data and also according to a recent survey, is quite limited. This would help both to the creation of additional jobs for the local population and to the improvement of the degree of satisfaction of the residents with daily life in their city, which currently seems to reach 6.17/10. Because tourism often means extroversion, communication with new people, exchange of views, reduction of anxiety and increasement of pleasure from everyday life in the city.

At the same time, the systematic preservation and promotion of the cultural heritage of the place as well as the care for the creation of new worthy works of culture, including architectural ones, can have a direct positive impact on daily life, during which the citizens will be able to enjoy in their surroundings historic and contemporary tasteful, pleasant and neat spaces and to acquire new experiences and knowledge (e.g. historical or artistic).

Consequently, even if the direct economic return from the preservation and promotion of Lamia's cultural heritage is not huge, its intangible positive consequences can certainly be very important. Undoubtedly, there are many possible actions to achieve a more systematic utilization of the city's cultural potential. In addition, all of them mean big costs, so gradual implementation, over time, with patience and persistence. A necessary condition, however, is the existence of worthy local politicians who will realize the importance of the field of cultural and architectural heritage for the well-being of their region and will be willing to work systematically with the aim of upgrading it.

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# CONTEMPORARY PHOTOGRAPHIC NARRATIVES AS AN EDUCATIONAL TOOL FOR THE DEVELOPMENT OF RELIGIOUS TOURISM IN GREEK URBAN AND REGIONAL AREAS

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## **Abstract**

In the rapidly evolving global landscape, visual communication has become a preeminent form of expression. Investigating the impact of alternative photographic narratives, in contrast to the antiquated pictures disseminated by religious tourist organizations, is crucial for reinterpreting religious tours in both urban and rural regions of Greece. This strategy addresses the increasing demand for educational coherence in this developing sector of tourism.

This study aims to investigate the efficacy of contemporary photographic testimonies related to holy sites in Greece as an educational tool for enhancing their associations to religious tourism. Additionally, it seeks to ascertain whether this approach, through the use of appropriate visual media, can provoke interest for its development.

Methodologically, a multifaceted research approach was adopted. Initially, questionnaires were distributed to a random sample of 134 students enrolled in tourism programs across various institutions in Greece, focusing on their perspectives of religious tourism and sacred sites in the Hellenic urban and rural areas. In the subsequent phase, an experimental group from the original random sample was exposed to compelling photographic trends depicting holy landmarks and significant centers or events in urban and regional areas. Following this,



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semi-structured interviews were performed with each member in this group to evaluate potential transformations.

The study's primary findings indicate a significant shift in the participants' original opinions. This alteration is an indication of fresh viewpoints that have the capacity to forge more profound connections and reshape the manner in which contemporary tourism students perceive religious heritage. Unpretentious contemporary photographic narratives have demonstrated efficacy as educational tools that motivate and equip the upcoming generation with knowledge and insights, so introducing broader travel perspectives to religious tourism in Greece.

**Key words:** Photography, religious tourism, educational tool, Greece.

### 1. Introduction

Greece is a country with a strong religious identity, deeply intertwined with its rich cultural, historical, and spiritual heritage. However, the Greek religious tourism sector has not yet fully capitalized on this unique legacy. Despite its potential, it remains underdeveloped, with modern tourism strategies and the revitalization of this alternative sector failing to receive the attention they require. Greek travel agencies, in most cases, rely on pre-established pilgrimage routes and generic promotional tactics, overlooking the deeper, experiential aspects of religious sites and traditions. A recent case study on inaccessible religious festivals ("panigiria") in Sifnos found that a considerable number of tourists are encouraged to attend these events after being exposed to the first-hand stories of others uploaded on social media platforms (Tsilimpokou, 2023). However, ongoing observations indicate that this kind of event's authentic experiences and atmosphere, which often attract alternative tourism enthusiasts (Hung et al., 2020) and are shared in social media through photography (Wood et al., 2023), remain insufficiently represented in mainstream promotional campaigns for Greek religious tourism (Chrysanthi et al., 2015). This gap between the unfiltered experience and tourism promotion underscores the need for new approaches that convey both the deeper essence and contemporary perspective of religious tourism, making it more appealing to visitors and future tourism professionals.

Such an innovative approach lies in contemporary photographic narratives, which, as the dominant "global" language of our time, carry the power to bridge the divide between tourism marketing and the complex needs of alternative travelers. Although the younger generation typically demonstrates limited interest in religious tourism (Hardy and Taylor, 2024), it shows a strong predilection for photographic travel content (Khoa et al., 2021). This observation directs us to the core of the research, which examines the potential intersection between religious tourism — a sector that frequently struggles to engage youth — and contemporary photographic narratives. Visual testimonies resonate profoundly with younger audiences and are increasingly recognized as a valuable educational tool (Shaw, 2020). The study seeks to determine whether this interconnection can positively influence tourism students, ultimately shaping the next generation of travelers. In the future, these students will play a crucial role in

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successfully developing and sustaining the sector, thus supporting the Greek regional and urban religious destinations.

Photography, when exploited in a strategic and meaningful way, stops being just a medium of record, but becomes a dynamic narrative instrument capable of conveying the depth, atmosphere, and intangible aspects of religious experiences. To understand more precisely the scope of this study, it is important to clarify two key terms of the title. Photographic narratives refer to visual representations that:

- Serve as powerful tools for communicating true stories
- Portray issues honestly and without bias
- Capture authentic representations of both tangible and intangible elements of religious and spiritual life (sacred sites, religious customs etc.)
- Do not mislead viewers or promote specific agendas

Additionally, the term "contemporary" refers to:

- Modern or current trends in photography
- The latest visual and storytelling techniques in photography
- Approaches that reflect today's aesthetic, technological advancements, & conceptual ideas

With this in mind, photography can be used as an educational tool that not only provides information about religious destinations but also fosters a deeper connection between students and the country's religious heritage (Putra and Nindhia, 2024; Han, 2024).

Primarily, this study seeks to investigate and evaluate whether contemporary photographic narratives can serve as an effective educational means for understanding religious tourism and encourage their active engagement with the sector. In particular, it examines whether such photos can:

- Stimulate students' interest in religious tourism
- Reshape their perceptions of this topic culturally, socially, and conceptually
- Encourage active engagement in its development
- Strengthen young people's association with Greek religious destinations
- Inspire students to explore various aspects of the Greek religious tourism and therefore, contributing to the sustainable development of both regional and urban religious destinations in Greece.

By addressing these issues, this research contributes to a wider academic discourse on innovation in tourist education. In addition, it emphasizes photography's transformational significance, not simply as a passive medium of representation, but as a dynamic tool of experiential reception with the potential to redefine how religious tourism is taught, promoted, and ultimately experienced.

## 2.Theoretical Framework

In the ever-changing world of alternative travel, religious tourism is a multifaceted concept, navigating between the impacts of modern technological changes and the broader sociocultural context. By introducing new ideas and identities, the rise of new market segments such as volunteer-focused activities, spiritual retreats, and New Age spiritual journeys ushers in a new age (Iliev, 2020). A notable example is the term “spiritual development tourism,” which emphasizes introspection and highlights the critical need for a

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comprehensive typology that addresses both religious and secular seekers of meaningful spiritual experiences (Robledo, 2015).

Given that religious tourism has become an integral part of the wider tourism industry (Raj and Morpeth, 2007), and through its unique characteristics, which enhance cultural development and cooperation between major divine religions, it plays a central role in guiding human evolution. Also, it provides a fertile ground for innovation and cultural flourishing (Budovich, 2023). In light of these considerations, it is vital to prioritize the critical reappraisal and revitalization of its core, especially among the younger generation and future professionals in the industry. Encouraging their perceptions to be not only updated but also free from any preconceived notions or misconceptions, they can contribute to a more progressive attitude and management towards this form of alternative tourism to promote sustainable development (GOAL 4, UNITED NATIONS).

For the integration of new concepts, there is no more suitable environment than educational institutions and specifically tourism professions schools, where ideas multiply with increased momentum and are embraced with a new perspective, fostering a lively ambiance that favors their rapid diffusion. The contemporary trajectory of social progress has required a critical reassessment of pedagogical methodologies and educational paradigms (Meghan, 2019). Of course, the shortcomings of the current tourism curriculum, highlighted by the partial vision of teachers, the lack of value-based education in sustainable tourism, and the absence of practical skills for the labor market, highlight the urgent need for alterations towards a new educational approach that incorporates specific skills, especially innovative thinking, into the study plans for authentic alignment with the principles and mission of the university (Mínguez et al., 2021).

While academics extensively document the impact of technology on religious tourism, as in almost every aspect of everyday life, there is a notable tendency from their position to delve deeper into exploring the impacts rather than extending knowledge and conclusions to predict future behaviors, revealing a critical gap in the formulation of well-informed contributions to the field (Rashid, 2018). Within the same stream, the ubiquitous growth of images as the primary means of communication, particularly prevalent among young people, is becoming undeniable, as it has now become the most popular user-generated content (Taecharungroj and Mathayomchan, 2021; Wang et al., 2020; Zhan et al., 2023). Recognizing photography as a language that resonates with students could be used to a considerable extent to enhance teaching. Consequently, their delving into the religious tourism prospects necessitates the transmutation of data into visual language, epitomizing a primary aspect of our time.

Photography has proven to serve as an invaluable educational tool. It inspires, encourages reflection, prompts reflective observation, enhances creativity, and helps educators visualize abstract concepts and introduce intangible elements (Currie and Göttert, 2023). Therefore, incorporating contemporary photographic trends, such as current styles, techniques, or storytelling methods, into educational practices can complement the traditional tools, providing a strategic advantage in restructuring pedagogical approaches in the religious tourism field. Images sourced from prominent social media platforms such as Instagram can serve as valuable and representative data for comprehensive studies in the tourism sector, as Ning et al. (2023) pointed out.

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Furthermore, as a visual guide, unaffected photographic evidence could provide a powerful means of navigation in complex historical and cultural contexts, enhancing a deeper understanding of religious sites. This is proven by the success of photo-based virtual tours, particularly in cultural heritage, which highlight distinctive and breathtaking features through interactive map visualizations that improve comprehension and make it easier to plan an in-person visit (Antinozzi et al., 2022). In parallel, the dimension of religious tourism, which includes cultural globalization, suggests the increasing international exchange of goods and cultural symbols daily (Moaven et al., 2017). Thus, the common visual language between nations becomes integral to this interconnected narrative.

As demonstrated by the preceding points, modern photographic records could serve as a powerful educational instrument in fostering student engagement with religious tourism, offering a visually immersive approach that could deepen understanding and appreciation of cultural-spiritual heritage. By integrating carefully curated contemporary photos of religious destinations into tourism studies, students could develop a stronger connection to these sites (Onyekuru, 2024). In addition to stimulating scholarly curiosity, this visual method may raise critical awareness of the evolving role of religious tourism in regional and urban sustainability, especially in Greece, where sacred landmarks and pilgrimage sites constitute an essential component of the country's cultural environment. As students gain insight into the economic and social impact of religious tourism, they could become more inclined to support and promote sustainable tourism practices, ensuring the long-term preservation of these destinations while contributing to local economies. Thus, present-day photographic storytelling could transcend mere documentation, becoming a transformative medium that bridges education, culture, and sustainable tourism development.

### 3. Methodology

#### 3.1 Research Stages

This study implemented a mixed-methods approach (Creswell, 2014), using a combination of techniques such as structured questionnaires, exposure to actual images chosen by photo experts and academics for a tailored course, and individual interviews. According to Miles and Hubermann (1994) and Robson (2007), mixed research methods allow a more thorough study by combining qualitative and quantitative data. This process provides for a more in-depth examination of the research issue, allowing for insights that are feasible in real-world scenarios (Saunders et al., 2016). The subsequent sections will thoroughly cover the research phases in detail.

##### *Phase 1: Pre-Intervention Questionnaires*

In the initial phase of this study, a questionnaire was distributed to a random sample of 134 students enrolled in tourism-related programs at various educational institutions in Greece. This approach was designed to include a rather wide range of socioeconomic backgrounds, enhancing the study's findings' external validity and generalizability. The sample was carefully balanced to ensure gender representation, with 59% women and 41% men. The

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questionnaire employed a 5-point Likert scale to gather data on key areas of interest related to religious tourism. These areas included: personal interest in religious tourism, the interest in religious tourism as part of academic studies, the influence of social media and friends on religious tourism choices, the role of Greek travel agencies in shaping religious tourism preferences, and previous participation in religious tourism experiences. The object of this phase was to gain a fundamental understanding of participants' initial ideas and intentions concerning religious tourism, along with any prior knowledge or experience regarding sacred tourist attractions in general and in Greece.

### *Phase 2: Selection of the Experimental Group & Educational Intervention*

Following the collection of the questionnaire outcomes, a data analysis process was conducted to identify students exhibiting the lowest level of interest in religious tourism. From this subset of students, 15 were randomly selected to form the experimental group. These 15 students then participated in a carefully curated 45-minute educational intervention designed to increase their involvement with religious tourism.

This intervention included the display of genuine photographic narratives that laid emphasis on sacred locations, events, historical or cultural elements, and personal experiences from religious travels. The selected photographs illustrated the distinguished value of each place while also accentuating its cultural wealth, incorporating characteristics of the natural surroundings. Furthermore, they captured both material and intangible facets, reflecting the broader religious heritage alongside Greek places' unique regional and urban features. These images also depicted scenes that offered visitors opportunities for spiritual fulfillment or joy, enhancing their experience of the sacred atmosphere. Serving as a foundation for analysis and discussion, these visual materials encouraged deeper engagement with religious tourism.

The photographic documents used in this intervention were carefully selected from an assortment of digital media and personal archives, ensuring an appropriate modern thematic and unbiased depiction of both tourist and local engagements with these religious sites. They also highlighted aspects of religious travel beyond the conventional approaches, intentionally deviating from the conventional promotional content typically offered by travel agencies (Cooper, 1994).

This approach provided that the educational intervention was both instructive and culturally appealing for the participants in the experimental group. It conformed to the study process by offering a well-informed and comprehensive portrayal of Greek holy sites through well-curated photographic narratives.

### *Phase 3: Post-Intervention Interviews*

Immediately after the educational intervention, each student in the experimental group participated in individual interviews, as discourse, dialogue, and argumentation are key instruments in qualitative approaches (Issari and Pourkos, 2015). The questions for these interviews were designed to facilitate an unguided positioning of the participants' thoughts and feelings, providing an authentic depiction of their views about religious tourism. Additionally, particular attention was given to the researcher/interviewer as an essential factor for developing a dialogue with the participants (Rapley, 2001), encouraging them to share their thoughts, even on subjects indirectly related to the main theme.

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The interviews were conducted directly after the course to assess any immediate changes in the students' perspectives regarding religious tourism in Greece. The goal was to examine shifts in students' viewpoints and measure any alterations in their interest levels in religious travels following the intervention. By focusing on their reactions and reflections, these interviews provided valuable qualitative data on the effectiveness of the intervention and helped in understanding its broader impact on the students' perceptions.

### **3.2 Ethical Issues**

In the evolving field of research methodology, where social and technological innovations drive rapid fluid changes, the fundamental guide is the ethical compass (Iphofen, 2020). In this context, the present research followed the steps mentioned by Tatsis (2004), according to which informed consent was obtained from all participants, ensuring confidentiality and providing them with the opportunity to withdraw from the study at any time.

## **4. Results**

### **4.1 Pre-Intervention Quantitative findings & analysis**

The quantitative data collected from the Likert scale questionnaire (before the intervention) were analyzed using descriptive statistics in Excel focusing on frequency distribution to represent the number of students' responses. The results, displayed in the bar chart, show the distribution of responses to the question regarding personal interest in participating in religious tourism activities.

As illustrated in *Figure 1*, 61.6% of students strongly disagreed with the idea, while 24.8% disagreed. Meanwhile, 17.6% remained neutral, and only a small fraction—3.2%—agreed. Notably, none of the respondents strongly agreed with participating in such activities. These findings indicate a predominant lack of enthusiasm among students regarding religious tourism. This result suggests that students generally do not perceive religious tourism as an appealing activity, possibly due to beliefs, lack of interest, or alternative travel preferences. A similar trend was observed in a recent study by García-del Junco et al. (2021), which found that Generation Z higher education students are less likely to participate in religious tourism activities, indicating a shift towards secularization and diverse travel motivations.

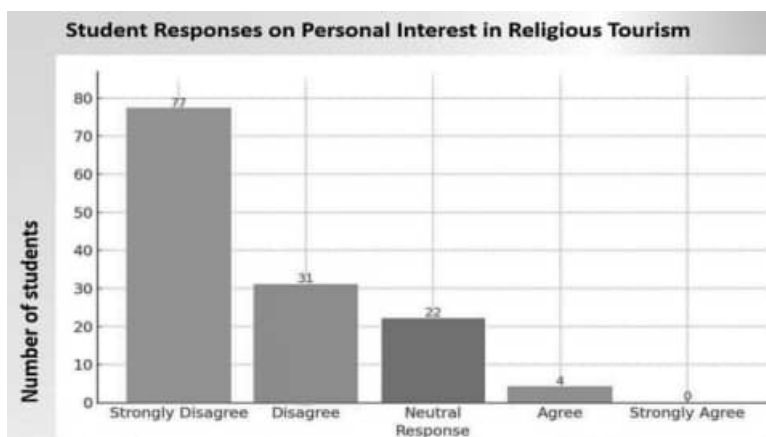


**Figure 1.b** *Distribution of students' personal interest in religious tourism activities.*



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Building on this, in the question regarding their interest in religious tourism as a subject within their academic tourism studies, the results indicate that a significant majority of students are not interested in the topic. Specifically, 69.4% of respondents strongly disagreed or disagreed with the statement (*Figure 2*). Additionally, 21.6% of students remained neutral on the matter, and only 9.0% agreed, with no students strongly agreeing (0%). These data indicate that the majority of students do not see religious tourism as an engaging or intriguing topic in their academic curriculum, with none expressing significant excitement for its ceremonial features. Recent research indicates that young people's lack of interest in religion is a crucial element impacting their views toward religious education in schools (Makosa, 2022). This may also suggest that students confuse religion with religious tourism, further distancing themselves from its deeper cultural and spiritual dimensions.

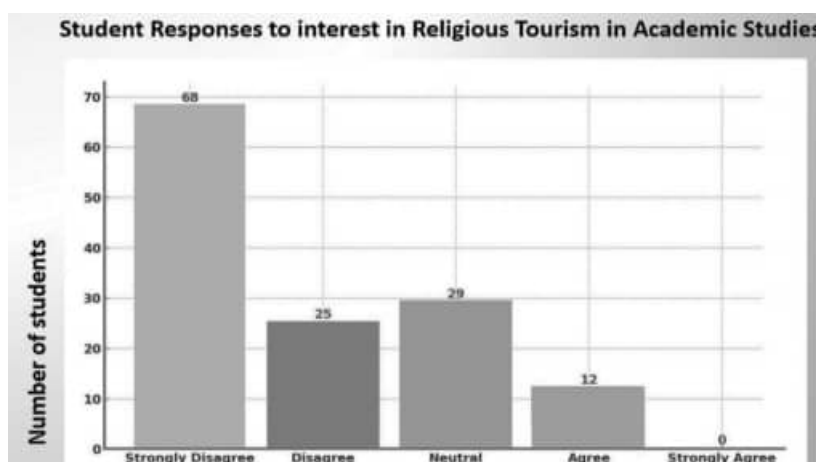


**Figure 2.** *Distribution of Students' Interest in Religious Tourism as Part of Their Academic Curriculum*

In continuation, 100% of students strongly disagreed with the statement that their interest or participation in religious tourism experiences has been influenced by religious travel agencies in Greece. This result suggests that Greek religious travel agencies have had little or no impact on shaping students' interest or participation in religious tours. It may indicate that the promotional efforts of these agencies are either insufficient or not effectively targeting the younger demographic. The fact that the students assessed have not been influenced by such travel companies may indicate a weakness in the way religious tourism is advertised and promoted. It may be essential for these travel agencies to rethink their marketing strategies by adjusting their approaches to better cater to the evolving preferences of tourists, focusing on enhancing the overall customer experience, as suggested by Ho et al. (2024), and specifically targeting the needs of younger demographics.

Furthermore, 81% of students either agree or strongly agree with the statement that any interest or involvement they have in religious tourism experiences has been influenced by photos on social media and the visual storytelling of their friends. Conversely, 19% of students remained neutral, while no respondents disagreed or strongly disagreed with the statement (*Figure 3*).

This suggests that visual content shared on social media plays a significant role in shaping students' perceptions and engagement with any kind of religious travel. The absence of disagreement highlights the powerful influence of social media in fostering interest in

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tourism experiences, particularly among younger generations. This aligns with recent research that emphasizes the importance of generational segmentation in the marketing strategies of tourism destinations (Correia et al., 2025). By understanding the role of UGC (user-generated content) in shaping cognitive and emotional perceptions, religious tourism marketers can more effectively tailor their strategies to engage younger demographics and strengthen their connection with this alternative form of tourism.

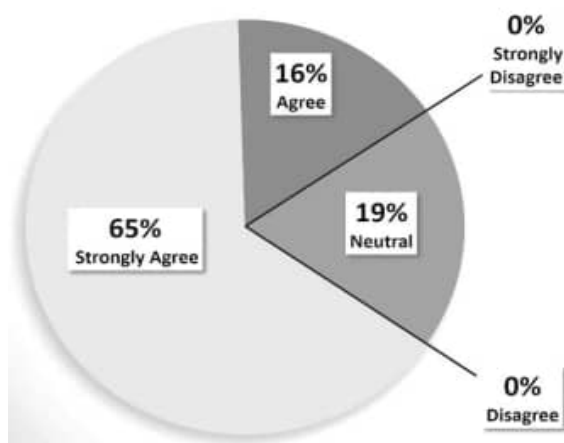


**Figure 3.** *Students' responses influenced by social media regarding religious tourism.*

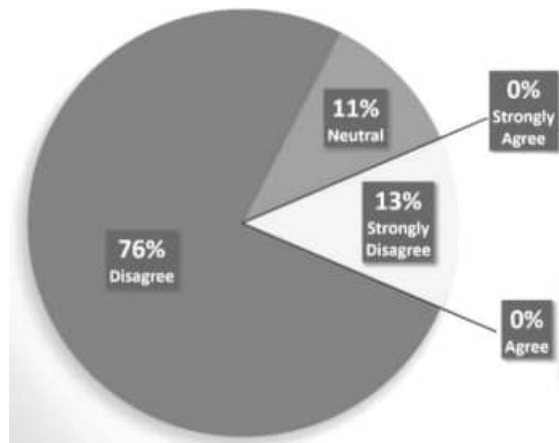


**Figure 4.** *Students' responses to the statement about how frequently they have participated in religious tourism experiences, either in the past or*

In response to the statement, "I frequently participated in religious tourism experiences in the past or recently," the distribution of responses further highlights the limited engagement of students in such activities. As *Figure 4* shows, a majority of respondents (76%) disagreed with the statement, indicating that they rarely engage in religious tourism, while an additional 13% strongly disagreed, signifying a complete lack of participation. Only 11% of students remained neutral, suggesting occasional involvement, whereas no respondents selected agree or strongly agree, demonstrating that frequent or consistent participation in religious trips is virtually nonexistent among the surveyed group. The results suggest that travel related to religion is not a prevalent activity among the surveyed students, with the overwhelming majority either rarely participating or not participating at all. Regardless of personal interest, engagement in religious tourism remains low, which may suggest the influence of structural, social, or cultural barriers. This is supported by Nguyen (2024), who noted that factors such as travel motivation and trip costs significantly impact young people's decisions to engage in spiritual tourism, implying that such barriers may limit participation.

### **4.2 Post-Intervention Qualitative Findings and Analysis**

Following the quantitative analysis, qualitative data were collected to delve deeper into students' opinions of religious tourism and the influence of modern photographic narratives. A chosen subset of students, determined by their first negative reactions to religious tourism, took part in a carefully curated and well-structured course that presented them with genuine

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current visual narratives involving religious travel. In-depth post-exposure interviews offered immediate insights into changes in their opinions, enabling a more complete understanding of how present-day photo storytelling can influence religious tourist interest.

One of the most noteworthy findings was the shift in students' perceptions of religious tourism as an experience. Many initially regarded religious travels as rigid, outdated, or solely focused on religious obligations. However, exposure to suitable, trendy, and visually appealing images enabled them to reinterpret this aspect more dynamically and engagingly. As one student (Participant 6) remarked:

*“...The pics were so cool!... different from what we normally see... showing that a religious trip can actually be interesting and fun...not just about the typical visits we're used to knowing...”*

This response demonstrates the effectiveness of current visual storytelling in reshaping cognitive associations with religious tourism. Furthermore, the findings indicate that when holy sites are presented more appealingly and unconventionally, beyond their ritualistic functions, they can spark curiosity and attract a broader audience, particularly younger demographics. Moreover, as future tourism professionals, these scholars will play a key role in redefining the appeal of religious destinations and could contribute to their sustainable development. Students learn through photography that a well-created place brand must authentically integrate sustainable attributes to ensure its long-term relevance and appeal to diverse audiences, like skilled tourism experts shape place branding by fostering emotional connections that deepen visitor engagement, as underscored by Jarratt et al. (2019).

Another key finding that emerged was the way modern visual stories disrupted stereotypes surrounding religious tourism. Before the intervention, students commonly associated such trips with passive participation, prayer, and limited engaging activities. However, after viewing the photographs, a shift occurred in their perceptions. For example, Participant 3 stated:

*“...Seeing these photo stories made me realize that one could go on such trips with peers, not just to pray and look around in silence, but to explore historic sites in beautiful natural landscapes ...participate in activities, in cultural events ... simply enjoy themselves....”*

The statement reflects a broader trend in tourism research, where younger travelers increasingly seek participatory and experience-driven engagements rather than passive observation (Sharma et al., 2024). This transformation implies that religious traveling can be redefined as a multidimensional experience incorporating not merely spiritual aspects but also cultural exploration, entertainment, and interactive activities, a view following the findings of Bond et al. (2015), who reported a high level of interest in history and culture at religious destinations.

Furthermore, the interviews indicated an underlying generational shift in how travel experiences are valued. In contrast to previous eras, younger tourists prioritize shared experiences and digital storytelling over traditional motivations for religious travel (Ranjan and Chaturvedi, 2025). This reinforces the need for tourist marketers to embrace a more interactive and socially driven promotional approach.

In addition, students also emphasized how the contemporary visual storytelling of the course presented religious tourism in a more appealing and accessible manner compared to conventional promotional materials. Participant 8 specifically noted:

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*“...These photos made religious tourism seem way more interesting...festivals, history, architecture... showing that it’s not the usual, boring kind of trip we’ve seen from religious travel agencies in Greece.”*

The emphasis on visual impact underscores the role of carefully selected photographic material in capturing the viewer’s attention, which aligns with the theory of cognitive stimulation and interest development reported by Bransford (1979), Gordon (2004), and Eysenck (2020), highlighting that exposure to unique and unconventional stimuli can increase interest levels. Additionally, incorporating this approach into touristic education can enhance students' awareness of the sense of place associated with this significant form of tourism (Deale, 2014).

At the same time, the student's critique of conventional religious promotions in Greek marketing strategies underscores their inability to attract the evolving interests of younger audiences. Advertisers seem to struggle to match the need for visually appealing and technologically connected marketing tactics. Recent research has demonstrated that visual storytelling is particularly effective in influencing tourism decision-making, as it fosters emotional connections and provides a sense of authenticity (Zhang et al., 2023). Campaigns with authentic photographic material that highlights the diverse activities within religious destinations while embedding a modern aesthetic in their ambiance, tourism agencies can bridge the gap between traditional pilgrimage tourism and the evolving expectations of younger travelers.

An anticipated but important insight emerged regarding the perceived limitations of religious tourism. Many students had previously associated it exclusively with older demographics and rigorous, pre-structured itineraries. However, after the course, some reconsidered its potential for adventure and exploration. Participant 14 explicitly stated:

*“...Religious tourism tends to be more suitable for older people... I never considered it to be an adventurous activity... after watching the course's images... I suppose certain religious journeys might be fun and unusual if done with buddies ...”*

The student's remark underlines a fundamental issue within religious tourism in Greece: its deep-rooted reliance on traditional representations that fail to evolve with contemporary perspectives. It also demonstrates that the sector remains anchored in the past, not because of an intrinsic resistance to modernization, but rather due to a persistent adherence to outdated tactics for presentation. The reluctance to adopt innovative visual storytelling techniques limits its appeal to younger generations, perpetuating the perception of religious tourism as rigid and predictable. However, this drawback also provides a tremendous learning opportunity for tourism students, motivating them to get involved in the industry and contribute to a more modern and dynamic transformation of religious tourism in Greece.

Perception is shaped not only by the inherent essence of a destination but also by how it is framed and communicated (Terzidou et al., 2021). A spiritual visit through a religious urban and rural area of Greece can introduce new perspectives to travel marketers, demonstrating that religious tourism can coexist with excitement and exploration. Furthermore, such a finding offers useful insights for tourism experts, underlining the need for organizing trips that promote peer-group experiences, thus increasing the appeal and significance of these places for younger tourists while also promoting their sustainable development (Gambhir et al., 2021).

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### 5. Conclusions

In current society, visual media constitutes a new alphabet that tells a story unlike any other. Images transcend their traditional function, dominantly influencing the knowledge that motivates travel activities (Alvarado-Sizzo, 2021), while their meaning is constantly shaped according to social norms and the perceptions that originate also from them.

Religious tourism in Greece, a sector brimming with enormous potential due to its exceptional blend of ancient traditions, rich heritage, and spiritual significance, remains underrepresented compared with other forms of alternative tourism. While it has the potential to offer much of what a modern traveler is looking for (Shinde and Olsen, 2020), it is not yet ready to accomplish it. One of the keys to this transformative evolution lies in modern photographic content and scholarship, as the research concludes.

Contemporary photographic narratives as an educational tool in Greek tourism institutions offered an innovative approach to religious studies. By having been exposed to genuine visual storytelling, students moved beyond misconceptions, developing a more profound understanding of religious tourism as a cultural, historical, and spiritual phenomenon. Based on our findings, youngsters as tourists are not necessarily disconnected from religious tourism but may require a readjustment of its portrayal. A substantial redesign that highlights personal involvement, experiential learning, active participation, and shared social experiences. This is consistent with Hampu and Coroş (2022) study, which argues that many young people cannot recall seeing any good marketing efforts that promote religious sites as something appealing to them. So, by leveraging UGC and innovative storytelling techniques, tourism stakeholders can invent more compelling plans (Lariba, 2023) that resonate with this demographic.

Moreover, this instructional material ensures a lasting impact by fostering creativity and revitalization. It allows learners to form personal connections with the religious heritage of each urban or rural area, making it more accessible and relevant over time (Levi and Kocher, 2009). In our case, real stories from sacred places, even in a broad gaze, communicated meanings and stirred emotions that went beyond social and language obstacles, supporting Das and Chakrabarti's (2021) approach. Through this action, the unique religious destinations of Greece can not only be preserved but also reinterpreted in the current world.

Authentic up-to-date images as a training tool eluded from the rigid pedagogical models, raised awareness, opened new avenues for learning, and encouraged interdisciplinary perspectives capable of bridging history, culture, and modern tourism dynamics. This framework equips future tourism professionals with a profound understanding of both tangible and intangible religious heritage and equips them skills to delve into it. Thus, harmonizing the appreciation for religious depth with contemporary travel needs will ensure that Greece's urban and regional religious sites will not only be preserved but also actively integrated into sustainable tourism strategies. In essence, the appropriate new-age photos can serve as both an educational tool and a strategic driver for a long-term vision of religious tourism in Greece.

Moreover, the integration of photographic material from social media as a tool in the course gives students what they are seeking, while having the power to equip future industry leaders with trends and fundamental features of religious traveling. According to Kim and



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Cake (2024) younger generation searches for information through social media because it desires personal growth, enjoyment through others' experiences, and shaping its perspectives on various topics. In agreement with that, practically, we brought social media into their classrooms with the key difference that the photographic content in this setting was carefully curated, real, focused, and highly informative. There possibly lies the student's remarkable shifts in their views after the intervention. However, in continuing, another pivotal conclusion is drawn from these alterations. It demonstrates that innovation in this field does not require altering traditions themselves but rather redefining how they are communicated and experienced. By reimagining the way tradition is visually and conceptually framed, religious characteristics can maintain their authenticity while resonating with the sensibilities of the modern era.

The study's outcomes about how students perceived religious traveling before and after the intervention give valuable impartations for tourism marketers, travel agencies, and religious institutions, pursuing not only to attract younger audiences to sacred landscapes but also to equip professionals for careers in the field. Involving new generations in this sector can foster long-term stewardship and strengthen the tourism economy. As Budovich (2023) emphasizes, religious tourism significantly contributes to economic growth despite existing challenges. Moreover, this educational approach could highlight the unexploited potential of lesser-known destinations, redefining their significance in the evolving global tourism setting. Since destination consumption tendencies still require ceaseless identification, these findings serve as a resource for developing more effective marketing and promotional efforts.

This research significantly contributes to advancing the understanding of the behavior of young students in the religious tourism sector. Taking everything into account, the overall conclusion is that contemporary photographic narratives, as an educational tool, possess the capacity to significantly redefine & improve the trajectory of religious tourism, fostering its development across both urban and regional areas of Greece. This underscores once again the fundamental role of photography in education as a catalyst behind any meaningful change.

## 6. Research Limitations and Suggestions for Future Research

This study, like any research, has limitations. First, the relatively small sample size limits the applicability of the conclusions to a wider population. This limitation is particularly important in tourism studies, given that different subgroups, such as age groups or cultural backgrounds, may react differently to religious tourism and the photographic material presented.

Furthermore, the use of photographic narratives in the study implies that the results are inextricably linked to the content, quality, and presentation of the intervention images. The professionals who will collect the images, from the various mass media and generally from modern information platforms, should be fully trained in photography or the semiology of the image and, in parallel, have experience in teaching techniques. Variations in these parameters may have a significant impact on educational performance and, therefore, on the expansion of religious tourism. Another limitation is that the photographic narratives focus exclusively on Greek religious institutions, restricting the study's applicability to wider global settings.

Future studies could overcome these limitations by employing an extended approach. This would allow researchers to examine changes over time in young people's views on and



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behavior toward holy sites after being exposed to photographic narratives. This technique would allow for a deeper comprehension of how the current photographic content affects the experience of religious tourism over time.

The above suggestions seek not only to address the observed shortcomings but also to broaden and deepen future studies. Thus, there will be the potential for achieving larger-scale outcomes that will assist stakeholders in the field of religious tourism.

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**ALTERNATIVE AND SPECIAL FORMS OF TOURISM IN THE  
GREEK CONTEXT, AS A MOTIVE FOR RUSSIAN SPEAKING  
TOURISTS TO VISITING GREECE**

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**Abstract**

Among other motives for paying a visit in Greece, alternative forms of tourism derive as a special purpose for the implementation of a journey to the country. Greek heritage and the landscape (natural and urban) comprise an autonomous background which can successfully support a plethora of alternative and special forms of tourism. The purpose of that paper is to present and analyse various forms of special and alternative tourism in Greece and their attractiveness among Russian speaking tourists who choose Greece as their destination (actually as it was mainly happening till 2022).

Various types of special forms of tourism are discussed, among them cultural and religious-pilgrimage tourism, sailing tourism, health and educational tourism, sports tourism, tourism for the older age groups and people with disabilities and business tourism. Russian speaking tourists are keen on being involved in all those various types of activities. A key question was that if any of these types of tourism could be the only reason for visiting the country.

The main part of the research was done in 2022, involving a questionnaire which aimed finding out which categories of Russian speaking tourists come to Greece and for what purpose. As people of such an ethnicity are really connected to Greece due to religion, the survey wanted to find out whether special and alternative forms of tourism could be the sole reason for visiting Greece. Furthermore, research looked at other types of motivation such as shopping and whether they could be the prominent reason for paying a visit to the country, beyond the sea and sun attractions. Time and space redistribution of tourism in Greece remains a key target for national tourism policies. Development of special and alternative forms of tourism remain a main tool towards that direction. Development of them however, has to look at the demand side. This means that policy makers have to look at key markets and how willing they are for the adoption of such tourism products, reducing at the same time their interest on mass sea and sun products.

War in Ukraine and Sanctions which followed against Russia have eliminated the arrivals of Russian tourists in Greece. As the research was done during the period just before the sanctions' introduction, it can give us plenty conclusions concerning the motivation of Russian Speaking people for the implementation of their potential visit to Greece, in the future.

**Key words:**Sustainable forms of Tourism, Special forms of Tourism, Greece, Russian Speaking Tourists, Sea and Sun Tourism



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### Introduction

The purpose of that paper is to present and analyse various forms of special and alternative tourism in Greece and their attractiveness among Russian tourists who choose Greece as their destination (actually as it was happening till 2022). The main part of the research was done in 2022, involving a questionnaire which aimed finding out which categories of Russian tourists come to Greece and for what purpose

Additionally, statistics on the number of Russian tourists arriving in Greece were studied. Finally, an analysis of these statistics and questionnaire results was done, in order to draw conclusions about the preferences of Russian tourists of various age groups, as far as the attractiveness of various forms of tourism are concerned, (besides of course the main established one, that of sea and sun).

Russian speaking tourists are mainly tourists going abroad from Russia. A small minority of them come from other countries which used to be part of the Soviet Union such as the Baltic States. As Russian speaking people are sharing common cultural characteristics with Russian people leaving in Russia, they can be considered in a way, as a common market generating demand with similar characteristics.

Conclusions are drawn at the end and it is for sure that are quite interesting. Russian speaking tourists are generally not so consciously consuming tourism products of alternative and special forms, neither in the country of origin or abroad. A journey to Greece always remains a journey to “sea and sun”.

### Alternative and Special Forms of Tourism in Greece

Alternative tourism can be defined as forms of tourism that aim to be consistent with natural, social and community values that allow both hosts and visitors to enjoy positive and worthwhile interaction and shared experiences (Coccossis et al 2011). It involves travel to relatively remote, undisturbed natural areas with the aim of admiring, studying and enjoying the landscape, wild plants and animals and cultural features.

In general, alternative forms of tourism consist an alternative to mass tourism as a philosophy and attitude. The main emphasis in these trips is on the preserved natural environment, authentic atmosphere, cuisine and local traditions. It also takes into account environmental conservation, nutrition and the well-being of local residents. In addition, guests are expected to be private individuals. Units of accommodation is locally owned and small-scale.

Alternative forms of tourism combine tourism products or distinct tourism services, different from mass tourism through the offer, organization and human resources involved. These are rural tourism, wine tourism, ecotourism, adventure (cycling, horseback riding, snowshoeing, ski mountaineering, rafting, diving, caving, climbing), thematic tourism that is linked to cultural and historical heritage, religion, wine, traditional cuisine, ethnography, traditional music and handicrafts. The effort to preserve, protect and enhance the quality of the resource base, is fundamental to tourism itself (Boniface and Cooper, 1994). Some basic steps on developing such kind of tourism are as follows:



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- Encouraging and actively promoting development, in relation to additional attractions and visitor infrastructure, rooted in the specific location and developed in ways that complement local characteristics
- Approving infrastructure, and therefore economic development, when and where it improves local conditions and not where it is destructive or exceeds the carrying capacity of the natural and social environment
- Enhancing tourism that strives to minimize its impact on the environment, tourism that is ecologically sound and avoids the negative impacts of many large-scale tourism developments that take place in previously undeveloped areas
- Emphasizing not only on ecological sustainability, but also on cultural sustainability. This is a kind of tourism that does not harm the culture of the hosting community, encouraging respect for the cultural reality experienced by tourists through education and organized ‘encounters’

In Greece the context of alternative and special forms of tourism has been developed significantly during the period after the 1990s. Several forms of tourism have been developed in various regions of the country. Various conditions in local level create a quite significant platform for the development of such forms of tourism. In this way, it can be said that the following forms are clearly developed:

- Urban Tourism
- Cultural Tourism
- Gastronomy and Wine Tourism
- Shopping Tourism
- Religious and Pilgrimage Tourism
- Sailing Tourism
- Health and Thermal Tourism
- Athletic Tourism
- Educational Tourism
- Eco tourism
- Conference and Congress Tourism
- Exhibition Tourism

It is for sure that all forms of tourism mentioned above, are not equally developed in all areas of the country. It is clear that the potential for the development of a certain form of tourism comprises a comparative advantage for a certain area (Zografos, 2019). Tourists visiting the country for sea and sun tourism, tend to encompass in their vacations certain activities which are related to certain forms of tourism mentioned above (Zografos, 2021). In this way they enrich their sea and sun vacations program with several other activities. Moreover, history plays a significant role in the development of urban tourism in Greece (Zografos, 2016).

Time and space redistribution of tourism in Greece remains a key target for national tourism policies. Development of special and alternative forms of tourism remain a main tool towards that direction. Development of them however, has to look at the demand side (insete.gr, 2022). This means that policy makers have to look at key markets and how willing

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they are for the adoption of such tourism products, reducing at the same time their interest on mass sea and sun products.

In this way, the following question can be clearly defined: ‘How knowledgeable are Russian tourists about the experiences they can enjoy in Greece, when it is clear that due to the totally different climate and landscape conditions they face Greece as a true sea and sun destination?’ Research mentioned below tried to figure out what is happening.

### Methodology

The main part of the research was done in 2022, involving a questionnaire which aimed finding out which categories of Russian tourists come to Greece and for what reason. For the research purposes, a questionnaire was created and was sent to 100 randomly chosen Russian potential tourists in order to investigate what forms of alternative tourism attract Russian tourists to Greece. Various questions were selected.

Additionally, statistics on the number of Russian tourists arriving in Greece were studied. Finally, an analysis of these statistics and questionnaire results were done, in order to draw conclusions about the preferences of Russian tourists of various age groups, as far as the attractiveness of various forms of tourism are concerned, (besides of course the main established one, that of sea and sun).

This research was really focused on the preferences of the frequently characterised as dynamic age group (that between twenty and forty years old). It is challenging to be proven that tourists from Russia are interested in Greece especially for its offers in sports tourism and historical-cultural tourism.

### Statistics about Russian Tourists

According to Association of Russian Tourism Organisers (atorus.ru, 2020) every year Greece is one of the most popular tourist destinations among Russian tourists and this is shown by the statistics for the last years (before the corona virus and the Ukraine war).

- 2016- 595,5 thousand Russian tourists
- 2017- 786,6 thousand Russian tourists
- 2018- 844,1 thousand Russian tourists
- 2019- 777,9 thousand Russian tourists

According to a survey conducted in 2015, most Russians (32%) want to travel to Greece for family holidays. The main part of the flow from Russia is the middle class (35%). Above all, Russians are attracted by the sea and the islands of Greece. The main reasons for tourists visiting Greece are the islands (50%), culture and history (20%). The rest chose Greece as a holiday destination because of the price, safety and hospitality (10% each). At least 40% of Russian tourists choose beach holidays (Kozlov & Popov, 2015).

The Federal Security Service of the Russian Federation has published the final list of the deportees of Russian citizens in 2019 (atorus.ru, 2020). The total outbound flow increased by 7.9% compared to 2018, or by 3.5 million trips. At the same time, almost a third of the annual increase in trips of Russian citizens (31%) was made (48,072,285 trips in total). This is a 7.9% more than in 2018 (44,551,092) (atorus.ru, 2020).

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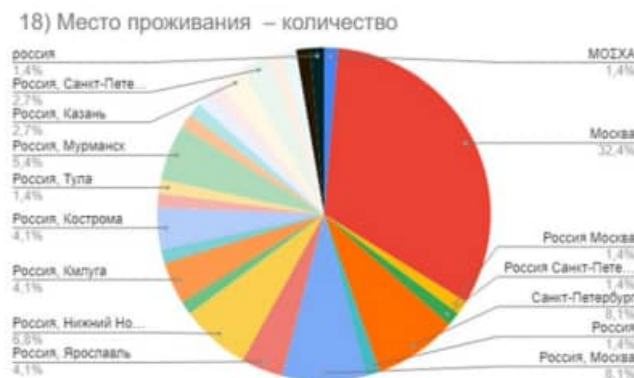
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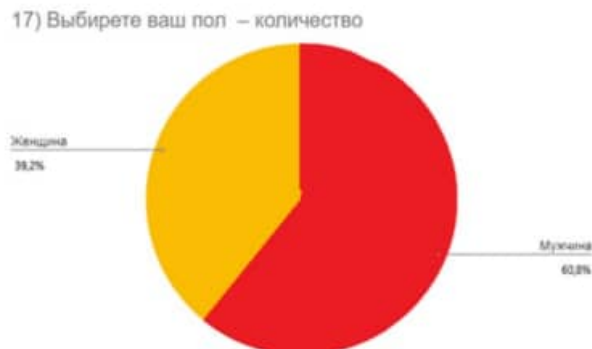
### Findings

While almost everyone sees Greece as a great place for tourism in general, when it comes to alternative forms of tourism, the number of people who see it positively drops significantly. This is maybe due to the fact that Greece is one of the perennial "all-inclusive hotel stay" options in the minds of Russian tourists.

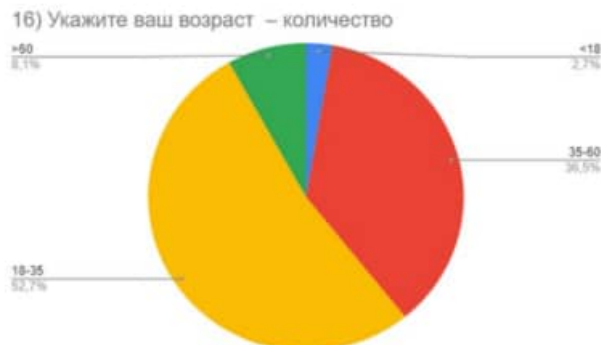
**Graph 1: Where do you live? Moscow: 43%, Other Cities 37%**



**Graph 2: What is your sex ? Male 60%**



**Graph 3: What is your age? 18-35 53%**

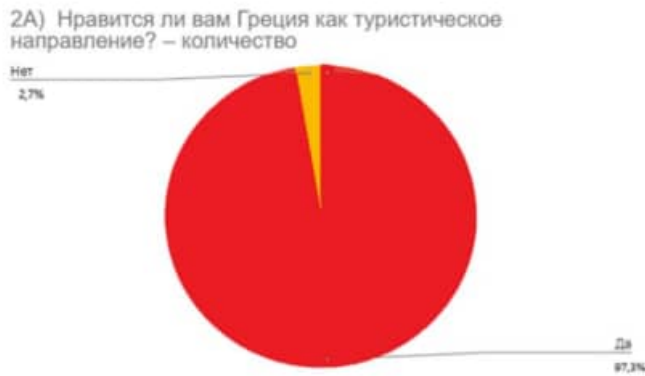


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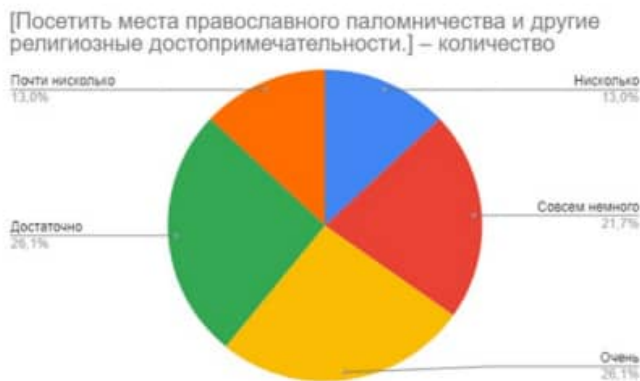
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**Graph 4: Do you like Greece? 97% said yes!**



**Graph 5: Would you be interested in organizing a religious and pilgrimage trip to Greece? Maybe 26% - Very Much 26%**



There are some interesting findings in the questionnaire results. For example, while almost everyone sees Greece as a great place for tourism in general, when it comes to alternative forms of tourism, the number of people who see it positively drops significantly.

This may be due to the general misunderstanding of Russians regarding alternative tourism, as in answering the question related to if they have ever taken part in an alternative form of tourism, it appears that only about 60% of Russian tourists have ever dedicated their travels to some form of it. When they were asked however directly about various forms of tourism in Greece and whether they would consider them, the situation improves somewhat. For example, more than half respond positively to ideas of gastronomic and commercial tourism in Greece, and reactions are generally positive regarding religious tourism and cruises.

Answers to the question regarding what activity you enjoyed mostly during your trip to Greece, show that almost half of the respondents see sports as something interesting they would like to do on their trip to Greece. This correlates very well with the answers to questions regarding what special activities (which are directly related to a special or an alternative form of tourism) are interested in doing, during their potential visit to Greece. Almost 30% of people who responded that they would like very much to do their favorite sports represent the largest share of “very positive” reactions of all the questions asked in the entire questionnaire. Considering that people aged 20 to 40 make up more than half of the

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respondents and that older people generally prefer calmer and safer ways to spend their time, it is reasonable to conclude that people aged 20 to 40 really consider Greece to be a very tempting destination for sports tourism.

Furthermore, as evidenced by the results, more people aged 20 to 40 are either single or have no children, and this allows them to be more flexible in planning sporting activities as they often exclude other family members due to skills or safety barriers (e.g. children cannot snorkel or windsurf in more extreme conditions or locations).

Reactions towards various forms of cultural tourism are less enthusiastic, although still quite positive, even among young people. It is possible that if, for example, instead of a question about Greek theaters (usually not a popular form of entertainment among younger age groups) a question about the Greek carnival season was asked, the number of people choosing “very interested” in Greek cultural tourism would be higher. Cultural tourism however still ranks second after sports in the overall list of things that Russian tourists would like to do in Greece, showing significant interest in it.

## Conclusions

Russian tourists want to combine different forms of alternative tourism throughout their trip. The most popular are cultural tourism, sports tourism and various recreational activities, although the popularity of Greece as a religious destination cannot be denied, especially among older and more pious Russians. Also, very popular among Russian tourists are cruises to the islands of the Aegean and the Ionian Sea. There, tourists get to know the historical and archaeological sites and enjoy the nature of Greece. Cruises to islands such as Rhodes, Patmos, Crete, Santorini, Mykonos and others last from 3 to 8 days.

Many of these forms of tourism are available not only in the summer but also at other times of the year. Russian tourists are interested in combining different forms of alternative tourism throughout their trip. Greece offers great opportunities for those who love sports and sporting events. From hiking trails and winter ski resorts to water polo, diving, snorkeling, surfing and a plethora of other water-based sports activities such as sailing, Greece has something for everyone when it comes to sports tourism. Apart from that Greece has significant infrastructure for sporting events of various levels. The country’s product manages to combine all these things at a competitive price level. Even without any concentrated efforts for the country to be marketed as a sports tourism destination, it is already quite popular with Russian tourists, and especially among millennials.

Russian tourists go easily to any of the major cities in Greece in order to visit many ancient cultural sites and enjoy antiquities. Excursions and tours are extremely popular and sometimes combine trips to the sea and beaches just a few hours away in one great package. This is a very attractive proposition for any Russian tourist, especially older groups who tend to prefer packages and complete tours as opposed to booking different parts of their trip. Orthodox Christians travel to Greece to visit legendary monasteries and churches. They come to pray at the icons and relics of the Saints. It is also a dream of many Orthodox believers from Russia to visit the monastic state of Mount Athos.

People with health problems are offered relaxation in the thermal springs, diagnosis and treatment in modern medical centers that are quite well equipped and employ experienced

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staff. Tours are also organized for people over 50 years old and people with disabilities. Such tourists need special treatment when moving and staying in a hotel as many of them are users of wheelchairs. There are hotels in Greece that are able to provide comfort to these tourists with disabilities, which is a big advantage for choosing a destination. Family hotels create bright and wonderful holidays with lots of games for children and adults.

Also very popular among Russian tourists are cruises on cruise ships to the islands of the Aegean and Ionian Seas. There, tourists get to know the historical and archaeological sites and enjoy the amazing nature of Greece. Cruises to islands such as Rhodes, Patmos, Crete, Santorini, Mykonos and others last from 3 to 8 days. Lovers of sea walks and free swimming can easily rent a boat. Sea trips can be made even in winter.

Conference tourism includes the organization of business events, exhibitions, presentations, forums, business lunches. It offers the opportunity to combine work and vacation. Event tourism is a trip for tourists who like to receive vivid impressions from cultural events. These are usually weekend trips or two-day trips. Entertainment trips can take place all year round and corresponding activities can be organized. Event trips are dedicated to a specific event, such as the Carnival in the city of Patras.

Greece as a country puts several efforts for the establishment of quality higher education. There are many benefits for young people from Russia if they decide to study in a greek University, such as entrance without exams, free accommodation and meals, discounts on travel and free visits to museums and exhibitions. There are also many educational trips to Greece in order to study Greek and English.

In summary, this study fulfilled its objective of presenting many forms of alternative tourism in Greece and discussing which ones are most preferred by tourists coming from Russia. The research conducted, helped in reaching definitive conclusions regarding the popularity of sports and cultural tourism in Greece among Russian people and established further possible areas of research, such as the issue of deciding which forms of cultural tourism would be preferred. Sanctions of European Union against Russia have eliminated the arrivals of Russian tourists in Greece. As the research was done during the period just before the sanctions' introduction, it can provide us with fruitful conclusions concerning the motivation of Russian people for the implementation of their potential visit to Greece, in the future by Russian visitors.

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### **TIME-DRIVEN ACTIVITY-BASED COSTING & BUDGETING IN ECOTOURISM (AN ECOTOURISTIC HOTEL IMPLEMENTATION MODEL)**

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#### **Abstract**

The growth of Tourist Sector in Greece consists of well-organized hotels and apartments similar to the best of the world. Hence, the need of information about costing is essential and crucial. Especially, the Eco-Touristic enterprises that provide extra services to their customers, such as interaction activities with biotic components of the natural environments, and, activities that promote energy efficiency, water conservation, recycling.

The present research, analyses the newly method of costing accounting and management, the one known as Time-Driven Activity-Based Management (TDABM). This method overcomes the difficulties of implementing and maintaining conventional Activity-Based Management. The theoretical model, that has been applied in a touristic enterprise, along with new technologies in computing, provides information of great detail regarding the operations, the bottlenecks, and assists management to take action to solve the problematic areas and feel confident for future decisions.

Time-Driven ABM has the following advantages. It is easier and faster to be built with great accuracy. Integrates well with data now available from ERP systems and CRM systems. It drives costs to transactions and orders using specific characteristics of particular orders, processes, suppliers, and customers. Provides visibility to process efficiencies and capacity utilization. Forecasts resource demands, allowing companies to budget for resource capacity. It is easily scalable to enterprise-wide models via enterprise-scalable applications software and database technologies. Enables fast and inexpensive model maintenance. Supplies granular information to assist users with identifying the root cause of problems. And, can be used in any industry or company with complexity in customers, products, channels, segments, and processes and large amounts of people and capital expenditures.

Having adopted the basics of design and implementation of the Time-Driven ABM model from Kaplan and Anderson (2007), an attempt is made to apply this model directly to an eco-touristic hotel.

**Key words:** *Time-Driven Activity-Based Management in Hotels, Time-Driven Activity-Based Costing in Tourist Sector, Eco-Tourism in Greece, Costing of Tourist Services*

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### Introduction

As hotels evolve, they focus more and more on creating specialized services for their customers. All these special activities create more indirect costs such as the expenses for leasing special machinery, using greater warehouses, creating more focused advertising and providing specialized technician training. These indirect costs using classical method of costing are transferred to the general ledger and then either to all products, or, other costing centers such as the selling costing center. This action manipulates the cost of these specialized services providing false information leading to setting false selling price.

Those problematic areas are limited by a newer method called Activity-Based Costing (ABC). This method analyses the activities taken part in order to provide each specialized service. Next, these activities are evaluated and the result is to sum these activities in order to estimate the cost of each product-service. Although the analysis of cost per service that this method provides is extremely detailed and accurate, a survey in 2003 argues that only 50% of those companies that tried to adopt ABC finally did it (Rigby 2003). According to Kaplan and Anderson (2007), ABC encountered the following problems:

- ✓ The interviewing and surveying process was time-consuming and costly.
- ✓ The data for the ABC model were subjective and difficult to validate.
- ✓ The data were expensive to store, process, and report.
- ✓ Most ABC models were local and did not provide an integrated view of enterprise-wide profitability opportunities.
- ✓ The ABC model could not be easily updated to accommodate changing circumstances.
- ✓ The model was theoretically incorrect when it ignored the potential for unused capacity.

Those shortcomings of the ABC method can be solved by its evolution called Time-Driven or Capacity-Driven Activity-Based Costing (TDABC) inspired by Kaplan and Anderson (2007). This method puts aside the need for interviewing the employees so as to set the activity-drivers (the connection of the resources to activities taken place). On the contrary, assigns the cost of the resources directly to the cost objects (products) depending on the two fundamental elements:

- ✓ The cost of supplying resource capacity.
- ✓ The capacity cost rate.

### Methodology and Theoretical approach of Time-Driven Activity-Based Costing

In order for the fundamental elements to be explained, the following example is necessary. In a manufacturing company, the cost of supplying resource capacity of a division is €500.000 (raw materials, salaries, asset depreciation, and miscellaneous expenses). The capacity cost rate is measured as the quotient of Cost of Supplying Resource Capacity to the Total Time Available in minutes. The denominator is the most important factor of the manufacturing procedure, the time that the employees work to convert raw materials to products.

Assuming that there are 5 employees, working 8 hours per day, 5 days per week for 50 weeks per year, meaning that in minutes they can work for 600.000 minutes per year (5 workers \* 8 hours \* 5 days \* 50 weeks \* 60 minutes). If there are 70 minutes as breaks per day (87.500 minutes per year = 5 workers \* 70 minutes \* 5 days \* 50 weeks), the Net Total

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Time Available is 512.000 minutes per year ( $600.000 - 87.500$ ). Thus, the Capacity Cost Rate is calculated as  $€500.000 / 512.500 \text{ minutes} = €0,98$  total cost per working time (minute). The cost per minute is the base to measure the cost of each activity and then each cost object. It is possible to use hours as the base for the Capacity Cost Rate, but it has been recorded that the minimum time measure is a better costing tool.

The next step is to indicate the time that each cost object (product) needs in order to be manufactured. This information is not needed to be obtained by interviewing all the employees that take part, just their supervisors. The absolute accuracy of time spent is not necessary and if not achieved is not a mistake either. The actual time spent can also be measured in real action several times per year in order for the costing model to be accurate. In this example, the activities that create the company's product consume time as follows:

- Transportation of the raw materials from warehouse to the machinery (10 minutes).
- Conversion of the raw materials to the company's product (40 minutes).
- Transportation of the finished product to the warehouse (10 minutes).

Having the two elements needed, the cost per product can be calculated. The following table shows the cost of each activity performed.

Table A, COST PER ACTIVITY

| ACTIVITIES                                                          | TIME-DRIVEN ACTIVITY-BASED COSTING   |                       |
|---------------------------------------------------------------------|--------------------------------------|-----------------------|
|                                                                     | TIME CONSUMED PER ACTIVITY (minutes) | COST PER ACTIVITY     |
| Transportation of the raw materials from warehouse to the machinery | 10                                   | $€0,98 * 10 = €9,80$  |
| Conversion of the raw materials to final product                    | 40                                   | $€0,98 * 40 = €39,20$ |
| Transportation of the finished product to the warehouse             | 10                                   | $€0,98 * 10 = €9,80$  |

According to the table, the cost of each product manufactured is €58,80 ( $€9,80 + €39,20 + €9,80$ ). Supposing that during the costing period there have been manufactured 8.400 products, the total cost of the products is €493.920 ( $8.400 * €58,80$ ). At this point, it is crucial to mention that the resources used during the period cost €500.000, the difference of €6.080 is the cost of unused capacity, and management should take action such as lay-offs or reducing the money paid for some resources, or even better, increasing the production.

Furthermore, using the table, the time equation of the specific product can be created as follows:

• Time needed to manufacture one product (in minutes) =  $(10 * \text{Transportation of the raw materials from warehouse to the machinery}) + (40 * \text{Conversion of the raw materials to final product}) + (10 * \text{Transportation of the finished product to the warehouse})$ .

If the products to be manufactured are 10, then the equation is:

• Time needed to manufacture 10 products (minutes) =  $(10 * 10) + (40 * 10) + (10 * 10) = 600$  minutes and the cost of production is  $€588 = (600 \text{ minutes} * €0,98)$ .

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This simplified time equation can be easily modified in order for the management to produce more specialized products or to get information relative to production what-if scenarios. For example, if the management wants to offer its customers the choice of colour (red or blue) or the way of delivery (courier or post-office), then they need to measure the time that each choice needs in order to be performed, and, to update the time equation formula. Hypothetically, the extra time is 10 minutes for the red colour, 15 minutes for the blue, 5 minutes if sent by courier and 30 minutes if sent by post-office. The updated formula is as follows:

- Time needed to manufacture one product (in minutes) = (10 \* Transportation of the raw materials from warehouse to the machinery) + (40 \* Conversion of the raw materials to final product) + (10 \* Transportation of the finished product to the warehouse) + (10 \* (if red colour)) + (15 \* (if blue colour)) + (15 \* (if sent by courier)) + (30 \* (if sent by post-office)).
- Having the Capacity Cost Rate (€0,98), it is easily to cost the product with its variations.

Upgrading the basic time function does not need any interviews held anew, concerning what is the necessary time for e.g. a product to be painted red and sent by mail. A simple measurement or estimation by the executive producer and the function is renewed. Each time a significant change in the values of the above mentioned production function takes place, the cost estimators are informed and they change either the Capacity Cost Rate or the activities costs table and thus the time function as well. Often, upgrading does not take place only after significant events, but even in case the management itself wants to assess scenarios featuring specific requirements.

The concept of time used by the Time-Driven ABC concerns the approximate time one or more employees or machines take to perform a specific activity. There is no need the exact time to be also the right one, since, in case of low production periods, such time is different than when the same activity is performed in a high production and intense period. Thus, average specific observation is considered the most correct approach.

Times are calculated once – which is sufficient for several accounting periods. Once a year, usually during the lowest production period, control is made with the correctness of such times being examined. Changes in the pattern are made when there are changes in the way in which an activity is performed, or, when new activities are created.

The theoretical approach of the new method is implemented in a Greek mid-sized manufacturing organization. The next paragraphs show the planning of the new costing model along with the implementation results that applied for the first time in Greek bibliography.

## Research

In Greece today, two kinds of hotels exist: the hotels that function the entire year, as well as the hotels that function only at the period of tourism that is usually 9 months per year (seasonal hotels).

The departments of operation of a hotel are the same, no matter the hotel functions 12 months per year, or, functions less months. However, there are certain peculiarities that exist in the hotels that function less months of time, such as depreciation and payment of the personnel.

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More analytically:

The main Departments of operation of a hotel are:

Table 1. Departments of a Hotel

| DEPARTMENTS      | BY-DEPARTMENTS                         | DESCRIPTION                                                                                                                                                                                                                                                                                                               |
|------------------|----------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| ROOMS DEPARTMENT | Rooms & Reception                      | The reception is compelled to ensure generally the welcome and settlement of the customers. That is to say, this service distributes the rooms to the customers, keeps record in relative table the occupied and free rooms, enters the full names of tenants, provides interpreters, gives information on exchange, etc. |
|                  | Cleaning the Rooms & Washing-machines  | This service undertakes the cleaning of the rooms, along as the cleaning of the sheets and the cushions in the washing-machines.                                                                                                                                                                                          |
| RESTAURANT       | Restaurant                             | The restaurant is compelled to provide the food for the customers, so much for the tenants as for the passerby. Usually the breakfast is connected closely with the renting of the rooms.                                                                                                                                 |
|                  | Cafeteria – Tavern – Refreshment Stand | They function usually as a by-department of the restaurant, but many times however functions also as an autonomous department.                                                                                                                                                                                            |
|                  | Supply Drinks and Food                 | This service undertakes the obligation to provide the hotel unit with grocery and drinks. It also has to maintain the food and the drinks in good situation.                                                                                                                                                              |
| ADMINISTRATION   | Administration                         | In this department managers and accountants evaluate the figures and make their decisions.                                                                                                                                                                                                                                |
| MARKETING        | Marketing                              | Advertisement methods are decided and ways of improving the image of the organization.                                                                                                                                                                                                                                    |

"ASTIR" SA is a hotel company in the mainland of Greece close to archeological sightseeing that enables it to operate yearly. In the following table are all the necessary limitations and information of the example.



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Table 2. Cost Object and Limitations

|                                                                                                                                                                                                                                                                                                                                    |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>LIMITATIONS – COST OBJECT (AIM)</b>                                                                                                                                                                                                                                                                                             |
| The cost object of this article is to analyze ONLY the cost of the ROOMS DEPARTMENT                                                                                                                                                                                                                                                |
| Personnel: 56 employees receiving €800.000 per year.<br>(30 working in the Rooms Department receiving €500.000 per year<br>14 working in the Restaurant Department receiving €150.000 per year<br>8 working in the Administration receiving €100.000 per year<br>4 working in the Marketing Department receiving €50.000 per year) |
| Rooms: 70 one-bed rooms & 50 twin-bed rooms                                                                                                                                                                                                                                                                                        |
| High season from 1/3 – 31/10 (8 months)                                                                                                                                                                                                                                                                                            |
| Low season from 1/11 – 28/2 (4 months)                                                                                                                                                                                                                                                                                             |
| Prices have a minimum set by the government and differ during high and low season:                                                                                                                                                                                                                                                 |
| from 1/3 – 31/10 (8 months) prices are: €68,74 one-bed rooms, €103,11 twin-bed rooms                                                                                                                                                                                                                                               |
| from 1/11 – 28/2 (4 months) prices are: €54,99 one-bed rooms, €82,49 twin-bed rooms                                                                                                                                                                                                                                                |
| Vacancies: high season (1/3 – 31/10) as of 8 months is 100%                                                                                                                                                                                                                                                                        |
| low season (1/11 – 28/2) as of 4 months is 60%                                                                                                                                                                                                                                                                                     |
| Rooms Dep. has 3 working shifts 6 a.m. – 14 p.m., 14 p.m. – 10 p.m., and 10 p.m. – 6 a.m.                                                                                                                                                                                                                                          |
| Restaurant has 2 working shifts 6 a.m. – 14 p.m., 14 p.m. – 10 p.m.                                                                                                                                                                                                                                                                |
| When you see “Furniture” all the furniture and machinery of the hotel are included                                                                                                                                                                                                                                                 |
| Indirect Cost of Activities includes only the depreciation cost of building and furniture                                                                                                                                                                                                                                          |
| Overhead Cost of Activities includes all other kinds of cost that cannot be directly associated to the activities                                                                                                                                                                                                                  |
| Goods and Materials bought are all the products used in a hotel (sheets, paper, lamps, writing instruments, service materials, etc.)                                                                                                                                                                                               |

By the end of year 2023, accountants provide management with the following statements (the most important numbers are shown below):

Table 3. Adapted Accounts Balance as of 31/12/2023 (in €)

| ACCOUNTS                     | BALANCE   |           |
|------------------------------|-----------|-----------|
|                              | DEBIT     | CREDIT    |
| Buildings-Assets             | 1.364.000 | -         |
| Depreciated Buildings-Assets | -         | 1.100.000 |
| Furniture-Assets             | 350.000   | -         |
| Depreciated Furniture-Assets | -         | 120.000   |
| Goods Bought                 | 280.000   | -         |
| Materials Bought             | 600.000   | -         |
| Cash                         | 300.000   | -         |
| Loans -Liabilities           | -         | 149.000   |
| Employment Fees - Expenses   | 800.000   | -         |
| Maintenance – Expenses       | 200.000   | -         |
| Transportation – Expenses    | 100.000   | -         |
| Interest – Expenses          | 25.000    | -         |

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|                                      |                  |                  |
|--------------------------------------|------------------|------------------|
| Depreciation of buildings– Expenses  | 230.000          | -                |
| Depreciation of furniture – Expenses | 20.000           | -                |
| Goods Revenue                        | -                | 300.000          |
| Product Revenue                      | -                | 800.000          |
| Service Revenue                      | -                | 1.800.000        |
| <b>TOTAL</b>                         | <b>4.269.000</b> | <b>4.269.000</b> |

The expenses are then categorized and allocated to the Departments consumed as shown to the following table.

Table 4. Allocation of Expenses to the Departments as of 31/12/2023 (in €)

| EXPENSES                  | TOTAL AMOUNT     | EXPENSES OF THE ROOM DEPARTMENT | EXPENSES OF THE RESTAURANT DEPARTMENT | EXPENSES OF THE ADMINISTRATIO N | EXPENSES OF MARKETING DEPARTMENT | FINANCIAL EXPENSES |
|---------------------------|------------------|---------------------------------|---------------------------------------|---------------------------------|----------------------------------|--------------------|
| Employment Fees           | 800.000          | 500.000                         | 150.000                               | 100.000                         | 50.000                           | -                  |
| Maintenance               | 200.000          | 135.000                         | 30.000                                | 25.000                          | 10.000                           | -                  |
| Transportation            | 100.000          | 70.000                          | 20.000                                | 5.000                           | 5.000                            | -                  |
| Interest                  | 25.000           | -                               | -                                     | -                               | -                                | 25.000             |
| Depreciation of buildings | 230.000          | 165.600                         | 9.200                                 | 36.800                          | 18.400                           | -                  |
| Depreciation of furniture | 20.000           | 14.400                          | 800                                   | 3.200                           | 1.600                            | -                  |
| Goods Used                | 280.000          | 50.000                          | 200.000                               | 20.000                          | 10.000                           | -                  |
| Materials Used            | 600.000          | 200.000                         | 300.000                               | 50.000                          | 50.000                           | -                  |
| <b>TOTAL</b>              | <b>2.255.000</b> | <b>1.135.000</b>                | <b>710.000</b>                        | <b>240.000</b>                  | <b>145.000</b>                   | <b>25.000</b>      |

Another table that is necessary for the analysis is the asset depreciation table, only the part that concerns the assets that still have value to be depreciated.

Table 5. Depreciation Cost of Furniture of all Departments as of 31/12/2023

| DEPARTMENTS     | ASSET           | VALUE  | QUANTITY | TOTAL VALUE | DEPRECIATION PERCENTAGE | DEPRECIATION PER ASSET | TOTAL DEPRECIATION |
|-----------------|-----------------|--------|----------|-------------|-------------------------|------------------------|--------------------|
| ROOM DEPARTMENT | DESK            | 500    | 4        | 2.000       | 15%                     | 75                     | 300                |
|                 | CHAIR           | 200    | 9        | 1.800       | 15%                     | 30                     | 270                |
|                 | PC              | 2.000  | 2        | 4.000       | 30%                     | 600                    | 1.200              |
|                 | TELEPHONE       | 3.000  | 2        | 6.000       | 20%                     | 600                    | 1.200              |
|                 | VACUUM CLEANER  | 1000   | 2        | 2.000       | 20%                     | 200                    | 400                |
|                 | WASHING MACHINE | 28.000 | 1        | 28.000      | 20%                     | 5.600                  | 5.600              |

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|                |                  |        |    |        |      |       |               |
|----------------|------------------|--------|----|--------|------|-------|---------------|
|                | SPINNING MACHINE | 12.000 | 1  | 12.000 | 20%  | 2.400 | 2.400         |
|                | IRONING PRESS    | 15.000 | 1  | 15.000 | 20%  | 3.000 | 3.000         |
|                | TROLLEY          | 200    | 1  | 200    | 15%  | 30    | 30            |
| ADMINISTRATION | DESK             | 500    | 8  | 4.000  | 15%  | 75    | 600           |
|                | CHAIR            | 200    | 14 | 2.800  | 15%  | 30    | 420           |
|                | PC               | 500    | 8  | 4.000  | 30%  | 150   | 1.200         |
|                | HANDHELD PC      | 200    | 2  | 400    | 30%  | 60    | 120           |
|                | PRINTER          | 150    | 8  | 1.200  | 30%  | 45    | 360           |
|                | TELEPHONE        | 50     | 8  | 400    | 20%  | 10    | 80            |
|                | OVAL TABLE       | 500    | 1  | 500    | 15%  | 75    | 75            |
|                | PROJECTOR        | 500    | 1  | 500    | 30%  | 150   | 150           |
|                | SCREEN           | 150    | 1  | 150    | 30%  | 45    | 45            |
|                | FILING CLOSETS   | 500    | 2  | 1.000  | 15%  | 75    | 150           |
| MARKETING      | DESK             | 500    | 4  | 2.000  | 15%  | 75    | 300           |
|                | CHAIR            | 200    | 4  | 800    | 15%  | 30    | 120           |
|                | PC               | 500    | 4  | 2.000  | 30%  | 150   | 600           |
|                | PRINTER          | 150    | 4  | 600    | 30%  | 45    | 180           |
|                | TELEPHONE        | 50     | 4  | 200    | 20%  | 10    | 40            |
|                | TOOLS            | 360    | 1  | 360    | 100% | 360   | 360           |
| RESTAURANT     | DESK             | 500    | 1  | 500    | 15%  | 75    | 75            |
|                | CHAIR            | 200    | 12 | 2.400  | 15%  | 30    | 360           |
|                | HANDHELD PC      | 200    | 1  | 200    | 30%  | 60    | 60            |
|                | PC               | 500    | 1  | 500    | 30%  | 150   | 150           |
|                | PRINTER          | 150    | 1  | 150    | 30%  | 45    | 45            |
|                | TELEPHONE        | 50     | 1  | 50     | 20%  | 10    | 10            |
|                | VACUUM CLEANER   | 500    | 1  | 500    | 20%  | 100   | 100           |
| <b>TOTAL</b>   | -                | -      | -  | -      | -    | -     | <b>20.000</b> |

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Table 6. Traditional Cost Analysis of a Hotel

The accountants keeping in mind the special conditions of the prices and the big competition, they allocate all the cost to the rooms in order to provide the first information about cost per room to the management. The following tables express this analysis allocating the cost of all departments to the rooms engaged the whole year having in mind that the information is based on historic data. Then in the table 8 we provide the cost per room information including the cost of the Restaurant and excluding this department. This variation can be useful to the management when they make the offers to the tourist agents, whether they should include full, or, half, or, no board to the customers.

| ROOMS        | DAYS<br>PER<br>MONTH | MONTHS<br>PER<br>YEAR | TOTAL<br>NO. OF<br>ROOMS | OCCUPATION<br>PERCENTAGE | ROOMS<br>OCCUPIED | PRICE<br>FACTOR | PARTY<br>MONADS  | EXPENSES OF<br>THE ROOM<br>DEPARTMENT | EXPENSES<br>OF THE<br>RESTAURANT<br>DEPARTMENT | EXPENSES OF<br>THE<br>ADMINISTRATION | EXPENSES<br>OF<br>MARKETING<br>DEPARTMENT | FINANCIAL<br>EXPENSES | TOTAL<br>COST       |
|--------------|----------------------|-----------------------|--------------------------|--------------------------|-------------------|-----------------|------------------|---------------------------------------|------------------------------------------------|--------------------------------------|-------------------------------------------|-----------------------|---------------------|
| 70 one-bed   | 30                   | 8                     | 16,800                   | 100%                     | 16,800            | 1               | 16,800           | 468,123.87                            | 292,835.26                                     | 98,986.57                            | 59,804.38                                 | 10,311.10             | 930,061.28          |
| 70 one-bed   | 30                   | 4                     | 3,360                    | 60%                      | 2,016             | 0.80            | 1,612.80         | 44,939.90                             | 28,112.19                                      | 9,502.71                             | 5,741.22                                  | 989.87                | 89,285.99           |
| 50 twin-bed  | 30                   | 8                     | 12,000                   | 100%                     | 12,000            | 1.50            | 18,000           | 501,561.40                            | 313,752.06                                     | 106,057.04                           | 64,076.13                                 | 11,047.61             | 986,494.24          |
| 50 twin-bed  | 30                   | 4                     | 6,000                    | 60%                      | 3,600             | 1.20            | 4,320            | 120,374.73                            | 75,300.49                                      | 25,453.68                            | 15,378.27                                 | 2,651.42              | 239,158.59          |
| <b>TOTAL</b> |                      |                       |                          |                          | <b>34,416</b>     |                 | <b>40,732.80</b> | <b>1,135,000</b>                      | <b>710,000</b>                                 | <b>240,000</b>                       | <b>145,000</b>                            | <b>25,000</b>         | <b>2,255,000.00</b> |

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Table 7. Cost per Room per Day using Traditional Costing Method

| TOTAL COST          | EXPENSES OF THE ROOM DEPARTMENT PER ROOM PER DAY | EXPENSES OF THE RESTAURANT DEPARTMENT PER ROOM PER DAY | EXPENSES OF THE ADMINISTRATION PER ROOM PER DAY | EXPENSES OF MARKETING DEPARTMENT PER ROOM PER DAY | FINANCIAL EXPENSES PER ROOM PER DAY | TOTAL COST PER ROOM PER DAY INCLUDING THE EXPENSES OF THE RESTAURANT | TOTAL COST PER ROOM PER DAY EXCLUDING THE EXPENSES OF THE RESTAURANT |
|---------------------|--------------------------------------------------|--------------------------------------------------------|-------------------------------------------------|---------------------------------------------------|-------------------------------------|----------------------------------------------------------------------|----------------------------------------------------------------------|
| 930.061,28          | 27,8645                                          | 17,4307                                                | 5,8921                                          | 3,5598                                            | 0,6138                              | 55,3609                                                              | 37,9302                                                              |
| 89.285,89           | 22,2916                                          | 13,9445                                                | 4,7136                                          | 2,8478                                            | 0,4910                              | 44,2885                                                              | 30,3440                                                              |
| 996.494,24          | 41,7968                                          | 26,1460                                                | 8,8381                                          | 5,3397                                            | 0,9206                              | 83,0412                                                              | 56,8952                                                              |
| 239.158,59          | 33,4374                                          | 20,9168                                                | 7,0705                                          | 4,2717                                            | 0,7365                              | 66,4329                                                              | 45,5161                                                              |
| <b>2.255.000,00</b> |                                                  |                                                        |                                                 |                                                   |                                     |                                                                      |                                                                      |

Explanation of the figures: the **price factor** of the one-bed rooms is calculated using as a base the rooms occupied in the high season and have the maximum price, and get the price factor of 1. Then, the one-bed rooms that were occupied in the low season have 20% lower price, thus they get the price factor of 0,80. Similar is the calculation of the twin-bed rooms. The ones used in the high season are priced 50% over the one-bed rooms during the same period, so, they get the price factor of 1,50. Lastly, the twin-bed rooms in the low season were priced 20% lower than those of the high season and get the price factor of 1,20 (1,50 - 20%). The column “**parity monads**” is the multiplication of the rooms occupied with the price factor, and these monads allocate the total expenses of the Room Department to the rooms occupied during 2007, e.g.  $468.123,97 = (16.800 / 40.732,80) * 1.135.000$ .

### Cost of the hotels (Time-Driven ABC)

Time-Driven ABC simplifies the costing process by eliminating the need to interview and survey employees for allocating resource costs to activities before driving them to the cost objects (orders, products, and customers).

The new model assigns resource costs directly to the cost objects using an elegant framework requiring only two sets of estimates, neither of which is difficult to obtain.

First, it calculates the cost of supplying resource capacity. The cost of all the resources as personnel, supervision, occupancy, equipment and technology supplied to this department or process. It divides this total cost by the capacity the time available from the employees actually performing the work of the department to obtain the capacity cost rate.

Second, uses the capacity cost rate to drive departmental resource costs to cost objects by estimating the demand for resource capacity (typically time) that each cost object requires.

It allows the time estimate to vary on the basis of the specific demands by particular orders.

### Advantages of Time-Driven Activity-Based Costing (Kaplan 2007)

- ✓ Easier and faster to build an accurate model
- ✓ Integrates well with data now available from ERP and Customer Relationship Management Systems, making the system more dynamic and less people-intensive

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- ✓ Drives costs to transactions and orders using specific characteristics of particular orders, processes, suppliers, and customers
- ✓ Can be run monthly to capture the economics of the most recent operations
- ✓ Provides visibility to process efficiencies and capacity utilization
- ✓ This model simulates the actual processes used to perform work throughout an enterprise. It can therefore capture far more variation and complexity than a conventional ABC model, without creating an exploding demand for data estimates, storage, or processing capabilities. Using TDABC, a company can embrace complexity rather than being forced to use simplified, inaccurate ABC models of its complex businesses.
- ✓ Forecasts resource demands, allowing companies to budget for resource capacity on the basis of predicted order quantities and complexity
- ✓ Is easily scalable to enterprise-wide models via enterprise-scalable applications and technologies
- ✓ Enables fast and inexpensive model maintenance
- ✓ Supplies granular information to assist users with identifying the root cause of problems
- ✓ Can be used in any industry or company with complexity in customers, products, channels, segments, and processes and large amounts of people and capital expenditures.

In order to create a Time-Driven ABC Model, an analysis of the entity is needed, along with the activities-processes taking part (Library of Activities). Then, we create the main and the less important Cost Equations of the Services Provided. We calculate the Capacity Cost Rates of all departments.

A small size analysis to check the accuracy of the costing model is needed. Finally, we create the Time Equations of the Departments and the Services Provided, aiming to estimate the total Cost of Accommodation.

As said before, according to Time Equations, we can measure all cost-objects (the cost of the restaurant, the cost of the outdoor activities etc.). Furthermore, we can approach multiple budget scenarios, and what-if analysis. The analysis needs 6 to 8 weeks to get the basic model interviewing the supervisors, measuring the processes and creating the library of the activities.

Then, the Time Equations can provide us with many possibilities of analysis.

The Total Cost of Hotels consists of the Cost of Accommodation (+) the Cost of the Secondary Departments, such as:

- ✓ RESTAURANT
- ✓ OUTDOOR ACTIVITIES
- ✓ MANAGEMENT
- ✓ MARKETING

So, the cost of the provided services of a hotel consists of:

**COST OF THE HOTEL = COST OF ACCOMMODATION + COST OF RESTAURANT + COST OF OUTDOOR ACTIVITIES + COST OF MANAGEMENT + COST OF MARKETING**



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If we want to estimate the Cost of Accommodation (Rooms Department), and more specifically the Cost of Reservation (the only to be shown, because it is an on-going research), then:

COST OF ACCOMMODATION = COST OF ROOM-RECEPTION & INFORMATION DESK + COST OF ROOM CLEANING + COST OF SHEET CLEANING + COST OF MAINTENANCE + COST OF LUGGAGE MANHANDLE

COST OF ROOM-RECEPTION & INFORMATION DESK = COST OF RESERVATION + COST OF CONFIRMATION + {IF CANCELATION = COST OF CANCELATION} + {IF SPECIAL NEEDS = COST OF SPECIAL TREATMENT} + {IF GROUP = COST OF MULTIPLE RESERVATIONS}

COST OF RESERVATION = {IF ORDER VIA INTERNET = R1} + {IF ORDER IN PERSON = R2} + (ROOM SELECTION = R3) + (ARCHIVING = R4) + (ACCOUNTING REGISTRATION = R5) + (PRICING = R6)

For instance, the Reservation Department occupies 4 personnel (working 3 shifts => 100 hours per month => 6.000 working minutes) using 2 desks and 2 PCs. Total Monthly Expenses are as shown below:

Employment Fees: €10.000 , Utility Expenses: €4.000,

Rent: €400 , Depreciation of Assets: €600 , Total: €15.000

COST of RESERVATION = {IF R1} + {IF R2} + R3 + R4 + R5 + R6 = CAPACITY COST RATE of RECEPTION \* [(TIME IN MINUTES OF EACH ACTIVITY WHEN PERFORMED \* FREQUENCY OF EACH ACTIVITY PERFORMED)] = CAPACITY COST RATE of RECEPTION \* [(IF R1 in min \* frequency of R1) + (IF R2 in min \* frequency of R2) + (R3 in min \* frequency of R3) + (R4 in min \* frequency of R4) + (R5 in min \* frequency of R5) + (R6 in min \* frequency of R6)]

CAPACITY COST RATE of RECEPTION = COST OF CAPACITY SUPPLIED / PRACTICAL CAPACITY OF RESOURCES SUPPLIED IN MINUTES = (Employment Fees + Utility Expenses + Rent + Depreciation) / (4 Employees => 6.000 Minutes) = (€15.000 / 6.000 min) = €2,50

When the usual Time Spent in each Activity in min is as follows:

R1 = 4, R2 = 7, R3 = 2, R4 = 3, R5 = 5, R6 = 5

And, the frequency of those Activities in the month (June) was as follows:

The Hotel received 200 Reservations via Internet and 100 In Person, then the Cost of the Department of Reservation is:

COST of RESERVATION = CAPACITY COST RATE \* [(IF R1 in min \* frequency of R1) + (IF R2 in min \* frequency of R2) + (R3 in min \* frequency of R3) + (R4 in min \* frequency of R4) + (R5 in min \* frequency of R5) + (R6 in min \* frequency of R6)]

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frequency of R4) + (R5 in min \* frequency of R5) + (R6 in min \* frequency of R6)] = €2,50 \* [(4 \* 200) + (7 \* 100) + ((2 + 3 + 5 + 5) \* 300)] = €2,50 \* (800 + 700 + 4.500) = €15.000

The rest of the analysis will be ready by the end of January 2026, and will be presented as a whole in the next “3rd Open-Air Cities International Conference” (if accepted by the Committee).

## Conclusions

The analysis of the cost of a hotel enterprise using both traditional costing and Time-Driven ABC, not only provided us with different approach of the cost per room per day, but also gave a lot of other information very useful to a number of management decisions. The Traditional Method was a lot easier to apply, thus, it is presented as a whole for the year 2023. On the other hand, the implementation of Time-Driven ABC is more time consuming, but provide us with a lot more information. The Time-Equations are many, which needs an ERP System to handle them, or, an Excel Sheet with many macros and security formulas applied. The information is like a “Gold Mine” for the Management looking to improve its operations. Even though the data was the same (historic accounting figures 2023), new information appeared about how employees work, what they do, and how their activities cost.

As of this time (now), the only information is provided to the Management is the list of Activities (Library of Activities), and the time that those activities consume, without any information about how much they cost.

And only by this information, Management can analyze the activities taken place by the following questions:

- ✓ How much time does it take to complete the activity?
- ✓ How much unused capacity exists?
- ✓ Are the best practices followed in doing the work?
- ✓ Is the customer satisfied?
- ✓ Furthermore, it is needed to Improve Activities and Processes (a number of activities).
- ✓ The best way to improve activities-processes is to:
- ✓ Improve working methods
- ✓ Reduce workload
- ✓ Minimize unutilized capacity
- ✓ Eliminate root causes of problems.
- ✓ Also, Management can use Time-Driven ABC to:
- ✓ Perform Quality Controls on the Activities of each Department.
- ✓ Modify Time Equations due to better performance of the Activities and better Service provided.
- ✓ Intervene in the time, quality and quantity of the activities performed.
- ✓ Affect, in the case when final equation cannot be changed, the factors that are very important in the Equation by giving them motivation to perform better.
- ✓ Check if there is any “Unused Capacity”, time to be used elsewhere.

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### Special session: CLIMATE-RESPONSIVE DESIGN

#### Leveraging Architecture and Urban Design for Environmental Resilience

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#### Abstract

In the Anthropocene era, humanity is radically reshaping the planet and is now confronting increasingly severe repercussions from these actions. The undeniable influence of the built environment on climate formation places urban areas at the forefront of efforts to mitigate climate change.

Architects, urban designers and planners are intensifying their commitment to develop built environments that minimize impact on natural surroundings. They are embracing climate-responsive strategies, methods and tools that seek harmony with nature and local climates, rather than exploitation or confrontation.

Although the concept of climate-responsive design is straightforward, its execution by designers is multi-dimensional and multi-scalar. Climate-responsive design adopts an integrated approach that considers environmental, economic, social, and cultural factors. Grounded in climatology, urban morphology, and building physics, it highlights the significance of passive strategies, embraces a circular economy, and fosters the integration of innovative technologies. Its approach aims not only to curb global warming through reduced greenhouse gas emissions and align with the EU's 2050 carbon neutrality goals, but also to enhance quality of life and promote human freedom, all within a sustainable framework.

This pre-organized session aims to broaden and deepen our understanding of how building and urban form can optimize environmental performance and urban resilience. Participants will have the opportunity to:

- Assess climate-responsive models through a comprehensive analysis of historic and contemporary case studies.
- Learn from exemplary practices in the implementation of climate-responsive frameworks.
- Explore intersections with circular economy principles, urban morphology, and smart technologies.
- Engage in discussions on emerging theories and innovative concepts addressing the climate crisis.

In conclusion, participants will engage in a critical dialogue on how architectural and urban design can innovatively address contemporary challenges, thereby shaping sustainable and resilient habitats for the generations to come.

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### INDUSTRIAL DOMAINS AS FUTURE’S RUINS: CHALLENGES AND STRATEGIES FOR SUSTAINABLE TRANSFORMATION

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#### **Abstract**

This study examines the categorisation and analysis of future ruins within industrial domains, emphasising their critical role in sustainable urban development and resilience. Industrial sectors, including manufacturing facilities, commercial spaces, and specialised infrastructures, often contribute to environmental degradation and urban decay when abandoned or underutilised. This research investigates the factors driving the transformation of these domains into urban ruins, exploring their broader implications for sustainability and socio-economic cohesion.

Drawing on global literature and case studies, the study identifies key factors contributing to the emergence of industrial ruins, such as aging infrastructure, economic shifts, and inadequate urban planning. These ruins are classified into three core categories: manufacturing sites (shipyards, storage facilities), commercial domains (office buildings, retail spaces), and special infrastructures (hospitals, military installations). Each category is analysed through illustrative examples, highlighting the environmental, cultural, and economic challenges posed by their neglect.

The research proposes an integrated framework for repurposing industrial ruins through adaptive reuse and sustainable reconstruction. Suggested strategies include incorporating renewable energy technologies, fostering circular economies, and encouraging community-driven initiatives. The findings underline the importance of addressing these challenges to curb industrial sprawl, enhance urban resilience, and support global sustainability objectives.

This study aims to equip urban planners, policymakers, and researchers with practical insights for managing industrial ruins effectively, transforming them into dynamic, productive, and environmentally responsible urban assets.

**Key words:** Industrial domains, Future ruins, Adaptive reuse, Sustainable urban development, Urban resilience, Circular economy, Environmental impact



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### Introduction

Industrial landscapes have long been pivotal to the formation of urban identity and economic development. However, the deindustrialisation of the late 20th and early 21st centuries has left behind numerous underutilised or abandoned infrastructures, what the literature increasingly refers to as future ruins (Edensor, 2005). These neglected industrial domains represent both a spatial and symbolic trace of human activity, raising critical questions about urban resilience, sustainability, and socio-economic regeneration.

This paper explores the categorisation and transformation of future ruins within industrial contexts. It focuses specifically on manufacturing infrastructures, commercial domains, and special-purpose facilities, such as hospitals and military compounds, which—when left derelict, contribute significantly to urban decay and environmental degradation. Drawing upon an interdisciplinary methodology rooted in international literature, the study analyses the drivers behind industrial decline, including ageing infrastructure, economic restructuring, and inadequate spatial planning (Rode et al., 2017; Bullen & Love, 2010).

The research adopts a comparative case study approach. It contrasts a successful transformation, Zeche Zollverein in Essen, Germany, an exemplary model of adaptive reuse and cultural regeneration with a failed paradigm, the Packard Automotive Plant in Detroit, USA, which remains an enduring emblem of industrial collapse. Alongside these, the study examines two contemporary redevelopment initiatives: HafenCity in Hamburg, a large-scale port-city revitalisation project, and Harland & Wolff shipyards in Belfast, with special attention to the symbolic preservation of the Titanic cranes as a case of heritage-led urban identity.

By analysing these cases through the lens of sustainable urban development and resilience theory, this paper proposes a structured categorisation model for industrial ruins. It offers a framework for their reactivation through strategies such as circular economies, renewable energy integration, and socially inclusive design. Ultimately, the aim is to reposition industrial ruins not as passive remnants, but as active catalysts for resilient and sustainable urban futures.

### Industrial Domains as Future’s Ruins, Typologies and Key Challenges Analysis

Industrial domains represent one of the most vulnerable categories of urban space susceptible to abandonment, obsolescence, and eventual ruination. Once vital components of the modern city’s economic, infrastructural, and social systems, these sites ranging from large-scale production facilities to specialised and commercial infrastructures, are increasingly exposed to risk due to structural, economic, and environmental pressures (Berens, 2011; Edensor, 2005).

The process of industrial decline is neither sudden nor uniform. It is influenced by a convergence of multidimensional factors, including:

- I. Aging Infrastructure: The inability of industrial systems to meet contemporary technological and efficiency standards contributes to abandonment (Langhorst, 2018).
- II. Economic Restructuring: Shifts toward post-industrial and service economies have rendered many industrial activities obsolete (Harvey, 2000).

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- III. Environmental Contamination: Pollution and hazardous legacies deter reinvestment and complicate redevelopment (DeSilvey & Edensor, 2013).
- IV. Policy Gaps and Urban Mismanagement: The absence of long-term planning and adaptive zoning has led to fragmentation and physical decay (Hollander et al., 2009).
- V. Socio-spatial Alienation: Communities often dissociate from derelict industrial sites, perceiving them as disconnected from contemporary urban needs (Millington, 2013).

In response to these processes, this study categorises industrial ruins into three primary typologies:

1. Production Facilities: This includes shipyards, energy plants, and heavy logistics infrastructure, spaces typically characterised by expansive land use and high contamination levels, often requiring significant remediation efforts before reuse (Berens, 2011).
2. Commercial Industrial Structures: Encompassing office buildings, retail parks, and commercial centres, these structures are increasingly vulnerable due to shifts in remote working, e-commerce, and suburban development (Couch et al., 2003).
3. Specialised Infrastructures: This category includes military complexes, hospitals, and correctional institutions—facilities with high spatial specificity and regulatory barriers to transformation (Bagaeen, 2006).

These typologies reflect not only the material deterioration of infrastructure but also a broader systemic challenge in aligning industrial heritage with contemporary urban priorities. Understanding these categories allows planners and scholars to formulate targeted strategies for sustainable transformation and reuse. The typologies are presented at the table 1.

**Table 1. Typologies of Industrial Domains and Associated Challenges**

| Type                               | Examples                           | Key Characteristics                                                | Primary Challenges                                            |
|------------------------------------|------------------------------------|--------------------------------------------------------------------|---------------------------------------------------------------|
| <b>Production Facilities</b>       | Shipyards, energy plants, depots   | High spatial demands, pollution, outdated logistics infrastructure | Contamination, cost of remediation, market inadaptability     |
| <b>Commercial Structures</b>       | Retail centers, office parks       | Rigid typology, economic obsolescence                              | Low adaptability, vacancy cycles, urban disconnection         |
| <b>Specialised Infrastructures</b> | Military sites, hospitals, prisons | Symbolic load, strict design, functional specificity               | Regulatory hurdles, public perception, limited reuse pathways |

By establishing this typology, the study creates a framework through which industrial ruins can be systematically identified, assessed, and reimaged. This analysis serves as a foundation for further exploration into adaptive reuse strategies in later sections, including comparisons between successful and unsuccessful examples of transformation.

### **Methodology: A Qualitative Comparative Case Study Approach**

This study employs a qualitative comparative case study methodology to investigate the transformation of industrial domains into future’s ruins, with a particular focus on two

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contrasting examples: Zeche Zollverein in Essen, Germany, and the Packard Automotive Plant in Detroit, USA. The method aims to evaluate the socio-spatial, architectural, and environmental implications of post-industrial abandonment, while assessing the strategies employed or neglected in their adaptive reuse.

The case study method is particularly suited to exploring complex urban and architectural phenomena within real-world contexts, allowing for the detailed examination of socio-economic, cultural, and policy-related variables (Yin, 2014). By selecting one successful case (Zollverein) and one failed or stalled case (Packard), the research establishes a comparative framework that elucidates the underlying conditions and decision-making processes which lead either to regeneration or prolonged decay.

The study relies on secondary data analysis derived from planning documents, architectural studies, policy papers, archival materials, and peer-reviewed literature. These sources are triangulated with visual documentation (photographs, maps, and site diagrams) to better understand spatial configurations and material deterioration (Flyvbjerg, 2006). In addition, academic publications and urban redevelopment reports were consulted to contextualise each site's historical significance and evaluate their respective trajectories toward or away from sustainable reuse.

The analysis is structured around key thematic categories drawn from the literature on industrial heritage and urban resilience:

- I. Historical industrial function and decline
- II. Architectural and infrastructural condition
- III. Governance and policy interventions
- IV. Community engagement and identity
- V. Sustainability and reuse strategies

This theory-informed approach allows for identifying replicable patterns and interventions, helping to formulate actionable insights for urban planners and policy-makers involved in the sustainable transformation of industrial ruins (Rossi, 1982; Bagaeen, 2006; Berens, 2011).

Ultimately, the methodological framework seeks not only to document the contrasting outcomes of the two sites, but also to reveal the broader systemic forces economic, political, and cultural, that condition the fate of industrial landscapes in contemporary cities.

### **Case Studies and Strategic Frameworks**

#### ***General Strategies for the Sustainable Transformation of Industrial Ruins.***

Before presenting the detailed case studies, it is crucial to outline the overarching strategic approaches that have emerged from international best practices in managing post-industrial landscapes. These strategies form a foundation for assessing the effectiveness of interventions in different contexts.

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**Table 2. Strategic Frameworks for the Sustainable Transformation of Industrial Ruins**

| Strategy                                  | Description                                                                 | Key Benefits                                                       |
|-------------------------------------------|-----------------------------------------------------------------------------|--------------------------------------------------------------------|
| <b>Adaptive Reuse</b>                     | Conversion of obsolete industrial buildings into new functional uses        | Preserves cultural heritage, reduces environmental impact          |
| <b>Ecological Restoration</b>             | Remediation of contaminated land and integration of green infrastructure    | Improves biodiversity, enhances public health                      |
| <b>Cultural and Creative Economy Hubs</b> | Repurposing sites into art, design, and cultural centres                    | Boosts tourism, fosters local identity and economic revitalisation |
| <b>Public-Private Partnerships (PPPs)</b> | Collaborative investment frameworks between government and private sector   | Enhances funding capacity, enables long-term maintenance           |
| <b>Community-Led Development</b>          | Inclusion of local stakeholders in planning and implementation              | Promotes social equity and civic ownership                         |
| <b>Circular Economy Integration</b>       | Use of waste reduction, material recovery, and energy efficiency principles | Supports sustainable production and consumption patterns           |

### *Case Studies*

The selected case studies, Zeche Zollverein (Essen, Germany) and Packard Automotive Plant (Detroit, USA), represent two contrasting trajectories in the lifecycle of industrial domains, providing a valuable comparative framework for examining the transformation of future ruins. These examples illustrate how urban planning strategies, policy implementation, and socio-cultural engagement can either catalyse sustainable renewal or reinforce spatial decay.

#### ***Zeche Zollverein: A Model of Adaptive Reuse and Cultural Regeneration***

Zeche Zollverein, once the largest coal mine in Europe and a symbol of Germany's industrial prowess, was decommissioned in 1986. Rather than falling into disrepair, it underwent a strategically coordinated process of adaptive reuse. Zeche Zollverein (Essen, Germany) represents one of the most renowned examples of successful industrial site transformation. After its closure in 1986, the site was reimagined through a UNESCO-backed vision that honored its industrial legacy while positioning it as a key cultural and economic node in the Ruhrgebiet (Storm, 2014; DeSilvey & Edensor, 2013).

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**Table 3. Applied Strategies in the Transformation of Zeche Zollverein (Essen, Germany)**

| Adopted                                   | Application in Zollverein                                                     |
|-------------------------------------------|-------------------------------------------------------------------------------|
| <b>Adaptive Reuse</b>                     | Museums, design centers, educational institutions within preserved structures |
| <b>Cultural and Creative Economy Hubs</b> | Establishment of Red Dot Design Museum, contemporary art spaces               |
| <b>Public-Private Partnerships</b>        | Co-investment from regional authorities and private developers                |
| <b>Ecological Restoration</b>             | Conversion of former industrial rail lines into green trails                  |

### ***Packard Automotive Plant: An Example of Unresolved Industrial Decline***

In stark contrast, the Packard Plant in Detroit, once a pioneering automotive facility has deteriorated into one of the most notorious symbols of urban decline in the United States. The Packard Plant (Detroit, USA) illustrates the challenges of managing post-industrial decline. Despite its historical value, the site fell victim to economic downturn, lack of coordinated vision, and infrastructural decay (Mah, 2012; Leary & Sholes, 2000).

**Table 4. Strategic Deficiencies at the Packard Automotive Plant (Detroit, USA)**

| Strategy Lacking or Failed          | Resulting Issues                                   |
|-------------------------------------|----------------------------------------------------|
| <b>Absence of Adaptive Reuse</b>    | Severe structural deterioration and safety hazards |
| <b>No Coordinated Public Policy</b> | Ownership disputes, disinvestment, legal gridlock  |
| <b>Lack of Community Engagement</b> | Social isolation and resistance to redevelopment   |
| <b>Environmental Inaction</b>       | Persistent contamination and urban blight          |

The juxtaposition of Zeche Zollverein and the Packard Plant highlights how divergent trajectories in post-industrial redevelopment are contingent on governance, stakeholder collaboration, and strategic foresight. Zollverein's success can be attributed to a holistic integration of adaptive reuse, cultural programming, ecological restoration, and inclusive financing. It demonstrates how resilience and sustainability can be embedded into the reconfiguration of industrial domains, thereby producing long-term socio-economic and environmental value (Langhorst & Kirkwood, 2014; Tölle, 2021).

Conversely, the Packard Plant underscores the consequences of strategic fragmentation, legal inertia, and environmental neglect. Without a coherent redevelopment strategy or active stakeholder participation, the site continues to deteriorate, reinforcing cycles of urban abandonment and spatial inequality (Ravetz, 2000; Mah, 2012).

These cases collectively reinforce the imperative for integrative, multi-disciplinary frameworks in the sustainable transformation of industrial ruins, ones that account for heritage, ecology, community, and economy in balanced measure.

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### *Contemporary Case Studies*

The cases of HafenCity in Hamburg and the Harland & Wolff Shipyards (Titanic Quarter) in Belfast offer valuable insights into how former industrial landscapes can be successfully transformed into vibrant, multifunctional urban districts. Through integrated planning, stakeholder engagement, and targeted sustainability frameworks, these examples illustrate best practices in aligning heritage conservation with urban innovation. The strategic approaches applied in these cases enrich the discourse on post-industrial futures and serve as replicable models for urban planners and policymakers.

**Table 5. Strategic Summary of HafenCity Redevelopment (Germany)**

| Strategy Adopted                                    | Application in HafenCity                                                                      |
|-----------------------------------------------------|-----------------------------------------------------------------------------------------------|
| <b>Adaptive Reuse &amp; Brownfield Regeneration</b> | Redevelopment of former port warehouses into mixed-use urban quarters                         |
| <b>Sustainable Urban Planning</b>                   | Implementation of the HafenCity Environmental Sustainability Label; pedestrian prioritisation |
| <b>Public-Private Partnership (PPP)</b>             | HafenCity GmbH coordinates public-private investments                                         |
| <b>Resilience-Oriented Design</b>                   | Flood-resilient elevated construction platforms; integrated climate adaptation planning       |

**Table 6. Strategic Redevelopment of Harland & Wolff Shipyards (Belfast)**

| Strategy Adopted                          | Application in Harland & Wolff / Titanic Quarter                         |
|-------------------------------------------|--------------------------------------------------------------------------|
| <b>Tourism and Knowledge Economy</b>      | Titanic Belfast Museum; development of creative and educational spaces   |
| <b>Sustainable Waterfront Development</b> | Integration into Belfast’s broader urban waterfront redevelopment vision |
| <b>Community Engagement</b>               | Public consultations and inclusive planning through cultural programming |

### **Conclusions & Recommendations**

This study has examined the transformation of industrial domains into future ruins, focusing on the complex interplay between historical neglect and strategic reinvention. Through a comparative analysis of the Zeche Zollverein in Essen, Germany, and the Packard Automotive Plant in Detroit, USA, it becomes evident that the sustainable reconfiguration of post-industrial landscapes is not merely a technical challenge, but a fundamentally socio-political and cultural one.

The success of Zeche Zollverein illustrates the potential of a multi-scalar strategy rooted in adaptive reuse, cultural integration, ecological restoration, and public-private cooperation. Its transformation into a cultural heritage site and innovation hub demonstrates how formerly



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obsolete infrastructure can be repurposed to generate long-term economic and societal value. As Storm (2014) and Langhorst & Kirkwood (2014) argue, embedding resilience and sustainability into redevelopment frameworks enhances both environmental performance and urban identity.

Conversely, the deterioration of the Packard Plant serves as a cautionary example. The lack of coordinated governance, financial investment, and community engagement led to a trajectory of irreversible decline. As noted by Mah (2012) and Ravetz (2000), the absence of an integrated strategic vision often perpetuates environmental degradation and social fragmentation.

Based on these insights, this research puts forward the following key recommendations:  
Develop Integrated Strategic Frameworks:

- I. Urban redevelopment efforts should align environmental, cultural, and socio-economic objectives under a coherent vision (Tölle, 2021).
- II. Foster Multi-Stakeholder Collaboration: Inclusive planning involving governments, private sector actors, and civil society ensures more sustainable and equitable outcomes (Langhorst & Kirkwood, 2014).
- III. Institutionalise Adaptive Reuse: Policies that promote the circular use of industrial buildings mitigate urban sprawl and reduce carbon emissions (DeSilvey & Edensor, 2013).
- IV. Preserve Industrial Heritage: Recognising the cultural value of industrial ruins fosters collective memory and place-making (Storm, 2014).
- V. Embed Resilience in Planning: Incorporating flexibility and redundancy into design allows industrial sites to better adapt to future socio-environmental shocks (Ahern, 2011).

Ultimately, the study underscores the necessity for context-sensitive, interdisciplinary approaches in the transformation of industrial domains. Only through such methods can we prevent future ruins and reimagine them as vital components of sustainable urban futures.

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### **THE 'GREEN' DIMENSION OF THE 15-MINUTE CITY. THE CASE STUDY OF ATHENS MUNICIPALITY, GREECE**

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#### **Abstract**

Urban areas are not only major contributors to the climate change crisis but are also among the most vulnerable to its impacts. Urban planning is increasingly focused on adopting more sustainable strategies, enhancing green infrastructure, and boosting energy efficiency. Among these innovative approaches is the concept of the "15-minute city".

The present research explores the 15-minute city concept, emphasizing the significance of green spaces within its framework. Athens is chosen as a case study to assess the distribution of green spaces following the 15-minute city model. By mapping these green areas and generating 15-minute walk isochrone maps, it aims to evaluate the sufficiency of public open spaces in central Athens. The approach considers several criteria, such as building density, the size and type of green spaces, and their accessibility to residents.

The Athens core features some notable green spaces due to its hills and archeological sites, however, the availability of green areas significantly diminishes in the dense urban fabric. The rapid, uncoordinated development and insufficient urban planning in Athens have led to dense urbanization with limited green spaces, making it one of the most densely populated cities in Europe, with one of the lowest ratios of green space per capita.

First, the research paper reviews international literature on chrono-urbanism, focusing on 15-minute cities. Then, tools used included data mapping software and building zone data from the Athens Municipality. A total of 170 green and public open spaces were recorded and categorized into the following typologies: squares, parks, gardens, hills, groves, and archaeological sites. Findings show that green spaces vary within a 15-minute walk radius, with squares dominating.

Further applications of the developed methodology could include urban areas of similar densities and development patterns to identify inequalities in the distribution of green spaces and for the state to create new ones.

**Key words:** Chrono-Urbanism, 15-Minute City, Isochrones, Green Spaces, Athens

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### Introduction

Climate change is one of the greatest challenges of our time and cities play a crucial role in addressing it. They are home to over half of the global population, generate 80% of global GDP, consume two-thirds of the world's energy, and account for more than 70% of annual carbon emissions. These figures are expected to rise significantly in the coming decades, with estimates suggesting that by 2050, over 70% of the world's population will live in cities, leading to a sharp increase in energy demand and infrastructure needs (G20, 2023). To reduce their environmental impact, cities must implement smart urban planning solutions that enhance sustainability and resilience (Ramirez Lopez & Grijalba Castro, 2020). One such approach is the 15-minute city model.

This concept, reintroduced in 2016 by Franco-Colombian urban planner Carlos Moreno, envisions an urban design where residents can access essential services and infrastructure within a 15-minute walk, bike ride, or other forms of active mobility. This model reduces dependence on motorized transport, minimizes cities' environmental impact, and enhances quality of life (Allam et al., 2024).

This research examines the application of the 15-minute city model in the Municipality of Athens, with a particular focus on green spaces, which are a key component of sustainable urban development (WHO Regional Office for Europe, 2023). The research aims to explore the distribution and adequacy of green spaces in the city within the framework of this urban model. To achieve this, mapping techniques were applied, and isochrone maps were created to depict 15-minute walking accessibility zones. Additionally, the relationship between green spaces and building density was analyzed to assess Athens' alignment with the principles of the 15-minute city.

The research methodology follows a case study approach, involving the mapping of all public open spaces in the Municipality of Athens. Geographic Information Systems (GIS) tools, such as Quantum GIS (QGIS) and the Iso4App API, were utilized, along with online mapping platforms like Google Maps and Google Earth. Furthermore, data from the digital services of the Municipality of Athens, including the e-POLEODOMIA information database, were used to map the different Floor Area Ratios (FAR). The findings were analyzed using Microsoft Excel, while green spaces were digitally represented at a 1:1 scale in AutoCAD to accurately calculate their area and percentage relative to the total urban space.

This research paper seeks to contribute to the discourse on sustainable urban development by highlighting the significance of green spaces in the Municipality of Athens. Through cartographic analysis, it aims to evaluate the extent to which Athens meets the criteria of the 15-minute city model and to identify challenges and opportunities for designing a more sustainable and resilient urban environment. Through this analysis, the research develops a tool that can be utilized to identify, map, and assess the distribution of green

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spaces across Athens. This tool offers valuable insights into the city's current urban structure and serves as a foundation for planning future improvements.

### **Chrono - Urbanism**

The term Chrono-Urbanism refers to a comprehensive approach that explores the benefits cities offer to their inhabitants in relation to the use of their lifetime. The legacy of Fordism, which established a lifestyle based on a highly specialized production model and produced spatially fragmented urban environments, has led to the loss of valuable and meaningful time from people's daily lives (Moreno, 2020). Chrono-Urbanism, as a form of urban planning, designs urban spaces based on time and distance, analyzing the relationship between temporal factors and spatial organization. It focuses on structuring key urban components such as circulation, transport, and land use across different time frames, adapting them to people's evolving needs. Chrono-urbanist approaches aim to challenge traditional urban design principles by shifting away from car-oriented planning, which often leads to dysfunctional cities that restrict social interactions and undermine urban sustainability (Allam et al., 2022).

Comparable urban design models such as the Green City and the Walkable City share common planning principles but often lack the realism and immediacy demonstrated by cities that have embraced chrono-urbanist strategies. These approaches became particularly relevant in the aftermath of the COVID-19 pandemic, when societies faced new urban realities, and the ability to meet basic needs quickly and efficiently became a critical necessity. This context gave rise to models such as the 10, 15, and 20-minute cities, with the 15-minute city becoming the most widely recognized and frequently referenced in international literature, often referred to as either the 15-minute city or the 15-minute neighborhood (Moreno et al., 2021).

### **15-Minute City**

The concept of the 15-minute city began with American urban planner Clarence Perry in 1929, who developed the idea of neighborhood units. This urban planning concept promotes walkability in cities by designing self-sufficient neighborhoods, as urban areas became industrialized. These units included cores such as schools, shops, and community centers, while the plan also included a road network, green spaces, and housing (Perry, 1929).

The concept of the neighborhood, as proposed by Perry, was adapted to address the issues of low density and uncontrolled urban development in the 1960s through the "New Urbanism" movement, focusing on the creation of cohesive communities through spatial organization (Kafkalas et al., 2015). According to this approach, the neighborhood is a small, clearly defined unit with a central point, allowing residents easy access to daily services. This idea was applied in urban development strategies such as "Transit Villages," "Urban Villages,"

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and "Traditional Neighborhood Design." These approaches aim to create dense, mixed-use, sustainable, walkable, and well-connected urban environments (Pozoukidou & Chatziyiannaki, 2021).

The idea of the 15-minute city was revived in 2016 by Carlos Moreno, a French - Colombian urban planner and associate professor at IAE Paris Sorbonne - Université Paris 1 Panthéon Sorbonne in France and gained significant attention after the COVID-19 pandemic (Moreno et al., 2021). It is a concept of urban planning in which small, self-sufficient communities are created, allowing residents to meet all their basic needs within a 15-minute walk, bike ride, or other forms of active mobility. These needs include work, education, shopping, entertainment, healthcare, access to parks and green spaces, as well as transportation networks (Moreno, 2021). This approach supports human-centered urban design, where social, cultural, and health-related needs are accessible and easily met (Pozoukidou & Angelidou, 2022).

The 15-minute city incorporates the concept of the “human scale,” providing a modern interpretation of the ideal city, focusing on health and environmental risks reduction. Time is no longer simply the twin concept of “space” but becomes a factor that influences the city’s climate and health outcomes (Abdelfattah et al., 2022). The core of this concept is direct and easy access to all essential urban functions. The design of 15-minute cities prioritizes the reorganization of urban functions to ensure easy access to amenities and services for residents.

Ultimately, this approach envisions the creation of small “neighborhoods” where residents can meet all their needs within 15 minutes, whether on foot, by bike, or through active mobility. The strict zoning in urban planning is eliminated, and mixed-use spaces are created, reducing unnecessary movement and strengthening the sense of community. The goal is to improve the quality of life and enhance community cohesion. In modern cities, areas are often segregated and used primarily for specific purposes, such as businesses or entertainment, which forces residents to travel long distances to reach their destinations. With this new approach, cars no longer play a dominant role in city planning and mobility, as more pedestrian paths and bike lanes are created. The core of this new approach is the individual and the need for a more sustainable and healthier urban environment (Allam et al., 2022).

### **The Functional Analysis of 15-Minute Cities**

The 15-minute city or 15-minute neighborhood aims to reconnect people with their neighborhoods by promoting a new approach to urban living. In terms of urban design, the 15-minute cities are based on principles that have been used as design cornerstones in the past, such as accessibility, walkability, density, land-use mix, and design diversity. Their main difference is that they focus on bringing activities into the neighborhoods, rather than moving people to activities, thereby reintroducing the concept of proximity-based urban design (Pozoukidou & Chatziyiannaki, 2021).



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In a later model, the concept of the 15-minute city is expanded to include four key principles that characterize the city of the future. The first principle is proximity, which refers to the short distances between different destinations, allowing easy and quick access. The second principle is density, which signifies high population concentration, enabling the support of various businesses and services. The third principle is diversity, which refers to the variety of urban amenities and design, ensuring that all residents' needs are met locally. Finally, the principle of ubiquity (digitalization) ensures that the city is accessible and affordable to everyone, allowing anyone to reside in it (Allam et al., 2022).

### Definition of Green Spaces

There is no single definition of green spaces, as their meaning varies depending on the environment and their use. According to the World Health Organization (WHO Regional Office for Europe, 2016), green spaces are defined as “all urban areas covered with any type of vegetation.” This includes parks, gardens, street trees, green areas around buildings, sports fields, flower beds, ponds, green roofs, and individual plants.

Additionally, urban green spaces encompass both natural surfaces and various types of urban greenery, such as tree-lined streets. The concept also extends to so-called “blue spaces”, which include water elements such as lakes, rivers, and coastal zones. The most common types of green spaces include public parks, private and public gardens, forests, playgrounds, riverbanks, trails, and beaches (WHO Regional Office for Europe, 2016).

### Categories of Green Spaces

Green spaces can be divided into two main categories, which also serve as different interpretations of the concept. The first category refers to natural landscapes that include bodies of water or areas with vegetation, such as forests, wilderness areas, geological formations, agricultural land, coastal zones, and food cultivation areas. This interpretation of green space could be considered synonymous with nature and opposed to urbanization. The second category represents urban vegetation, including parks, gardens, courtyards, and urban forests. This understanding of green space can be seen as a subset of the broader concept, as it is limited to the urban environment and is a part of open space. It also reflects the dominant role of green spaces within cities and the inevitable human influence on them (Taylor & Hochuli, 2017).

The first category can be classified as natural green spaces, which include forests, beaches, and natural parks. In contrast, the second category consists of human-made green spaces, such as agricultural areas, archaeological sites, public flower beds, public gardens, urban parks, and squares.

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### **The Contribution of Green Spaces**

The contribution of green spaces to urban environments is significant, as they intersect multiple aspects of city life, including environmental, social, health, cultural and economic dimensions. Their role extends far beyond aesthetics, influencing various sectors that contribute to the overall well-being and sustainability of urban communities.

Green spaces play a crucial role in shaping the urban environment, offering a dynamic balance between nature and the built environment. By integrating into the urban fabric, they break the monotony of constructed surroundings, providing aesthetic, ecological, and social benefits that enhance the city’s sustainability. In addition to their visual appeal, green spaces serve as essential connectors that influence mobility, accessibility, and transport networks, helping create a more functional, inclusive, and human-friendly urban system (Crăciun, 2014).

Beyond their structural role in urban planning, green spaces are also among the most valuable natural resources in cities. Due to issues such as climate change, global warming, and environmental pollution in urban areas, the importance of these spaces has significantly increased, as they help reduce heat and air pollution. The discussion about sustainable development and the well-being of cities has become crucial in recent decades, aiming to achieve sustainable development goals. Therefore, urban green spaces play a central role in the sustainable development of cities. Proper care and improvement of these spaces make cities more pleasant and sustainable, contributing to the enhancement of quality of life and public health in urban areas (Aram, 2024).

Regarding the social contribution of green spaces, they play a crucial role in urban environments, whether independent or combined with other public areas. These spaces create opportunities for social interactions, recreation, and relaxation, fostering stronger connections between residents. By offering a place for people to meet and engage, green spaces encourage community building and promote inclusivity. They also contribute to improving both physical and mental health by reducing stress and promoting physical activity. When managed properly, green spaces enhance social cohesion, improve the overall quality of life, and make cities more livable and sustainable for their inhabitants (Aram et al., 2019).

Regarding the benefits of green spaces for health, they significantly contribute to improving both physical and mental well-being. The modern urban lifestyle is associated with increased stress, reduced physical activity, and exposure to harmful environmental factors. Urban green spaces, such as parks, playgrounds, and green neighborhoods, provide a natural environment that enhances relaxation, reduces stress, promotes social interaction, and encourages physical activity. At the same time, they help reduce residents’ exposure to air pollutants, noise, and excessive heat, thus improving the overall quality of life in cities (WHO Regional Office for Europe, 2016).

An equally important aspect is that green spaces play a significant role in the cultural development of a community, as they serve as venues for cultural activities such as festivals,

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concerts, theatrical performances, and art exhibitions. Through these activities, environmental awareness is promoted, and sustainable development is reinforced, making these spaces hubs of cultural expression and social interaction.

The economic contribution of green spaces is linked to the financial and economic benefits that arise directly from their presence. These include enhancing the image of an area, increasing tourism, and attracting foreign investments. Additionally, green spaces have a positive impact on property values in the surrounding area (Juaneé Cilliers, 2015).

In conclusion, green spaces and public open spaces provide a wide range of benefits that extend beyond their aesthetic and recreational value. They play a crucial role in enhancing the quality of life and well-being of individuals by promoting physical and mental health, fostering social interactions, and creating opportunities for cultural and community activities. Additionally, they contribute significantly to economic growth by increasing property values, attracting tourism, and encouraging investment. At the same time, they serve as vital components of environmental sustainability, supporting biodiversity, improving air quality, and mitigating the effects of climate change. Their multifaceted impact highlights their essential role in shaping healthier, more resilient, and more sustainable urban environments.

### **Case Study: Municipality of Athens**

The case study focuses on the Municipality of Athens, located in the Attica region, covering an area of 38.96 km<sup>2</sup> with a permanent population of 637.798 residents and an elevation of 90 meters (Hellenic Statistical Authority, 2021).

For this study, isochrone maps were created to cover the entire Municipality of Athens, resulting in a total of 12 maps. These maps depict the areas that are accessible within a 15-minute walk from their center, considering factors such as changes in the route, inclines, declines, and obstacles. The analysis assumes a walking speed of 5.4 kilometers per hour, and the final result is represented by a polygon that defines the areas covered within the 15-minute walking distance.

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**Map 1:** The Outline of Athens Municipality



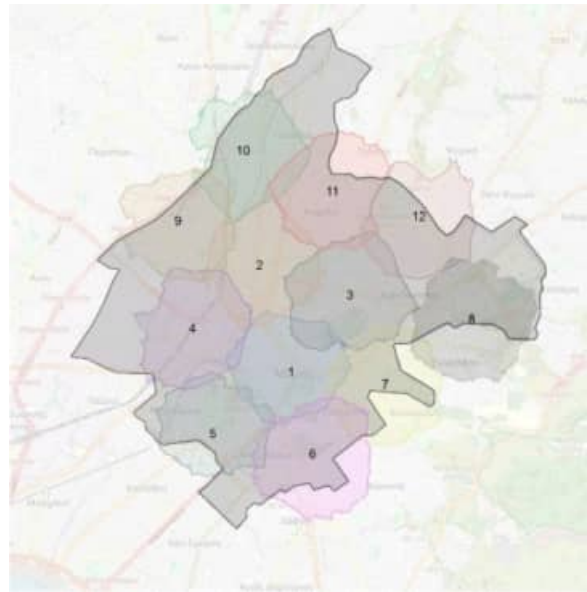
**Map 2:** The main Green Spaces in Athens Municipality



**Map 3:** The 12 Isochrone Maps



**Map 4:** The 12 Isochrone Maps within Athens Municipality



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**Map 5:** National Garden Area (Isochrone 1), 30 Green Spaces 21,5%



**Map 6:** Pedion Areos Area (Isochrone 2), 14 Green Spaces 8,6%





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**Map 7:** Lycabettus Hill Area (Isochrone 3), 16 Green Spaces 21,9%



**Map 8:** Thissio Area (Isochrone 4), 16 Green Spaces 3,9%





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**Map 9:** Philopappou Hill Area (Isochrone 5), 15 Green Spaces 22,2%



**Map 10:** Adritos Hill Area (Isochrone 6), 17 Green Spaces 5,4%



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**Map 11:** Ilisia Area (Isochrone 7), 18 Green Spaces 12,4%



**Map 12:** Zografou Area (Isochrone 8), 11 Green Spaces 22,2%



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**Map 13:** Plato’s Academy Area, (Isochrone 9) 10 Green Spaces 3,6%



**Map 14:** Kato Patissia Area (Isochrone 10), 13 Green Spaces 1,1%



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**Map 15:** Polygono Grove Area (Isochrone 11), 14 Green Spaces 3,5%



**Map 16:** Attic Grove Area (Isochrone 12), 14 Green Spaces 15,2%



A total of 170 green and public open spaces were recorded and categorized into the following typologies: squares, parks, gardens, hills, groves, and archaeological sites.

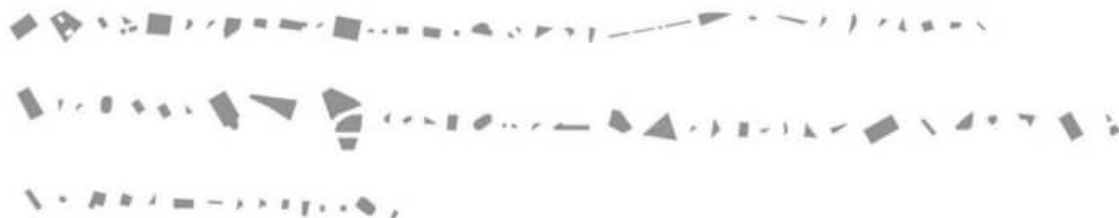
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### List 1: Green and Public Open Spaces

Squares



Parks



Gardens



Hills



Groves



Archeological  
Sites



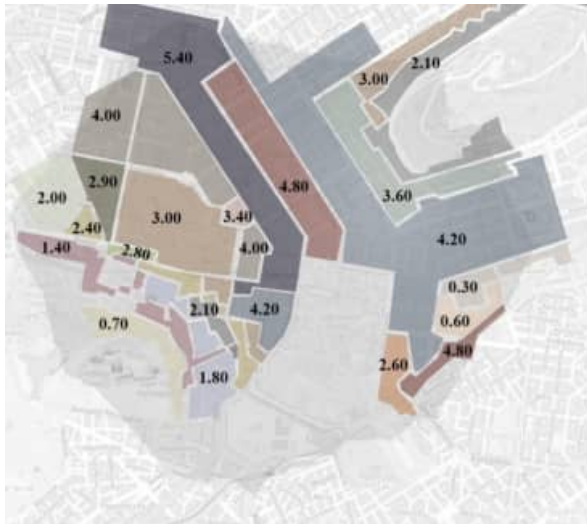
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The research continued with the recording of all different Floor Area Ratios through the e-Poliodomia platform for each isochrone map separately. A different color was used for each Floor Area Ratio (FAR).

**Map 17:** Isochrone 1, FAR: 0,3 – 5,4



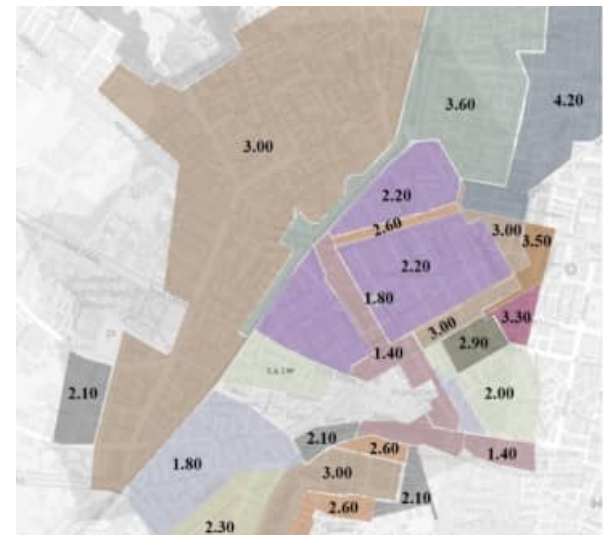
**Map 18:** Isochrone 2, FAR: 2,1 – 5,4



**Map 19:** Isochrone 3, FAR: 2,1 – 4,2



**Map 20:** Isochrone 4, FAR: 1,4 – 4,2





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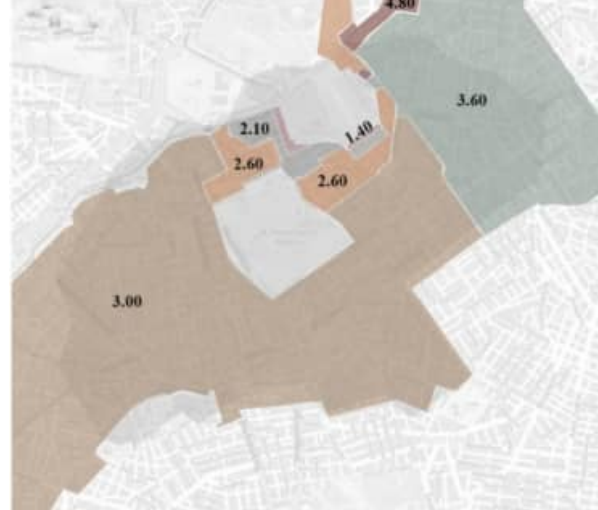
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**Map 21:** Isochrone 5, FAR: 1,4 – 3,6



**Map 22:** Isochrone 6, FAR: 1,4 – 4,8

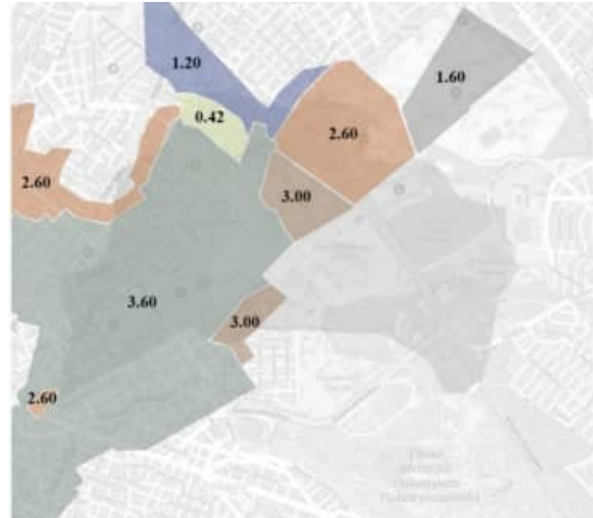


Some maps present a wider range of Floor Area Ratio (FAR), while others do not. The overall range found across all 12 isochrones is large, varying between 0.3 and 5.4.

**Map 23:** Isochrone 7, FAR: 0,3 – 4,8



**Map 24:** Isochrone 8, FAR: 0,42 – 3,6



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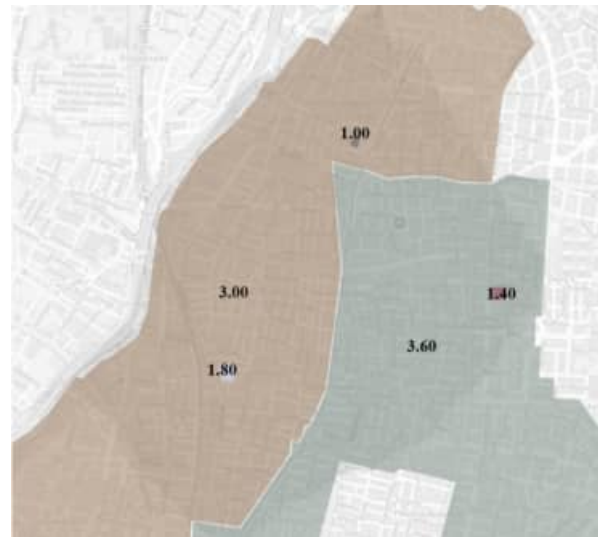
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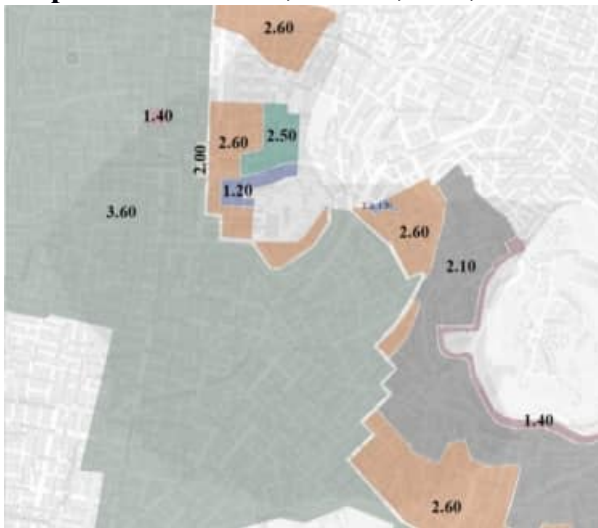
**Map 25:** Isochrone 9, FAR: 1,4 – 3,0



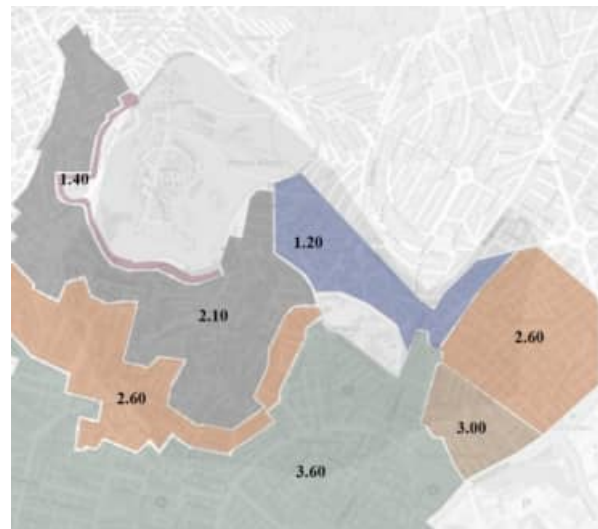
**Map 26:** Isochrone 10, FAR: 1,0 – 3,6



**Map 27:** Isochrone 11, FAR: 1,2 – 3,6



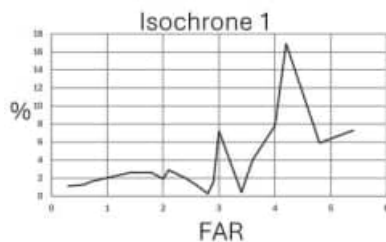
**Map 28:** Isochrone 12, FAR: 1,2 – 3,6



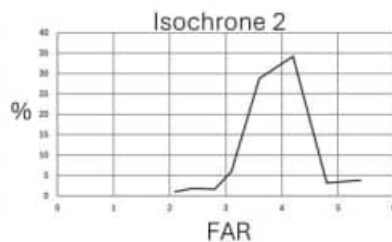
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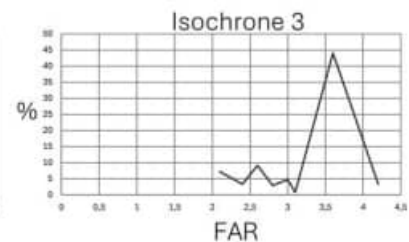
A recording of all different Floor Area Ratios was conducted and the percentage of area for each one was calculated in each isochrone map separately. The results were presented in graphs, clearly showing the sharp variations and the wide range. The horizontal axis represents the FAR, while the vertical axis indicates its percentage of occurrence. The numbering of the diagrams corresponds to the order of presentation of the above maps.



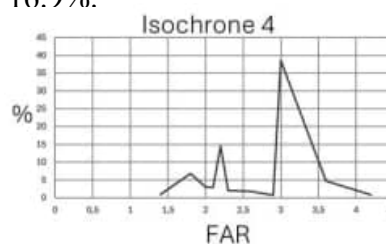
1. Green space: 21.5%. The prevailing floor area ratio is 4.2 with a percentage of 16.9%.



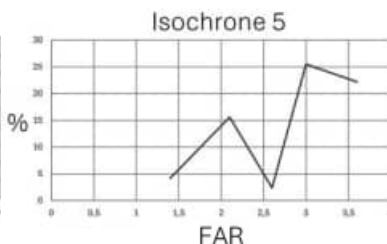
2. Green space: 8.6%. The prevailing floor area ratio is 4.2 with a percentage of 24.2%.



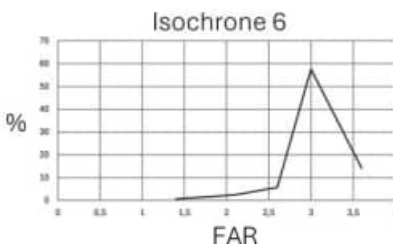
3. Green space: 21.9%. The prevailing floor area ratio is 3.6 with a percentage of 44.0%.



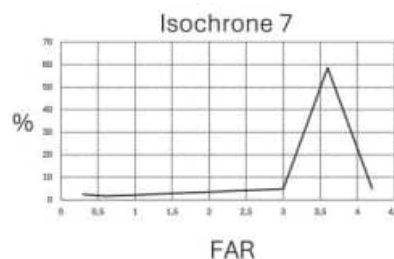
4. Green space: 3.9%. The prevailing floor area ratio is 3 with a percentage of 38.5%.



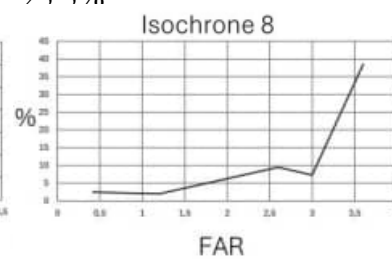
5. Green space: 22.2%. The prevailing floor area ratio is 3 with a percentage of 25.5%.



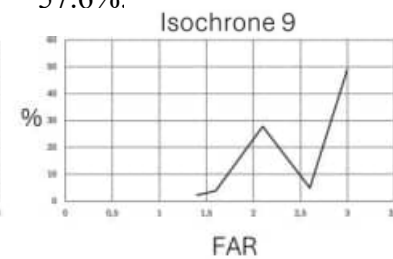
6. Green space: 5.4%. The prevailing floor area ratio is 3 with a percentage of 57.6%.



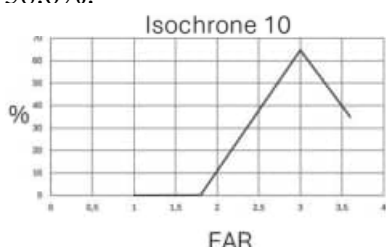
7. Green space: 12.4%. The prevailing floor area ratio is 3.6 with a percentage of 58.6%.



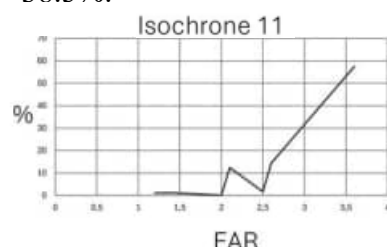
8. Green space: 22.2%. The prevailing floor area ratio is 3.6 with a percentage of 38.5%.



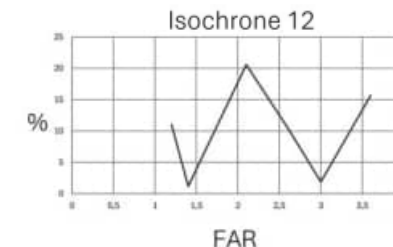
9. Green space: 3.6%. The prevailing floor area ratio is 3 with a percentage of 49%.



10. Green space: 1.1%. The prevailing floor area ratio is 3 with a percentage of 64.7%.



11. Green space: 9.4%. The prevailing floor area ratio is 3.6 with a percentage of 57.5%.



12. Green space: 15.2%. The prevailing floor area ratio is 2.1 with a percentage of 20.6%.

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### Findings

From the overall research, a total of 170 green and public outdoor spaces were recorded across the different neighborhoods. These spaces were classified into six categories based on their characteristics and function. Specifically, 82 squares, 49 parks, 7 gardens, 11 hills, 13 groves, and 8 archaeological sites were identified. The outlines of these spaces are presented in the above maps and the list showcasing the distribution and variety of these public areas throughout the studied region (Municipality of Athens). The second part of the findings relates to the corresponding Floor Area Ratios on the different maps and accessibility within a 15-minute walking distance. As recorded on the 12 maps, the FAR values vary significantly, ranging from 0.3 to 5.4.

### Conclusions

From the above research on green and public outdoor spaces, we conclude the following: Squares dominate in relation to other types of public outdoor spaces and constitute the most common type of green space in the study area, namely the Municipality of Athens. Additionally, from the recorded data, it appears that hills and groves occupy the largest area, followed by public gardens and archaeological sites. Parks follow, while squares, although numerically greater, occupy a smaller total area compared to the other spaces.

The range of green space distribution varies significantly from neighborhood to neighborhood, with the number of spaces ranging from 1 to 30 within a 15-minute walking distance. However, the presence of many green spaces on each map does not necessarily mean that they cover a large percentage of the total area. For example, in the fourth map, covering the area of Thissio, 16 green spaces were recorded, but the coverage percentage is only 3.9%. In contrast, in the eighth map, covering the area of Zografou, 11 green spaces were recorded, but their coverage percentage is more than five times higher (22.2%).

Regarding the different values of floor area ratios, from the above data, we conclude that, despite the broad range of values observed, the FAR values mainly range between 2.1 and 4.2. Furthermore, the need for more green spaces arises from a combined analysis of multiple parameters and is not solely dependent on the percentage of existing green space. For example, an area with fewer green spaces does not necessarily have a greater need for new green spaces compared to a densely populated area with more such spaces. This need is shaped by factors such as population density, urban development, quality of life, accessibility to public open spaces, as well as environmental and climatic conditions of the area.

Therefore, in order to determine the size and priority for the creation of new green spaces in each area, a comprehensive assessment of all data, such as population density, land use, and availability of other public resources, is required. Such a holistic approach is necessary to

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accurately determine the need for enhancing green and public outdoor spaces in each neighborhood or area of the city.

### **General Conclusions**

Athens has developed with high urban density, with cars serving as the primary means of transportation for decades. This approach has had immediate consequences, such as traffic congestion, air pollution, a lack of green spaces, and long distances that often do not favor walking or cycling. Although efforts have been made to promote public transportation and alternative modes of mobility, the city’s infrastructure remains largely oriented toward private vehicle use, which negatively impacts residents’ daily lives.

The lack of public green spaces is one of the biggest issues in the urban fabric. While the historic center offers some significant green areas, such as the National Garden and the hills of Lycabettus and Philopappou, these are not sufficient to meet the needs of the population. As the distance from the city center increases, the problem intensifies, with many neighborhoods having limited or neglected public spaces.

The Municipality of Athens, particularly in its surrounding areas, faces a severe shortage of greenery. The available spaces are often small, limited, and inadequately maintained, while in some cases, they have been abandoned. Residents of these areas have few options for recreation and exercise, which worsens their quality of life, especially during the hot summer months when temperatures in the city become unbearable.

The lack of comprehensive planning and investment in urban greenery makes the Municipality of Athens one of the most densely populated areas in Europe, with one of the lowest percentages of green space per capita.

### **Further Questions and Applications**

This research raises an important question: Is it better to have many small public outdoor spaces or a few large ones? The answer depends on various factors, including community needs and accessibility. Smaller green spaces are typically closer to residents, making them more accessible, especially in densely built areas. They ensure that more people have access to some form of outdoor public space, even if small. On the other hand, larger green spaces are better suited for bigger activities and provide more room for nature to thrive. However, they are often less accessible for those living farther away and are sometimes visited only on weekends or special occasions.

Further applications of this methodology could extend beyond the Municipality of Athens to the entire metropolitan area of Attica and other urban regions with similar density and development patterns. This could help identify inequalities in green space distribution and



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support authorities or urban planners in designing and creating new public open spaces to improve accessibility and quality of life.

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## **UNDERGROUND DWELLINGS: THE COEXISTENCE OF MAN AND NATURE BENEATH THE EARTH**

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### **Abstract**

In the light of evolving global climate change, architecture's attempts to harmonise buildings with the climate, the natural environment and the needs of users seek insights into the principles of bioclimatic design. Bioclimatic, climate sensitive design is an essential tool for meeting the challenges of sustainability, addressing climate change effects and improving the quality of life in modern societies.

This paper examines subterranean architecture, from the past to the modern era, with emphasis on habitation and the main tools being soil and topography. The examples are analyzed in terms of design principles and energy efficiency of buildings. Issues related to both traditional and contemporary cave architecture are explored, focusing on design principles and bioclimatic features that have been incorporated or can be applied to cave structures. Answers are sought through comparative analyses of literature sources, combined with a systematic evaluation of examples in terms of their typology, terrain, climate and architectural practices.

Through the exploration of the evolution and applications of subterranean architecture over the centuries, it emerges that the use of natural resources and climatic conditions in the design of housing is not just a requirement, but a strategy for the harmonious integration of buildings into the natural environment, allowing people to create housing that combines functionality, aesthetics, and ecological sensitivity. This architectural model is emerging as one of the most effective solutions to the modern challenges of climate change and energy efficiency. At the same time, it encourages the revival of traditional techniques using modern tools and technologies. Underground architecture is a prime example of preservation and enhancement of quality of life, while offering sustainable perspectives for the future.

**Key words:** Underground architectural heritage, types of subterranean architecture, energy efficiency, underground dwellings form and function, bioclimatic design

### **Introduction**

Underground architecture has long been a significant form of habitation, offering protection, energy efficiency, and a strong connection to the natural environment. This research explores how subterranean dwellings have evolved over time, from traditional settlements to modern bioclimatic structures, aiming to identify key design principles and sustainability strategies.

The study examines the spatial and environmental characteristics of underground architecture, focusing on its adaptability to different landscapes and climates. Through

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historical and contemporary examples, it seeks to understand the enduring appeal of underground living and the ways in which bioclimatic principles enhance its functionality. The research is guided by key questions: What factors have led people to live underground throughout history? How can bioclimatic strategies improve these spaces? What architectural elements contribute to their environmental performance?

To address these questions, the methodology combines theoretical analysis and case study research. Initially, fundamental concepts such as the relationship between built form and terrain are explored, followed by a historical overview of subterranean dwellings. The selected case studies- both traditional and modern- are analyzed based on climate data, thermal behavior, spatial organization, and bioclimatic features, such as passive ventilation, natural lighting, and green roofs. This approach highlights the potential of underground structures in creating energy-efficient, climate-responsive living environments.

By integrating qualitative and quantitative data, the study aims to offer a comprehensive understanding of underground dwellings as a sustainable architectural approach. The comparative analysis of case studies provides insights into their benefits, limitations, and potential improvements, demonstrating their relevance in contemporary bioclimatic design.

## Literature Review of Research and Publications

### *Subterranean Heritage*

Subterranean architecture has long offered shelter, climate control, and sustainability, fostering a deep connection between humans and their environment. Today, its modern applications integrate bioclimatic principles to enhance energy efficiency and spatial diversity.

### *Typologies of Earth Architecture*

There are three main typologies of earth-sheltered structures, classified based on their relationship with terrain (Khodabakhshian, 2012):

Type 1: Structures with Earth mount (Khodabakhshian, 2012), Bermed Design (Alkaff, 2016): These buildings are surrounded by compacted soil, with roofs fully covered by earth. Openings are carved into the walls, commonly found in Libya (Gharyan, Walout, Ghadami) (Khodabakhshian, 2012).

Type 2: Rocky Earth- Sheltered structures (Khodabakhshian et al., 2012), Terrain Contour Design (Alkaff, 2016): Built into hillsides or mountains, these structures optimize solar gains by orienting towards the equator. They are prevalent in temperate climates, such as Southern Europe. (Khodabakhshian, 2012).

Type 3: Bellow ground Earth- Sheltered Structures (Khodabakhshian et al., 2012) Courtyard/Patio Design (Alkaff, 2016): Entirely excavated underground, these buildings rely on central courtyards for light and ventilation. Found in densely populated areas with hot, arid climates, they use underground patios and roof openings to regulate indoor conditions. (Khodabakhshian, 2012).

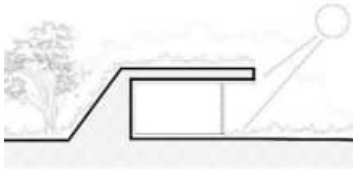
These typologies reveal how earth architecture adapts to environmental, cultural, and climatic conditions. The relationship between structure and terrain is fundamental, shaping functional and sustainable built environments. The study focuses on earth-protected dwellings, emphasizing their seamless integration with the land (Khodabakhshian, 2012).

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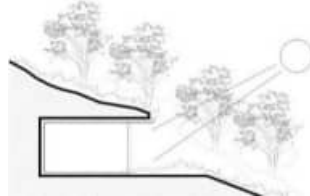
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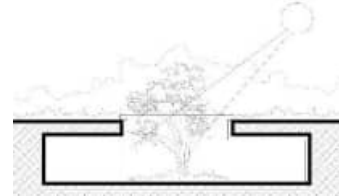
**Type 1**



**Type 2**



**Type 3**



### ***Typology and Energy Efficiency***

The increase in CO<sup>2</sup> levels has caused global warming, prompting a focus on reducing energy consumption. In building energy efficiency, the earth can act as a natural temperature regulator, supporting passive cooling techniques and sustainable development. Water scarcity and limited space in urban areas (Yu, 2020) have led to the development of underground buildings, improving energy efficiency, thermal comfort, and air quality.

The earth's subsurface temperature is lower in summer and higher in winter, acting as a thermal mass that stabilizes temperature fluctuations. The first ten layers of soil absorb and release heat slowly, providing thermal lag (Roy, 2006). This feature makes earth-sheltering ideal for cooling in hot and dry climates, with 30% of underground buildings located in such regions (Alkaff, 2016).

Hait's 1983 study on passive annual heat storage (PAHS) observed stable temperatures at a depth of six meters, reflecting an average air temperature of 21°C (Alkaff, 2016). The earth's thermal conductivity helps reduce cooling energy, especially in areas with high temperature variation and extreme radiation (Roy, 2006).

### ***Factors Affecting Energy Efficiency***

Energy efficiency in underground buildings is influenced by several factors, with climate playing a major role. Passive heat storage in the earth helps regulate temperature changes due to the earth's large mass, providing thermal stability (Shipp, 1980). Materials with long thermal lag times help absorb and release heat gradually. Additionally, the characteristics of the soil, such as moisture content and surface conditions, impact heat transfer to the building's shell, affecting overall energy performance (Shipp, 1980).

### ***Bioclimatic Design Elements in Underground Architecture***

Bioclimatic design is vital for sustainable underground architecture. It utilizes natural climatic conditions to create comfortable living spaces while minimizing energy use. The earth provides natural protection and thermal stability, and the use of natural materials reduces environmental impact (Wen, 2023). Aligning buildings with local winds allows for natural ventilation, reducing cooling needs. Renewable energy sources, like solar and wind power, enhance energy autonomy and reduce operational costs, promoting sustainability (Shipp, 1980).

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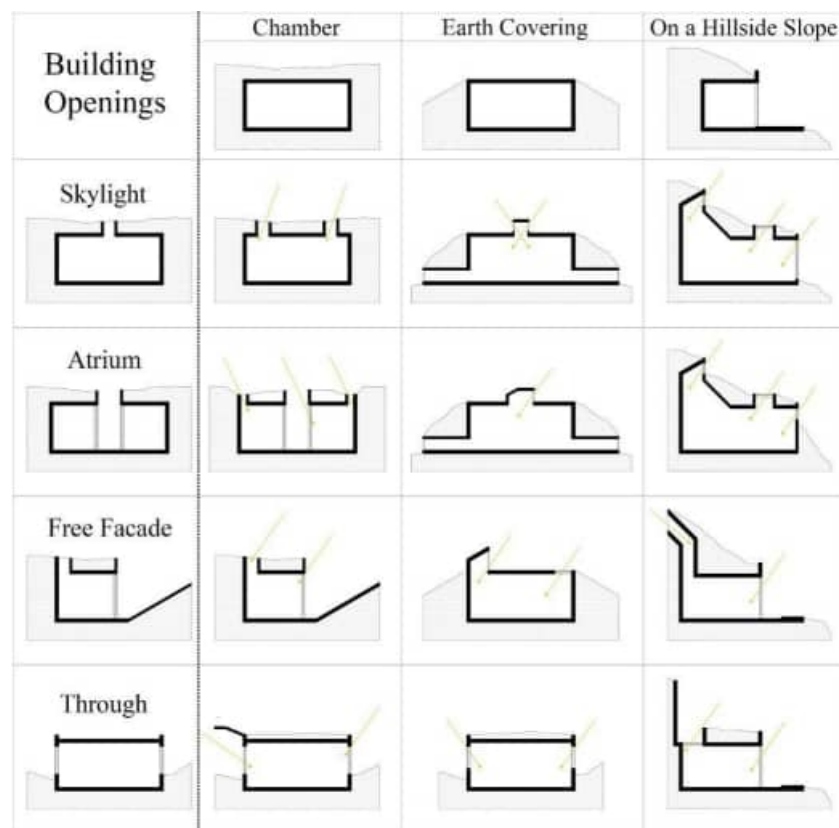
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### ***Relationship Between Form and Function***

Natural lighting is a fundamental technique of bioclimatic design that enhances the quality of life and the functionality of spaces. It reduces the need for artificial lighting, thereby conserving energy and lowering electricity costs (Andreadaki, 2017). At the same time, natural ventilation ensures air renewal by removing pollutants, odors, and moisture from indoor environments. It also helps regulate temperature, providing cooling during the summer months and reducing the need for mechanical cooling systems (Andreadaki, 2017).

### **Natural Lighting:**

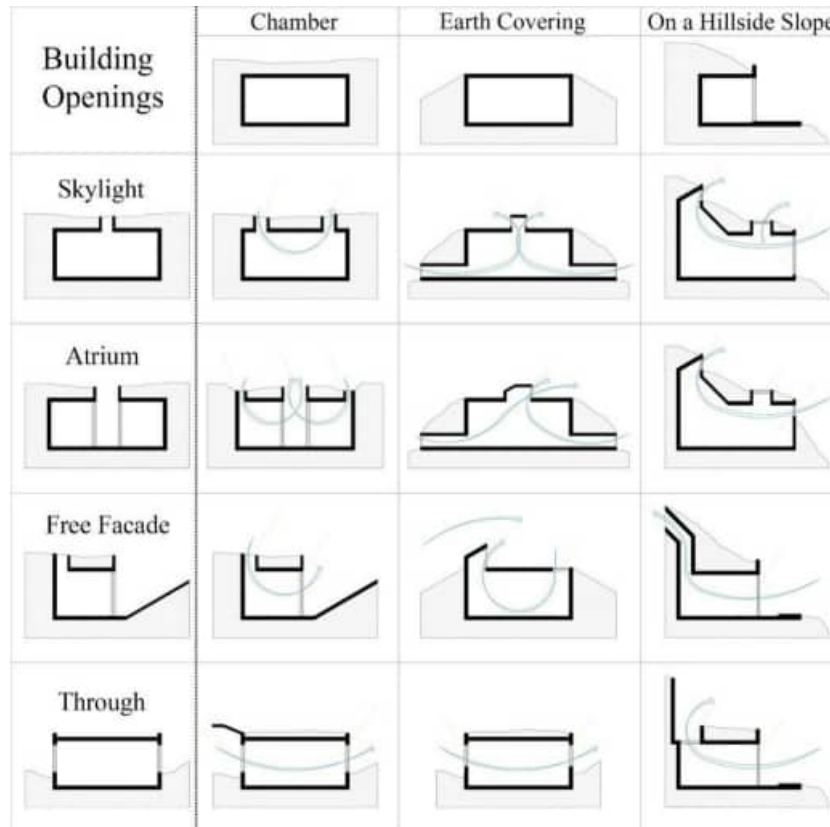


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### Natural Ventilation:



### *The Psychological Impact of Underground Structures on Users*

Underground living influences psychology and social behavior, with concerns about isolation, control, cultural perceptions, and safety.

Historically linked to burial, underground spaces can evoke entrapment and claustrophobia due to limited openness and natural light. However, in places like Singapore, they serve as social hubs, while in the U.S. and Japan, they offer comfort and modern workspaces (Lee, 2017). Perceptions vary by culture and environment.

1. Isolation: Limited outdoor access can cause separation but may also strengthen community bonds. Architectural solutions like openings, skylights, and intermediate spaces improve connectivity and lighting (Lee, 2017).

2. Perceived Control: Lack of environmental control, such as fixed lighting and closed spaces, can induce stress. Windows and clear wayfinding enhance users' sense of autonomy and reduce anxiety (Lee, 2017).

3. Negative Associations: Ties to themes of death and primitiveness can create discomfort. Highlighting privacy, weather protection, and urban relief can improve perception. High-end amenities also increase attractiveness (Lee, 2017).

4. Perceived Safety: Underground spaces can offer security but may feel unsafe if poorly lit. Enhancing lighting and visibility is key to fostering a sense of safety (Lee, 2017).

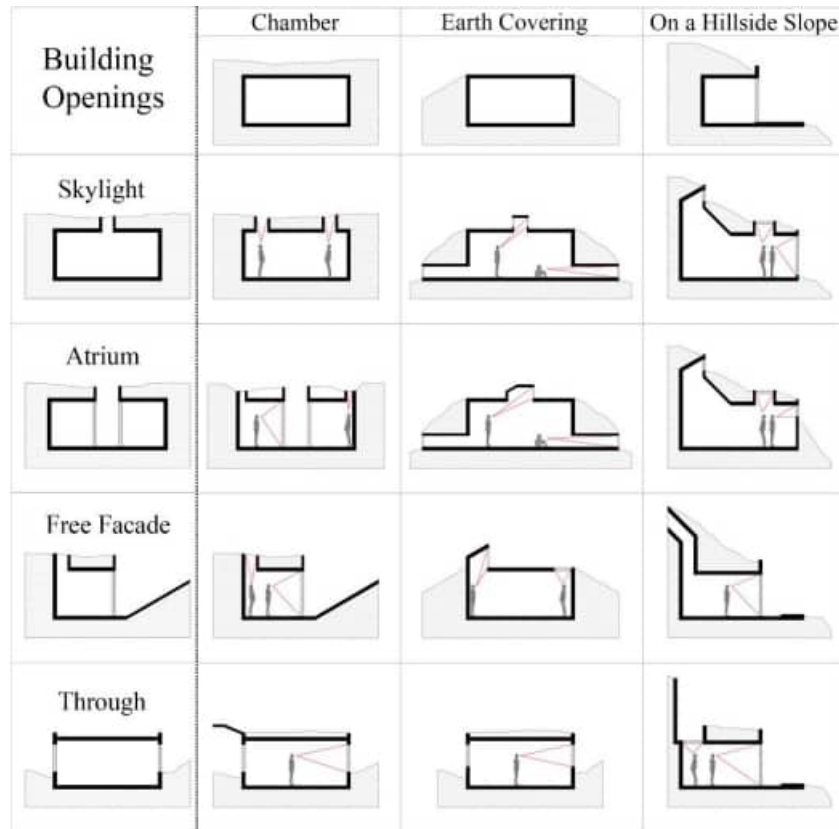


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### Visual Escape:



### Case Studies:

#### 1. Northern China Settlement/ Vernacular Architecture

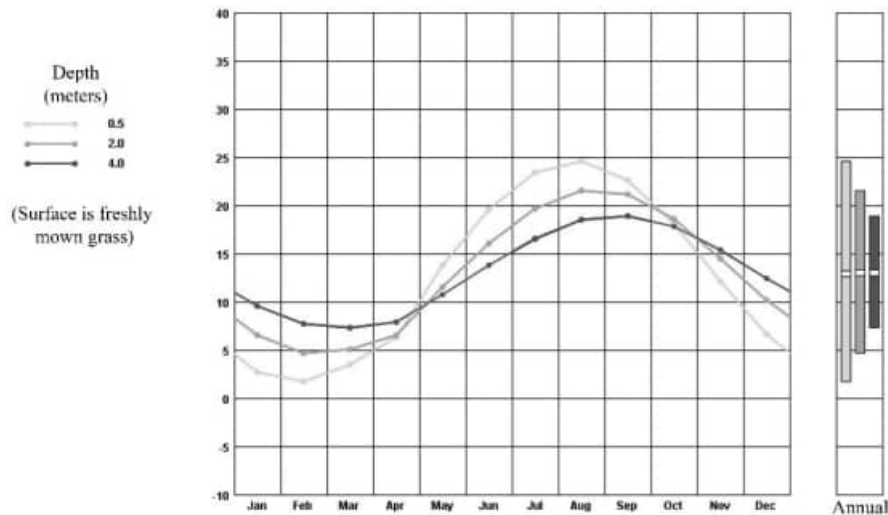
|                     |                                  |
|---------------------|----------------------------------|
| Construction time   | Estimated from The Neolithic Era |
| Designer/ Architect | Vernacular Architecture          |
| Use/ Function       | Inhabitation                     |

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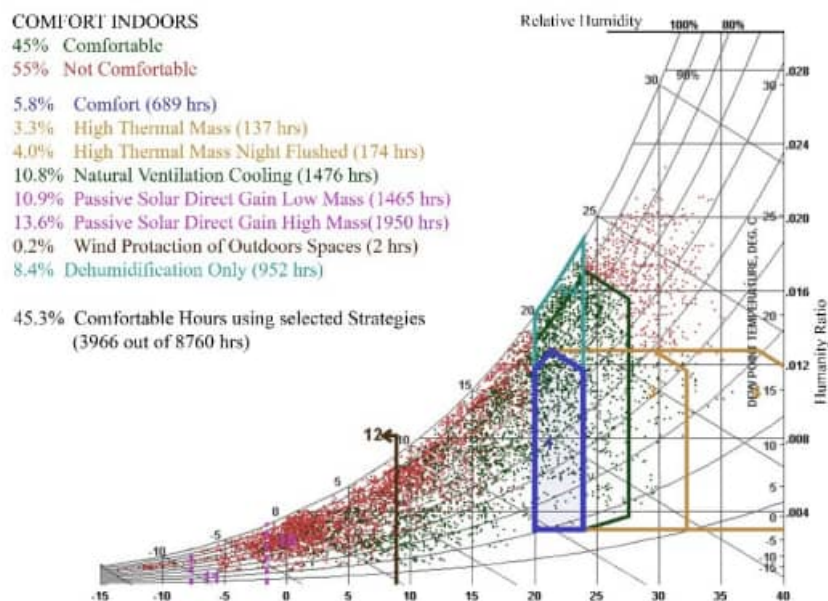
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### Climatic Data of the Study Area

#### a. Ground Temperature Diagram:



#### b. Psychrometric Chart:



The underground dwellings in the Loess Plateau region of China, known as Yaodong, represent a characteristic example of bioclimatic design that integrates traditional architecture with the optimal utilization of natural resources and environmental conditions. This region includes areas such as Shaanxi, Shanxi, and Henan, as well as Hebei, Ningxia, Inner Mongolia, and Gansu (Bouillot, 2008).

The climate in Northern China is classified as continental, with distinct characteristics: summers are hot and dry, with temperatures exceeding 30°C, while winters are cold and dry, often dropping below freezing. Rainfall is limited and mainly concentrated in the summer.

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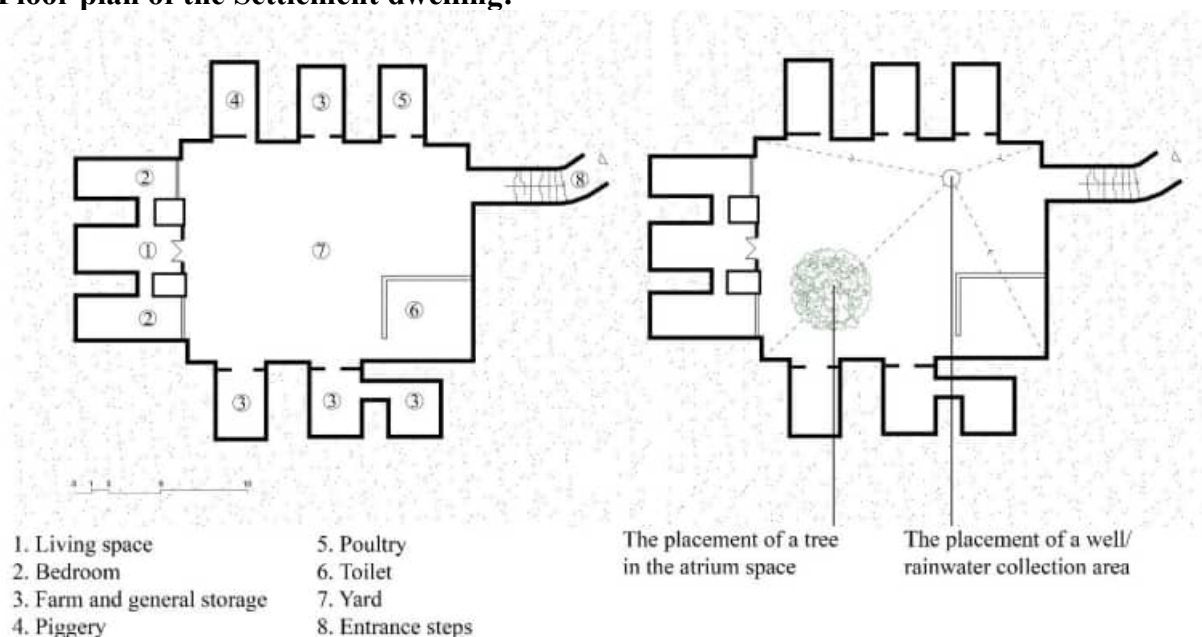
Prevailing winds come from the northwest in winter and the southeast in summer (FaviconRuqin China Travel, 2024).

The soil of the Loess Plateau consists primarily of loess (Bouillot, 2008), a fine-grained, lightweight, and easily erodible material with a thermal conductivity coefficient of  $k = 0.918 \text{ W/(m}^{\circ}\text{K)}$  (Technical Guideline T.O.T.E.E 20701-2/2010, 2010). It allows for easy excavation and shaping while providing good insulation. However, it is highly susceptible to erosion from water and wind, requiring careful structural management and maintenance.

The housing type varies based on the dimensions of the central courtyard. This analysis focuses on the rectangular courtyard type. The dwellings are arranged around it, with the vertical walls reaching 7.5-9m in height. In Miao Shan village, this rectangular type is oriented north-south (Polydora, 2015).

The pit depth depends on the quality of the loess soil in each area and ranges from 2 to 22m. to create a sunken courtyard (Polydora, 2015). The four sides of the pit extend above ground level, forming slopes that prevent rainwater from flowing into the courtyard. These walls are not entirely vertical ( $90^{\circ}$ ) but slightly inclined to prevent collapse due to long-term erosion from weather conditions (Bouillot, 2008).

### Floor plan of the Settlement dwelling:



The rooms, carved into the perimeter of the courtyard, do not follow a uniform functional orientation across all housing types. Typically, bedrooms and common areas are located on the same side, while storage spaces and livestock areas are located opposite them.

A key design element is the central courtyard well, used for rainwater collection (Gao, 2021). The well has an opening diameter of approximately one meter, covered by a round stone. The facade materials vary brick and adobe are mainly used on the east-west sides,

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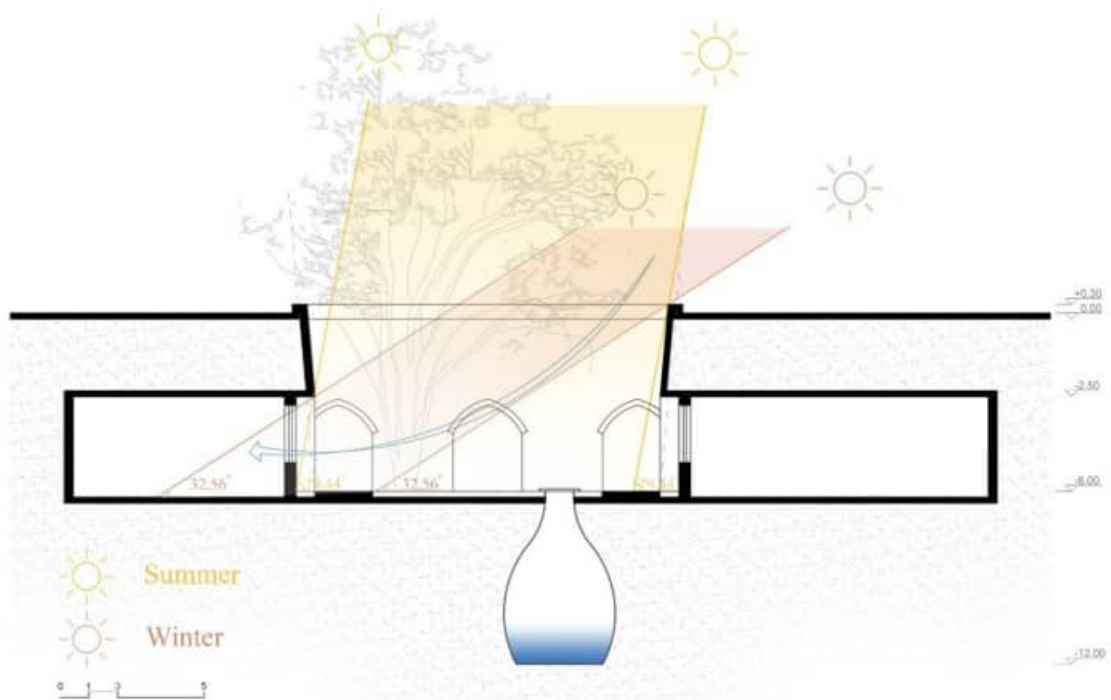
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while adobe dominates the north-south sides. Additionally, the bases of the east and west openings are reinforced with bricks to prevent erosion (Gao, 2021).

The roof has an approximate thickness of 2.20m, which slows down heat retention in summer and heat loss in winter, enhancing passive heating and cooling (Bouillot, 2008). Additionally, the placement of trees is crucial, as they provide shade for interior spaces during summer, when solar radiation is most intense.

### Elements of bioclimatic design

#### a. Bioclimatic section of the underground house:

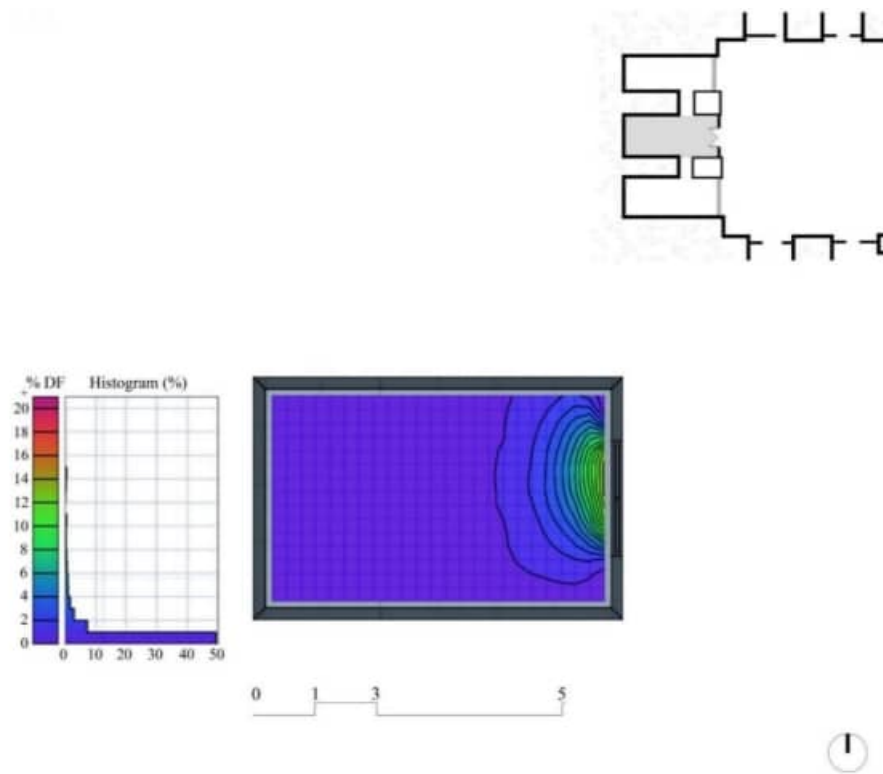


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### b. Diagram of the daylight factor for the western central room of the underground house:



## 2. Oia Settlement, Santorini/ Vernacular Architecture

|                     |                                                          |
|---------------------|----------------------------------------------------------|
| Construction time   | 19 <sup>th</sup> century- early 20 <sup>th</sup> century |
| Designer/ Architect | Vernacular Architecture                                  |
| Use/ Function       | Inhabitation                                             |

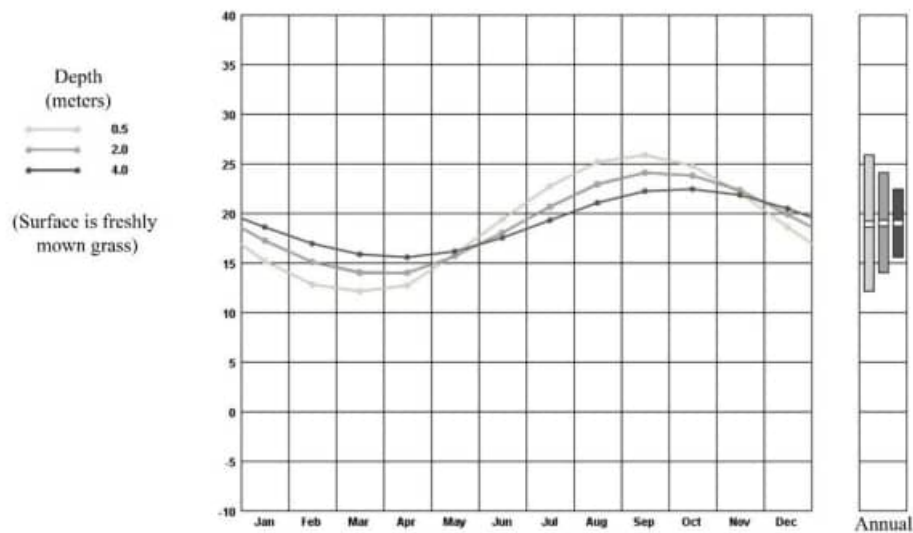
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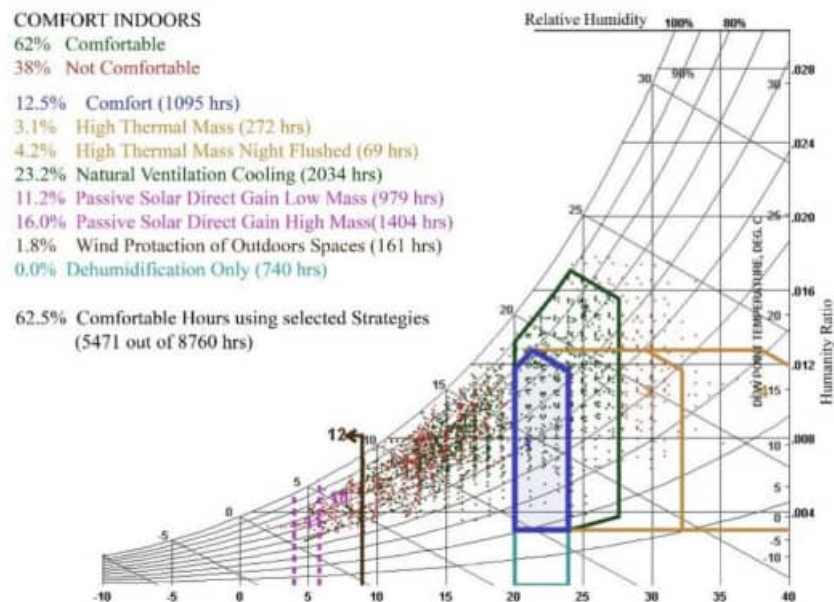
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### Climatic Data of the Study Area

#### a. Ground Temperature Diagram:



#### b. Psychrometric Chart:





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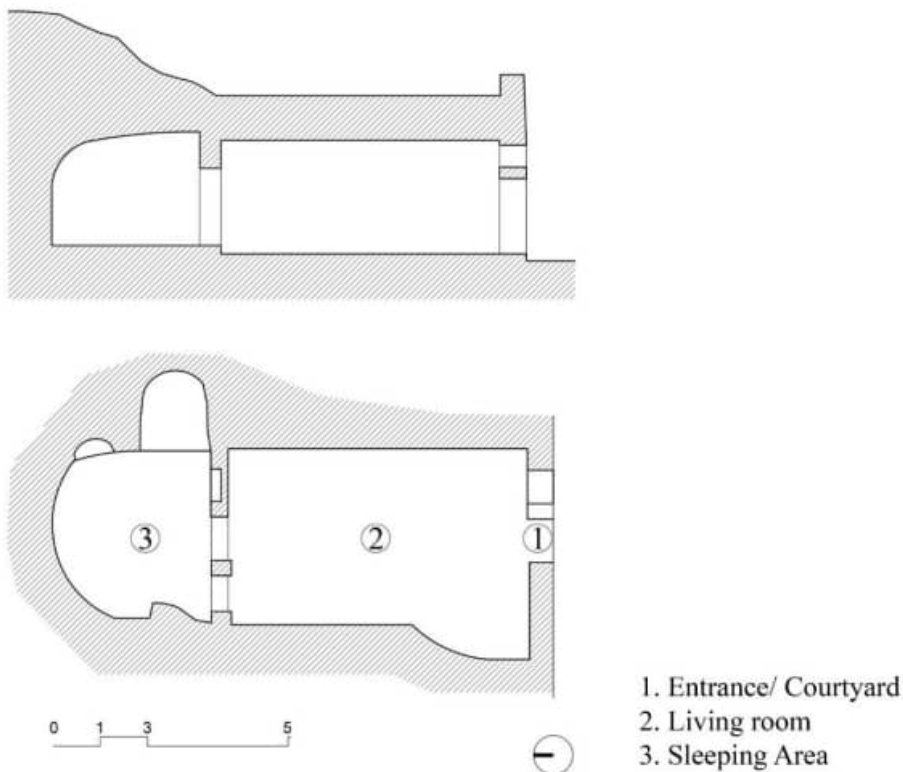
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Santorini is a dry island with rich historical and architectural features. Formed by volcanic eruptions, it showcases Cycladic architecture while being deeply influenced by its geomorphology (Skye, 2024).

The island has a dry, warm Mediterranean climate with strong sunlight, minimal rainfall, and winds from the south-southeast in winter and the meltemi (northerly winds) in summer. The need to protect the volcanic land from weather and pirate attacks led to the spread of underground settlements. The underground homes in Oia are a prime example of bioclimatic design, making use of the soft volcanic soil (Ovali, 2018).

Oia's architectural identity developed with terraced layers following the area's topography. The settlement consists of narrow streets, steep ramps, and cave-like homes carved into volcanic rock, which has a thermal conductivity coefficient of  $k = 0.05 \text{ W}/(\text{m} \cdot \text{K})$  (Technical Guideline T.O.T.E.E. 20701-2/2010, 2010). Domes were used due to the lack of timber, and rainwater cisterns were built, as the island lacks a water supply (Argyros, 2012). Local volcanic materials such as limestone, rocks, and pumice were used for construction, making the underground homes an economical solution in terms of resources and space (Manthou, 2020).

### Floor Plan:



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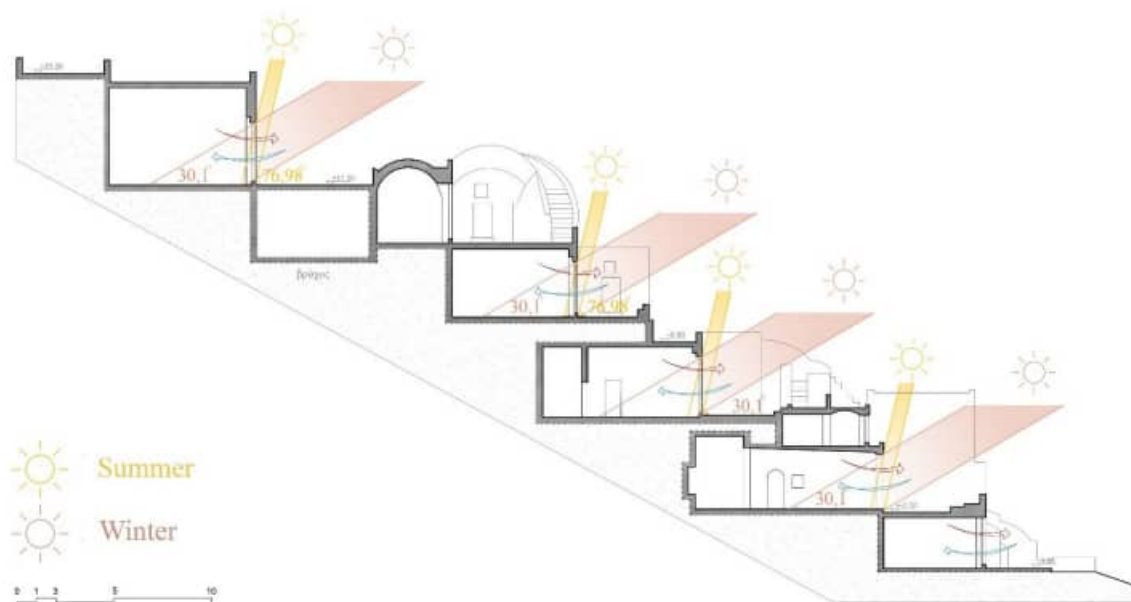
The dimensions of the homes are approximately ten meters in length and four meters in width. The dome extends along the narrow walls. The entrance is located at the center of the free stone facade, with small openings and a skylight (Argyros, 2012).

The interior of the dwelling is divided into two parts: the first houses the common area, a living room, while the sleeping area is located at the back (Argyros, 2012). The separation is made with an intermediate wall, like the one in the facade.

The free facades of the homes are oriented southeast and south. The white color of the facades protects the external shell by reflecting solar radiation, while the light is diffused into the interior due to the reflectivity of the internal surfaces. At the same time, the thermal load inside is reduced with the help of the vaulted covering (Ovali, 2018). Additionally, in some cases, chimneys are placed that penetrate the ground, allowing light to enter and air to flow into spaces without perimeter openings (Ovali, 2018). The thermal inertia is also ensured due to the underground technique, keeping the temperature relatively stable inside the structures.

### Elements of bioclimatic design

#### a. Bioclimatic section of the underground house:

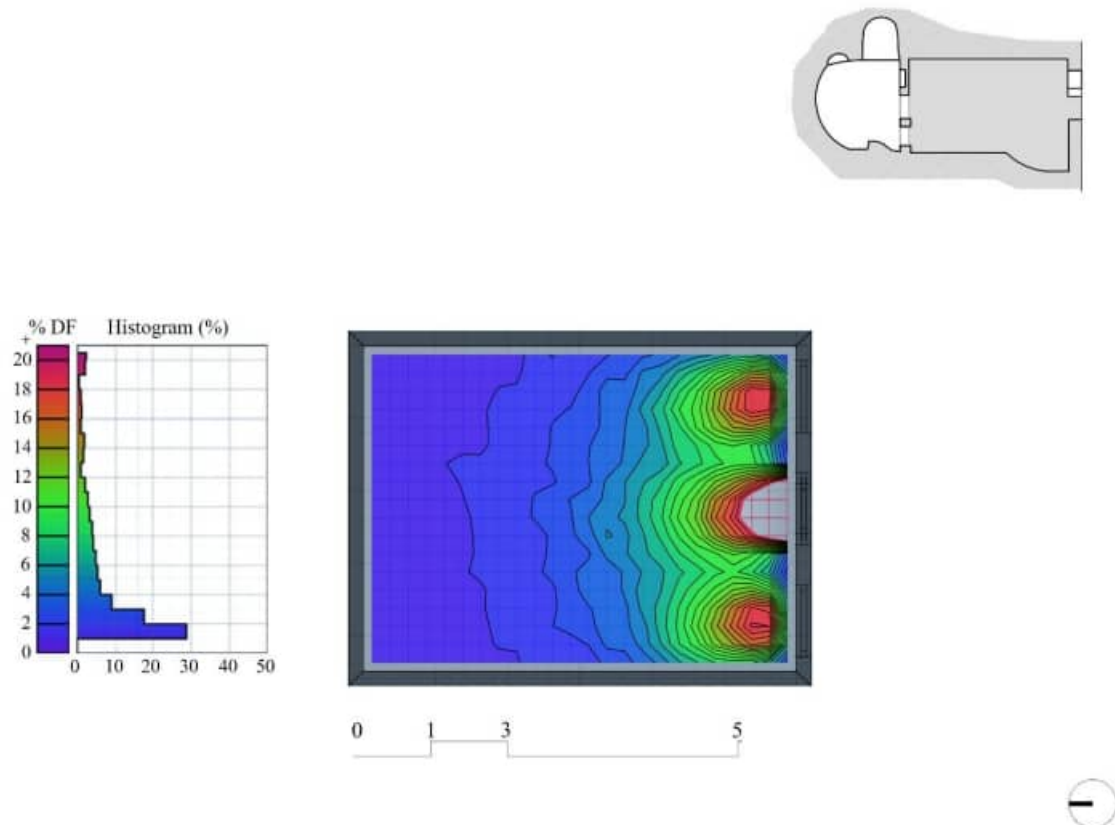


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- b. **Diagram of the daylight factor for the southern central room of the underground house:**



### 3. Yoma Suites in Zakynthos| by Urban Soul Project/ Contemporary Architecture

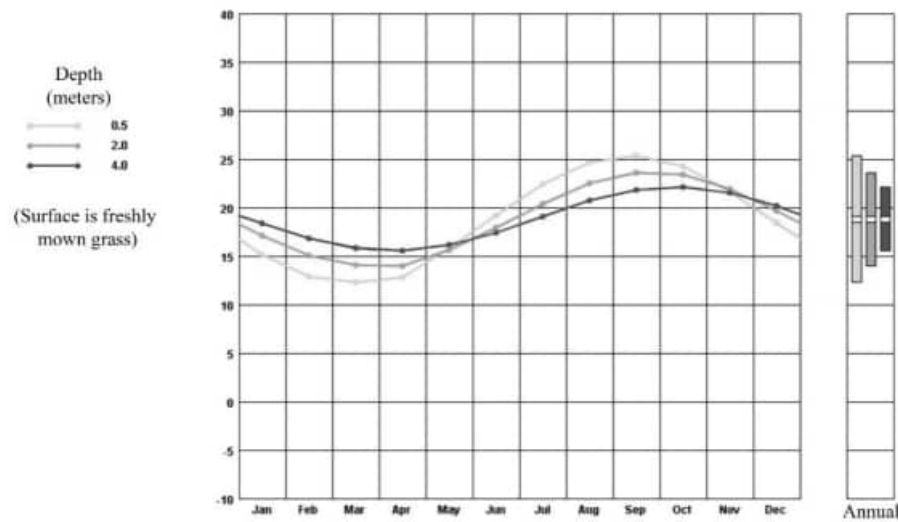
|                     |                              |
|---------------------|------------------------------|
| Construction time   | 2019-2021                    |
| Designer/ Architect | Maria Taftaki, Kwstas Flwros |
| Use/ Function       | Inhabitation                 |

## PROCEEDINGS

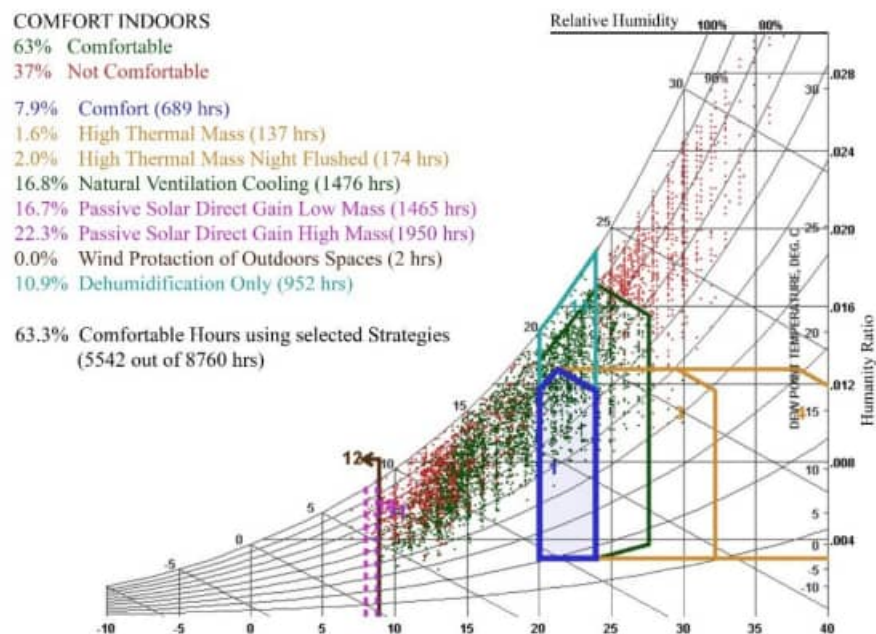
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### Climatic Data of the Study Area

#### a. Ground Temperature Diagram:



#### b. Psychrometric Chart:



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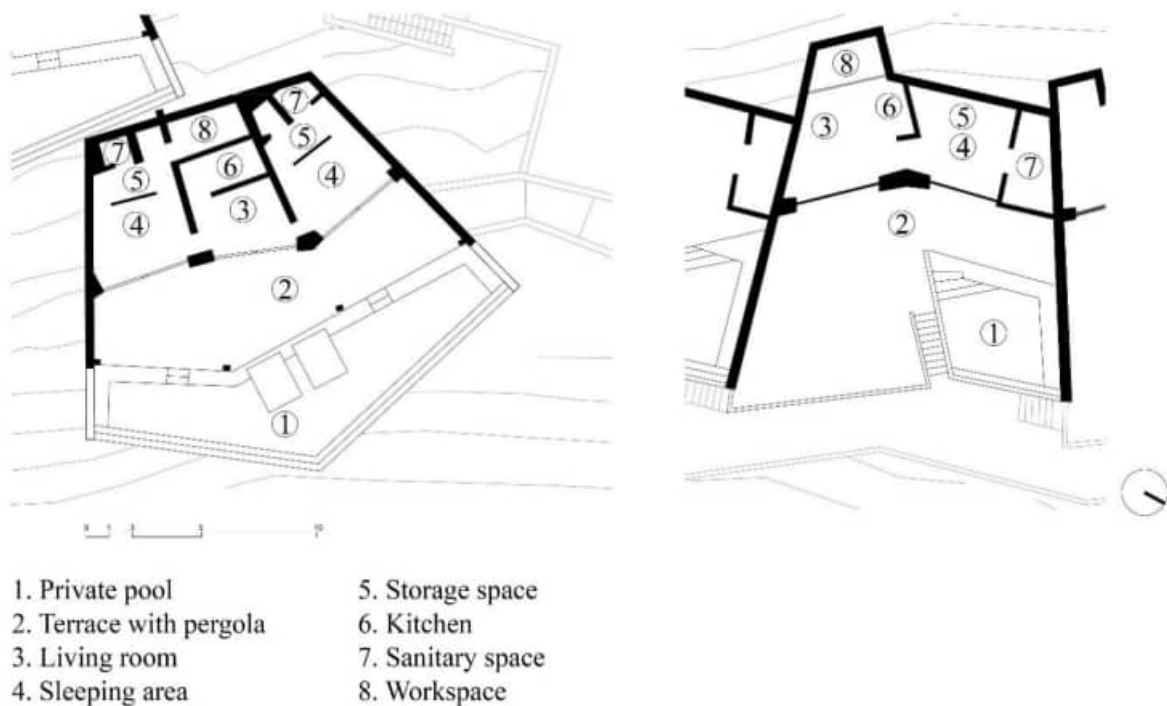
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Zakynthos, an Ionian Island with an area of 406 square kilometers, has a Mediterranean climate with mild, wet winters and warm, dry summers (Versus Travel). The island's terrain is varied, including flat, mountainous, and coastal areas. Winters bring more rain, while summers are dry. Winds are moderate from the west and northwest in summer and stronger from the south in winter.

The underground houses designed by Urban Soul Project architects are located in the northern, mountainous part of Zakynthos. The land, primarily limestone, is stable and suitable for underground construction. The buildings are integrated into four levels, with the reception area at the highest point and the rest of the residences across the lower levels (Panetsos, 2023).

The buildings have prismatic shapes with no right angles and east-facing openings. The design ensures both unobstructed sea views and privacy. Interiors include one or two bedrooms, a living room, kitchen, and small workspaces, while the exterior features a private pool, terrace, and pergola.

### Types of housing:



Natural lighting and the ventilation of warm air are achieved through the open western façades and additional skylights at the rear sections of the underground structures. The underground technique is realized by embedding the structures into the ground, respecting the existing landscape. The buildings' facing side functions as a single volumetric entity, while the surrounding outdoor spaces are also integrated as part of the design.

The choice of materials is carefully selected to harmonize with the environment and align with the island's traditional aesthetic. Local materials, such as stone and wood, are used

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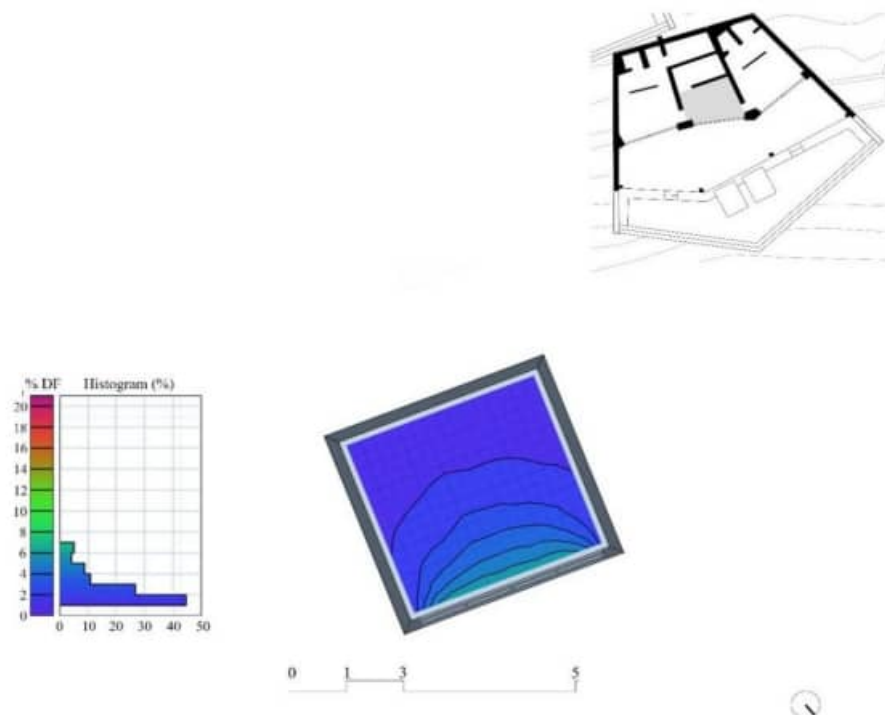
in shades that reflect the natural surroundings and local vegetation, such as sand-colored tones (Panetsos, 2023).

### Elements of bioclimatic design

#### a. Bioclimatic section of the underground house:



#### b. Diagram of the daylight factor for the northern central room of the underground house:





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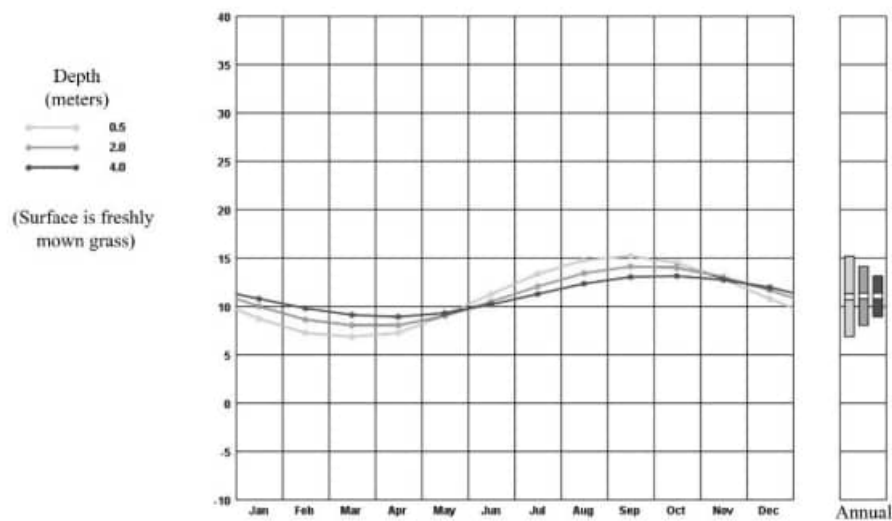
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### 4. Malator House| Future System/ Contemporary Architecture

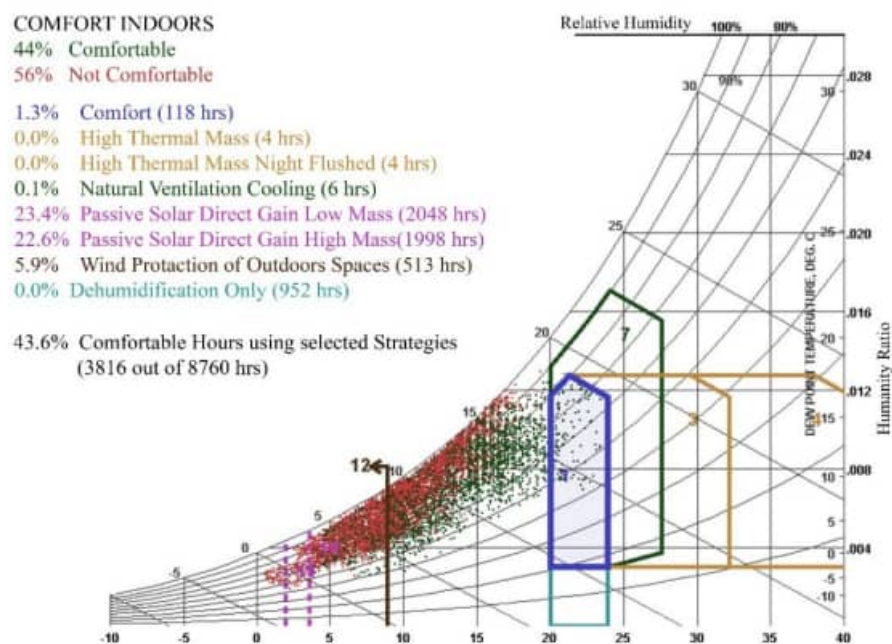
|                     |                             |
|---------------------|-----------------------------|
| Construction time   | 1998                        |
| Designer/ Architect | Jan Kaplický, Amanda Levete |
| Use/ Function       | Inhabitation                |

#### Climatic Data of the Study Area:

##### a. Ground Temperature Diagram:



##### b. Psychrometric chart:



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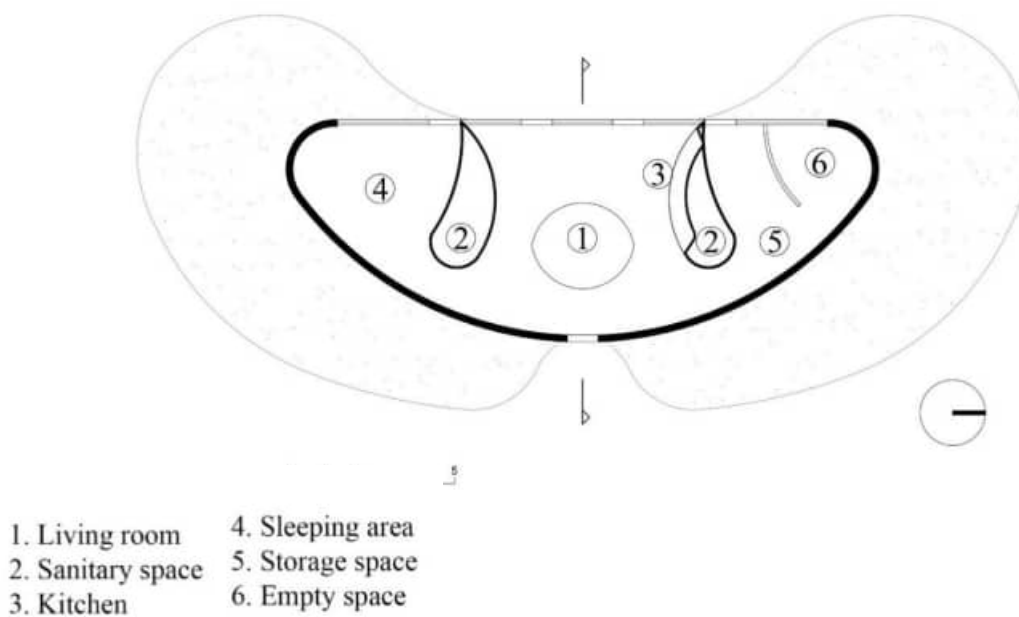
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The Malator House, located in Pembrokeshire National Park, Wales, is designed to blend discreetly with the landscape. Built 150 meters from the sea, it covers 300 kilometers of coastline and faces a mild, maritime temperate climate. The house was created for Bob Marshall-Andrews as a vacation home, replacing an old barracks (Rethinking the Future, 2022).

The building's design follows strict regulations to minimize environmental impact. Inspired by Northern Scandinavian architecture, the house is camouflaged with earth and turf, offering thermal protection (Bannikova, 2017). The roof, made of marine plywood and turf, is supported by steel beams and a concrete slab, eliminating the need for internal support. Some internal components, like the bathroom pods, were prefabricated, enhancing the house's lightness and brightness (Rethinking the Future, 2022).

### Floor Plan:



The simplicity combined with the organic curves of the floor plan reflects its harmony with the existing landscape. The layout is open, only limited by the prefabricated structures that also define the functionality of the spaces (Bannikova, 2017). Focus is placed on the living room area and the centrality of the chimney, which is oriented towards the horizon. Additionally, besides the organic floor plan, the playful character of the interior is enhanced by vibrant colors (Bannikova, 2017).

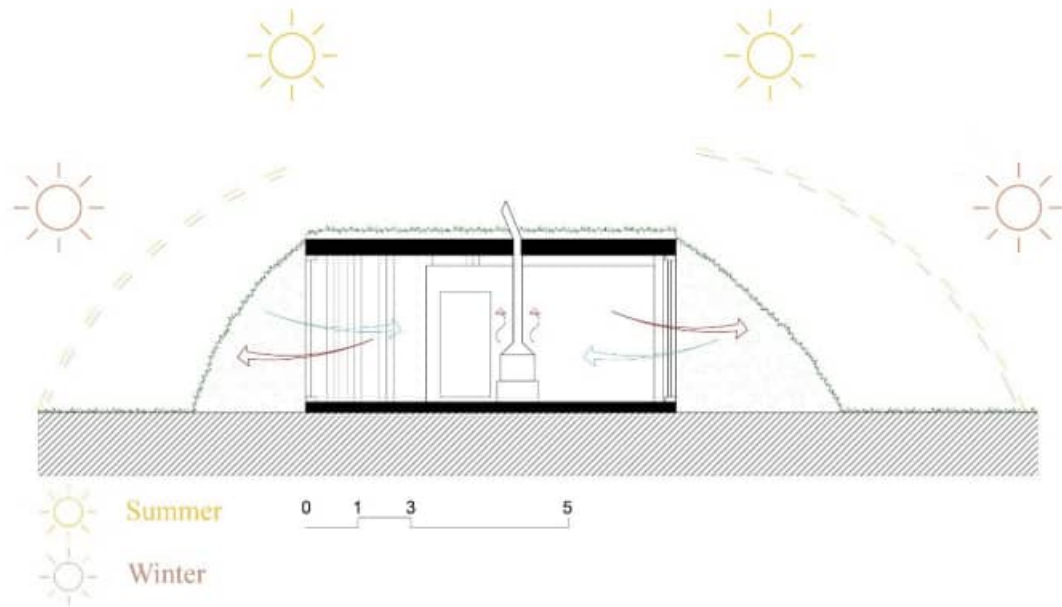
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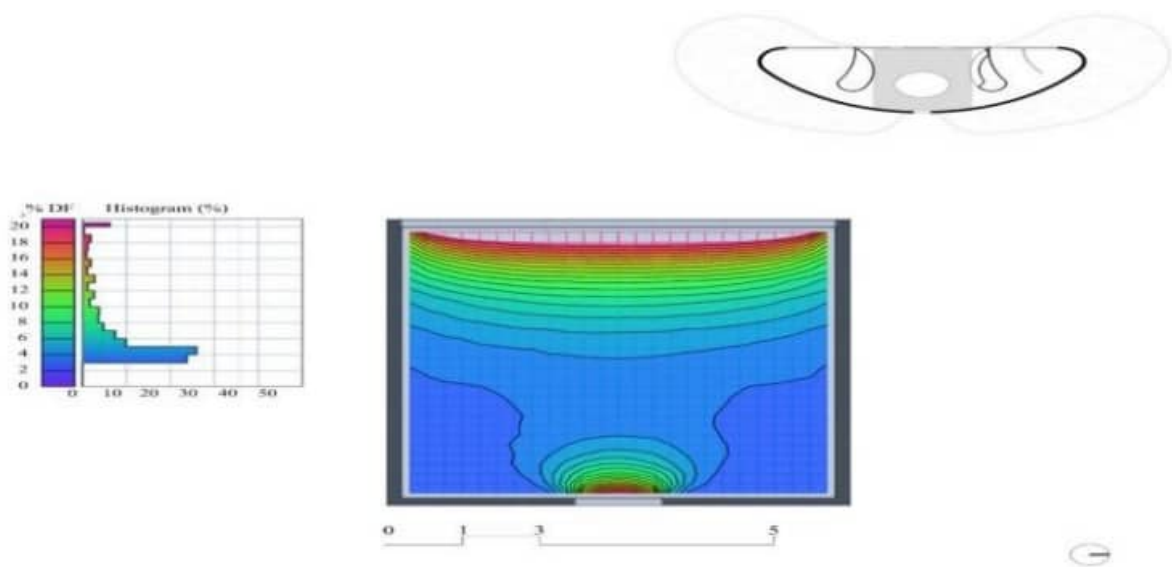
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### Elements of bioclimatic design

#### a. Bioclimatic section of the underground house:



#### b. Diagram of the daylight factor for the eastern central room of the underground house:



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### Conclusions of Case Studies

Northern China Settlement: Settlements protected by the earth, found in regions of northern China, Iran, Tunisia, etc., areas with dry and hot climates, are products of human efforts to protect against weather phenomena and other hazards (See Chapter [Typologies of Earth Architecture]). They combine elements of traditional architecture with features of the local climate and geographical conditions.

Thermal inertia is a characteristic effectively applied to manage large seasonal fluctuations between seasons. In this way, underground interior spaces ensure coolness in the summer and warmth in the winter, reducing the need for artificial heating and cooling. Additionally, the use of local materials, adaptation to the topography, and planting of trees for shading are elements of bioclimatic design. Finally, natural lighting and ventilation are provided inside, though not always effective.

Oia Settlement: This underground settlement offers a sustainable solution adapted to the unique climate and topography of Santorini. The use of local materials and traditional Cycladic techniques shape the dwellings, which incorporate bioclimatic principles. However, natural ventilation and lighting are not sufficient in all types of dwellings. Additionally, thermal inertia is ensured due to the underground form and the composition of the soil.

Yoma Suites in Zakynthos: The bioclimatic design principles that are evident include cross-ventilation and the enhancement of natural lighting throughout the interior, as well as solar protection due to the westward orientation of the dwellings, which shields them from summer radiation. Another feature is water. The water placed in the western part provides cooling through evaporation, and the water surfaces have high absorptivity, around 0.95, reflecting radiation during times when the solar radiation angle (solar altitude angle) is low (i.e., early in the morning and late in the afternoon). Lastly, the thermal delay provided by the thermal mass of the ground is not effectively utilized, as the dwellings do not make direct contact with the soil.

Malator House: The design principle behind the construction of the Malator House was focused on sustainability and harmonizing with the natural landscape. Its underground character, combined with the use of local natural materials, aims at energy efficiency, maintaining interior temperature, and reducing the need for air conditioning. Additionally, due to its low elevation and the absence of additional layers above the ground, it helps protect against the climatic conditions of the area, such as strong winds. The open facades of the house allow for cross-ventilation and sufficient natural lighting.

### Comparative Analysis and Evaluation

#### Comparison of Soil Materials' Thermal Transmittance Coefficient

Theran earth has low thermal conductivity, making it an effective insulator, while its low heat capacity helps maintain stable indoor temperatures. Silty sand also delays heat transfer, whereas limestone and compact soil conduct heat quickly, potentially increasing heating and cooling demands.

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### **Thermal Comfort and Energy Efficiency**

Underground dwellings benefit from the soil’s insulating properties, maintaining stable indoor temperatures and reducing energy needs for heating and cooling.

### **Protection and Safety**

Subterranean structures offer strong resistance to extreme weather and seismic activity, providing natural protection and historically serving as shelters.

### **Economy**

In some regions, natural materials are readily available, allowing the use of soil as a building material. Additionally, underground dwellings tend to be more durable and require less maintenance over time, depending on soil composition and climate. However, soil moisture may necessitate additional protective measures.

### **Aesthetics and Environmental Sustainability**

Blending with the natural landscape reduces visual impact and minimizes environmental footprint by using fewer natural resources. The combination of architecture and bioclimatic design promotes sustainable and eco-friendly living.

### **Land Utilization**

Subterranean structures allow for alternative land use, such as agriculture or urban development, particularly in areas with limited available space.

The choice of underground living, combined with these factors, offers a sustainable, comfortable, and safe housing solution. However, proper architectural and bioclimatic strategies—such as optimal orientation for natural light, ventilation openings, solar and wind protection, and moisture control—are essential to adapt to the specific climate and needs of each location.

## **Weaknesses of Subterranean Constructions & Improvement Proposals**

### **Settlement in Northern China**

1. Natural Lighting
2. Natural Ventilation

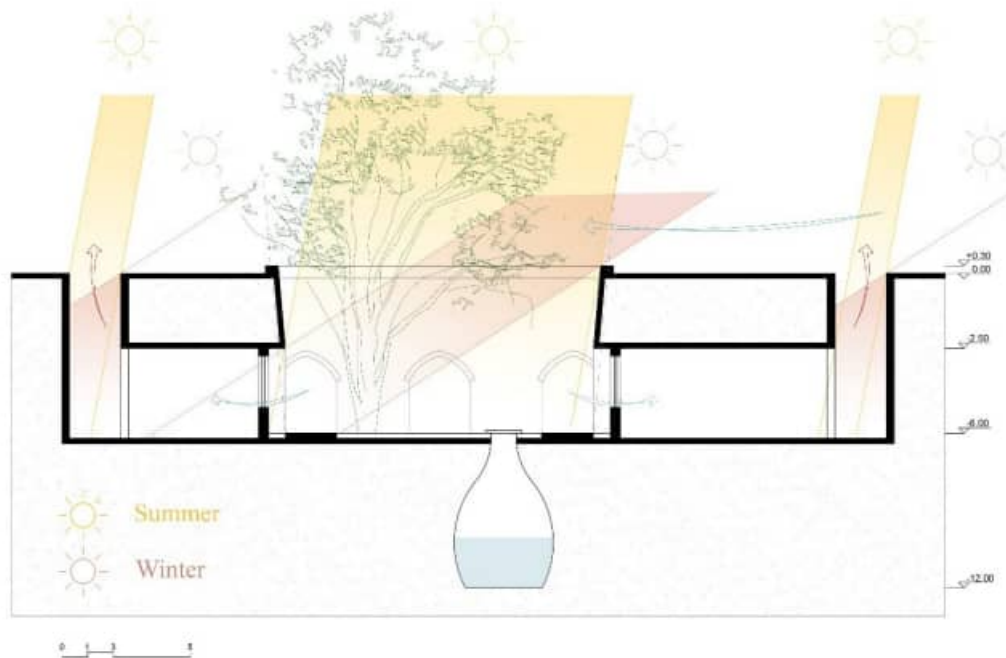
To enhance both aspects, skylights can be added to facilitate the release of warm air from indoor spaces and improve natural light penetration.

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### Enhanced Bioclimatic section of the underground house:



### Settlement in Oia, Santorini

1. Wind Protection
2. Sun Protection
3. Natural Ventilation

Due to the settlement's southern orientation and prevailing winds, wind protection can be achieved by adding perimeter fences and adjusting the entrance door orientation to the east or west. Small canopies provide both sun and wind protection. Additionally, skylights enhance natural cross-ventilation and increase daylight in interior spaces.

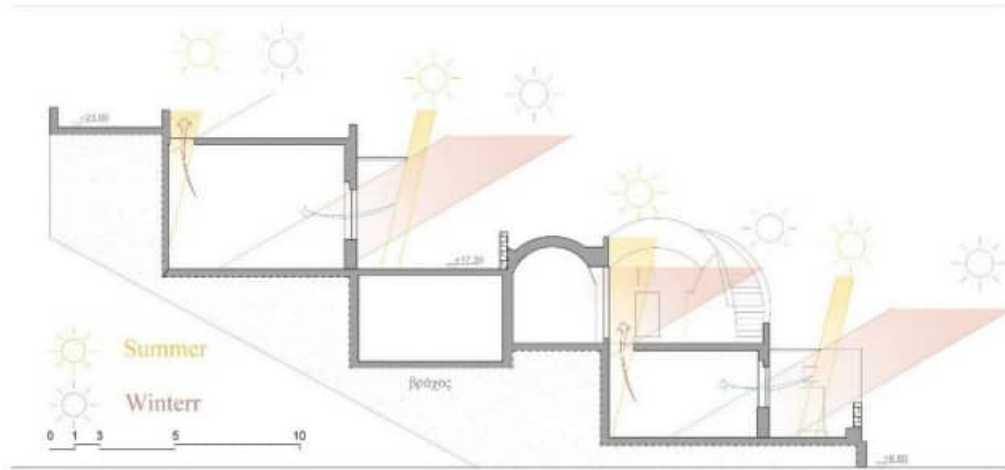


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### Enhanced Bioclimatic section of the underground house:

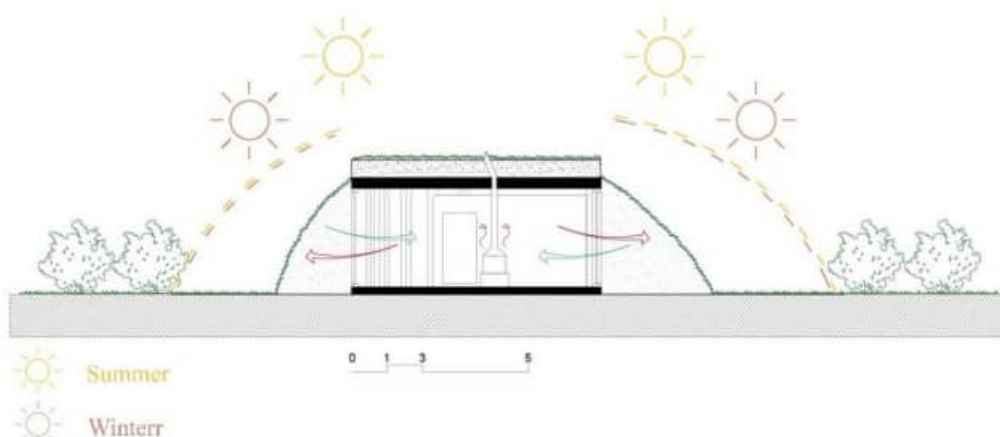


### Malator House, Wales

#### Wind Protection

- A possible improvement would be a southern orientation for the building.
- With summer temperatures not exceeding 20°C, the mild soil temperature variations and prevailing westerly winds ensure natural cross-ventilation and help reduce indoor humidity.
- Low vegetation on the western and eastern façades could provide additional wind protection.
- Adding thermal insulation or increasing the soil layer on the roof would further enhance energy efficiency.

### Enhanced Bioclimatic section of the underground house:



The study of the key characteristics of underground structures, their typology, their relationship with the climate, the concepts of place and terrain, the principles of bioclimatic design, and the analysis of traditional and contemporary underground constructions across

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different geographical zones has revealed enduring values of this architectural approach, as well as diverse ways of addressing specific challenges.

### **Sustainable Advantages of Subterranean Dwellings**

#### **Energy Efficiency**

The thermal mass of the ground helps maintain a stable indoor temperature. Both traditional and contemporary underground dwellings utilize the thermal inertia of the soil to reduce heating and cooling demands, as the building envelope is in contact with the earth, which has a more stable temperature than the air and is shielded from solar radiation and wind exposure. However, modern constructions that incorporate additional insulation layers reduce heat transfer between the envelope and the ground, thereby diminishing the impact of thermal inertia.

#### **Ecological Sustainability**

Underground dwellings blend into the natural landscape, minimizing environmental impact (e.g., Malator House). Additionally, the use of locally available materials reduces transportation needs and associated carbon emissions. Traditional settlements, such as those in Oia (Greece) and Northern China, exemplify this approach, as their buildings were constructed using materials sourced from the immediate surroundings.

#### **Aesthetic and Cultural Value**

Due to their minimal visible surfaces and low visual impact, underground dwellings create a harmonious integration with the landscape. Notable examples include residences in Zakynthos and Oia. Furthermore, traditional construction techniques, as observed in Zakynthos and Northern China, contribute to preserving cultural heritage and local architectural traditions.

#### **Economic Benefits**

The natural insulation provided by the ground lowers energy demands, reducing heating and cooling costs. Additionally, underground structures are highly resilient to natural disasters, leading to lower maintenance and repair expenses.

#### **Acceptance and Regulatory Incentives**

Today, there are favorable regulations for underground structures that allow for higher building density, provided that specific design criteria are met.

#### **Comfort and Well-being**

Underground buildings offer a stable and comfortable indoor environment, provided that adequate ventilation ensures air quality and thermal comfort. Moreover, the ground acts as a natural sound barrier, enhancing indoor acoustic comfort.

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### **Disadvantages of Subterranean Dwellings**

#### **Type of Underground Architecture**

The choice of underground architectural typology depends on soil composition and local climatic conditions. Not all earth-based architectural typologies can be applied universally. For instance, in regions with hot and dry climates or significant temperature fluctuations, earth-sheltered designs tend to offer the best performance.

#### **Construction Challenges**

Building underground dwellings is often more complex than conventional structures due to excavation requirements and structural reinforcements. Additionally, the presence of surrounding soil can lead to moisture-related issues, necessitating specialized waterproofing and insulation systems.

#### **Design Limitations**

Most underground homes have fewer openings (e.g., in Oia and Northern China), which may require artificial lighting solutions to ensure sufficient indoor illumination. Similarly, natural ventilation is often restricted, making mechanical ventilation systems necessary to maintain indoor air quality.

#### **Economic Factors**

The initial construction cost can be higher due to the complexity of excavation and the need for specialized techniques. Moreover, maintenance costs—such as those observed in Chinese settlements—can be significant, particularly concerning waterproofing and moisture management.

#### **Regulatory Constraints and Promotion Measures**

In many cases, building codes and local planning regulations impose restrictions on underground dwellings or require strict compliance with specific conditions, increasing construction complexity and costs (e.g., Malator House).

#### **Comfort and Livability**

Without adequate ventilation, soil moisture can create unfavorable indoor conditions, leading to high humidity levels and potential structural failures. Proper air circulation and humidity control are essential to ensure comfortable living environments.

#### **Permanent footprint**

Excavations for underground constructions can sometimes leave a permanent footprint on the landscape, altering the natural terrain and ecosystem.

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### Conclusions

Underground architecture offers notable advantages, including energy efficiency and environmental sustainability, but also presents challenges that require specialized knowledge and careful planning.

Key design considerations include proper building orientation for optimal daylight and thermal performance, as well as strategic placement of openings to enhance natural lighting and ventilation. Design constraints can be mitigated through solutions like skylights and courtyards. Additionally, selecting moisture-resistant and insulating materials is crucial for durability and comfort. By addressing these factors, underground dwellings can achieve a sustainable and livable balance between nature and built space.

A crucial aspect of underground dwelling design is its impact on the user's psychological and physical well-being. While these structures offer significant benefits in terms of energy efficiency and climate protection, they may also evoke feelings of isolation, loss of perceived control, or cultural biases. Future research could explore architectural strategies that balance the advantages of underground living with the user's mental well-being.

Another complex issue for further investigation is the cost comparison between underground and above-ground structures. Excavation can be challenging depending on the terrain, while moisture-resistant materials and maintenance requirements add to the overall expense. However, underground dwellings offer long-term energy savings. A comprehensive analysis of excavation, foundations, insulation, and thermal efficiency is needed to determine which construction method is more cost-effective and sustainable in the long run.

Underground bioclimatic architecture is one of the oldest and most effective examples of human adaptation to the natural environment. The study of its evolution over the centuries highlights that integrating natural resources and climatic conditions into residential design is not merely a necessity but a sustainable strategy. It enables harmonious integration with the landscape while ensuring comfort, aesthetics, and ecological awareness.

This architectural approach provides valuable solutions to contemporary challenges such as climate change and energy efficiency, promoting the revival of traditional techniques through modern technologies. Ultimately, underground architecture demonstrates how humans can coexist with nature in a way that enhances quality of life while offering sustainable solutions for the future.

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### **MNEMONIC PATHWAYS AT THE ROMAN ODEON AND ROMAN STADIUM OF PATRAS, ACHAIA, GREECE**

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#### **Abstract**

Public spaces provide the potential to connect archaeological sites with urban sites, while simultaneously improving the everyday life of the residents. Functioning as meeting spaces for communication and socialization, they contribute to the well-being, education and cultural expression. The intervention in the area of Patras aims to reunite Roman Stadium and Odeon, with the purpose of creating a single cultural axis that strengthens social sustainability and cultural consciousness.

The intervention consists the undergrounding of a central road, which separates the two monuments, the creation of factual public spaces and the improve of accessibility with the use of sidewalks and pathways, the design of green space and urban equipment for recreation **and** cultural event. The vegetation will contribute the creation of pleasant environment with shaded areas. The spaces are being designed to meet the social and cultural needs, promoting collective identity and reinforcing social cohesion.

The analysis indicates that the public spaces, when thoughtfully designed to integrate cultural heritage into daily lives of residents, they function as hubs for interaction, social empowerment, and leisure. Furthermore, offer changes for educational activities, cultural and social events, adding vitality to social spaces. This places act as bridging elements between future and past enhancing cultural continuity and fostering a sense of belonging. In the case of Patras, the intervention achieves to transform the monuments into vibrant landmarks harmonized with urban sites and the needs of modern society, ensuring simultaneously the preservation of their historical significance and enhance the cultural identity of the city.

**Key words:** Use of public spaces, sustainability, Patra, architectural heritage, archaeological sites, theatre



**TOWARDS POST-GROWTH OPERATIONALIZATION:  
A BIOREGIONAL LENS OF SPATIAL PLANNING**

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**Abstract**

Seemingly unending ecological disasters, floods and forest fires, along with ever-increasing social unrest continue to shed light towards the limits of growth - not only in Greece, but throughout the globe. In an effort to mend the relationship between human existence and planetary boundaries, the post-growth paradigm advocates for decoupling from economic indices as the sole determinant of prosperity. In terms of spatial planning it calls for ensuring a degree of regional sufficiency, investing directly in social services and infrastructure, proposing absolute limits to urbanization and prioritizing socio-ecological prosperity. Like many major transitions, however, this approach is mostly confined within academic circles or small-scale projects and is far from being institutionalized. This can be ascribed to several barriers, like limited societal acceptance, lack of alternative visions beyond growth-reliance or intense bureaucratic procedures.

This paper argues that bioregionalism - the understanding of a territory through its ecological functions, geo-morphological and socio-cultural characteristics - is of utmost importance in operationalizing the post-growth agenda due to several synergistic qualities that allow for bypassing key barriers. For example, bioregionalism could enable the emergence of a territorial place-attachment, encourage transnational cooperation, as well as propose eco-social indices of prosperity against GDP. Particularly interesting for the realm of spatial planning, bioregionalism suggests a land-based approach to territorial management. Building on this idea, this paper speculates about an alternative system of territorial administration through bioregions. Responding to the pressing issues of lacking water management, these bioregions could be administrative entities that mirror the basins of major rivers in Greece. This idea is tested through a case study of the river Spercheios. Overall, such a system could empower local governance, especially in rural areas, negate paralyzing bureaucratic procedures, potentially engage disinterested citizens and allow for new spatial imaginaries to emerge.

**Key words:** Post-growth, Bioregionalism, Bioregion, Spatial Planning, Spatial Imaginary

**Introduction**

While Greece's economic trajectory of the past years has been consistently praised for its “sustainable growth”, the ongoing social crises and ecological disasters shed light on a crucial disconnect. Conceptions of progress are usually based solely on economic indices, often ignoring social and ecological ones, or treating them as byproducts of economic advancement.

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This perception can skew decision-making towards short-term economic gain rather than aiming for long-term ecosocial prosperity. Such an economic-growth-reliant way of thinking can be particularly problematic for spatial planning, especially considering our rapidly changing climate reality. Greece’s unpreparedness in these fields is clearly evident—from the destructive flooding of the Thessaly region or the ever-repeating urban floods that have ascended to the realm of the “norm”, to the immense wildfire in the region of Evros and all around Greece, to the painful Tempi instance that brought to light both lacking infrastructure management and political corruption. We cannot continue business as usual - a different paradigm is required.

This paper explores post-growth as such a paradigm, an approach for achieving social, ecological and spatial justice and prosperity. It is examined through the perspective of a spatial planner—and not an economist—with the intention of furthering its operational agenda and suggesting ideas to other planners and institutions in Greece and beyond. It is largely based on the research conducted and its findings of my Master Thesis titled *Another Rural* (Xanthopoulos, 2024), in which I investigated a distant-future spatial imaginary for a rural bioregion in Greece. There, drawing from literature, I argued for the connection of bioregionalism with post-growth planning. In this paper I further this argument. First, I will briefly explore the definition of the post-growth paradigm and bioregionalism, while emphasizing their relevance for the case of Greece. Second, the multi-faceted barriers of operationalising a post-growth planning paradigm will be explored, while highlighting the potential of a bioregional approach to bypass them. Third, exploring lessons learned from my previous research, I will envision a bioregional administration for Greece and argue for this approach’s capability to allow for a post-growth planning to emerge. Finally, I will reflect on the approach’s potential shortcomings, as well as point to further research.

### **Defining the terms: post-growth (planning) and bioregionalism**

#### ***Endless economic growth is impossible on a finite planet***

As the most recognizable quote of post-growth advocates suggests, the post-growth approach challenges the hegemonic notion of an ever-growing economy, imagined as being decoupled from planetary bounds. Instead, this paradigm advocates for a “voluntary, democratically negotiated, equitable downscaling of societies’ physical throughput until it reaches a sustainable steady-state” (Büchs and Koch, 2019, p. 155). There is some confusion about the terminology, because it is often used interchangeably as degrowth. As Savini (2023) puts it simply: post-growth is an approach, a “useful concept to stimulate discussion”, but that in itself lacks tools; while degrowth is an agenda, it does “one step more” towards a politicised approach by demanding “socio-ecological redistribution” (p. 5). More recently, Savini refers to degrowth as an “ideology in the making” (Savini, 2025). For the purpose of this paper, I will continue using the more general post-growth approach. Regardless, this term emerged as degrowth in the nineteen-seventies through the term *décroissance* by André Gorz, a French political ecologist (Kaika et al., 2023, p. 1194). It was at the same year as the publication of the 1972 “Limits to Growth” report, which highlighted the impossibility of perpetual population and economic growth, utilising the first examples of computer simulation. The

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report urged immediate research on our economic model but those concerns were constrained mostly within academic circles. Since then much has changed and the impacts of such a growth-centric thinking are more evident, extensively studied and communicated than ever.

Post-growth as a “project of transitioning systematically toward a new society” (Savini, 2021, p. 1077) proposes an overwhelming agenda of societal, political and institutional changes. Items of this agenda include, among others, reduction of working time, a universal basic income and establishing a cooperative and regenerative economy (Büchs and Koch, 2019, p. 160). According to Strunz and Schindler (2018) a post-growth society would be characterized by three key conditions: a material throughput that aligns with ecological limits, phasing away from GDP-driven decision-making and directing gains in resource and energy productivity towards reducing material throughput—until the first condition is met (p. 70). As it is hard to envision such changes from an abstract, economic viewpoint, philosopher Kate Soper (2020) explores what a post-growth lifestyle would entail, advocating for a redefinition of what constitutes the “good life” itself; against overconsumption, closer to nature, more free time and less work. However, she highlights that such pleas “will remain theoretical in the absence of the powers and pressures required to translate them into effective practice—which means attention must also be paid to the possible agents and processes of transformation” (Soper, p. 162). Soper insists that furthering the post-growth approach would require emphasizing the benefits of a post-growth lifestyle instead of only debunking pro-growth thinking, in order to combat the negative connotations that arise from a perceived absence of societal growth.

The post-growth paradigm is an attempt to halt the hegemony of pro-growth thinking, which also still persists in academic circles. Most pro-growth scholars, policy-makers or commentators often dismiss post-growth approaches as a utopia or a dream—even during the presentations of this conference. However, much evidence illustrates that reaching our climate goals with our current strategies might actually be the impossible dream. Among other researchers, Vogel and Hickel (2023) clearly outline that “the decoupling rates achieved in high-income countries are inadequate for meeting the climate and equity commitments of the Paris Agreement and cannot legitimately be considered green”. Calling for a more holistic approach, they propose that we will need to “pursue post-growth demand-reduction strategies, reorienting the economy towards sufficiency, equity, and human wellbeing, while also accelerating technological change and efficiency improvements” (Vogel and Hickel, 2023). Thus, post-growth thinking critiques “green growth” or “sustainable growth” as scholars acknowledge the inability of these approaches to actually lead to meaningful change.

### ***A planning paradigm***

In order to both envision and enact such a post-growth paradigm, examining the role of spatial planning is imperative—a topic that many scholars are investigating. First, it is important to recognise that our current planning paradigm “has bound itself into a pro-growth agenda that is mentally and institutionally hard to overcome” (Durrant et al., 2023, p. 288). Instead of facilitating social and ecological prosperity, the role of planning processes has regressed into the facilitation of development and economic growth, in order to meet policy goals through their benefits. To this end, Federico Savini (2021) explores a spatial planning paradigm of

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urban degrowth by critiquing three growth-reliant mechanisms and proposing three degrowth counter-paradigms. These are: (a) from functional polycentrism to polycentric autonomism, or proposing radical cooperation instead of competition between regions, (b) from scarcity to finity, or halting the forces of land development through stricter regulations, and (c) from euclidean zoning to habitability, or empowering local governance and emphasizing the relationships between human and non-human agents (Savini, 2021). In short, post-growth planning would greatly differ from the functions, goals and tools of the current paradigm. Instead of targeting and facilitating a vague advancement measured through abstract economic indices, it would require direct investment to social and ecological prosperity.

This is very relevant for the case of Greece. Over the past century, growth in Greece has become interlinked with tourism, and spatial planning processes have taken on the role of facilitating tourism-driven development in both urban and rural settings. Such a pro-growth planning is evident in both national and regional levels and is best exemplified through the recently published “Special Framework for Spatial Planning and Sustainable Development for Tourism” or “Ειδικό Πλαίσιο Χωροταξικού Σχεδιασμού και Αειφόρου Ανάπτυξης για τον Τουρισμό”, in which all Greek regions, with minor exceptions of few hyper-touristic areas, are regarded as territories for potential “development through tourism”. This deep-rooted approach fosters competition between regions, or even municipalities and neighborhoods, and reduces the notion of place into mere destination, rather than promoting cooperation and long-term ecosocial prosperity. It has resulted in the gradual abandonment or degradation of other economic activities that were intrinsically tied to the land, like crafting or agriculture. Thus, it is imperative to examine alternate ways of enacting spatial planning, beyond purely economic, short-sighted goals and to reckon with our rapidly changing climate reality.

### *A bioregional lens*

Rarely cited within post-growth literature is the concept of bioregionalism. It refers to the acknowledgement “that we not only live in cities, towns, villages or ‘the countryside’; we also live in watersheds, ecosystems, and eco-regions” (Wahl, 2018) and aims to achieve “a co-adaptive fit between local cultures and local environments” (Evanoff, 2017, p. 57). In this way, bioregionalism can be understood as a critique on anthropocentric understandings of place and their subsequent delineations, advocating for a place-based approach (both geomorphological and social) to a region’s definition. Bioregionalism imagines vastly different decision-making processes, where “power would flow not from the global to the local, but from the local to the global” (Evanoff, 2017, p. 60). A bioregional paradigm of territorial management would entail decision-making taking place at the “smallest possible level while still permitting cooperative action at larger scales when necessary, particularly through confederal institutions” (Evanoff, 2017, p. 61-62). While it can be argued that humans have always operated through such principles—living through and at the land—the concept of contemporary bioregionalism is traced to the nineteen-twenties and has metastasized to various other ideas over the last century (Duží and Fanfani, 2019, p. 7). This could be understood as a response to how our contemporary lifestyles have become alienated from natural processes, particularly in urban areas. A plea to adopt a more nature-centric lifestyle and view is not controversial; what is more contested through is the definition of the

bioregion itself and whether such place-based delineations are more appropriate in responding to our climate goals, in both policy and administration. In this paper I argue that bioregionalism is of utmost importance in operationalizing the post-growth agenda due to several synergistic qualities or opportunities that allow for bypassing key barriers of the post-growth transition. These are explored below.

**Exploring barriers of post-growth transition and the opportunities offered through bioregionalism**

Despite considerable thought and continuous effort from post-growth scholars and advocates, the post-growth paradigm has remained confined within academic circles and found spatial manifestations only with small-scale initiatives. Few cities in Europe have embraced these ideas by utilising the analytical framework offered by Kate Raworth’s Doughnut Economy and embracing a model of circular economy (for a brief exploration of terminology see Savini, 2023), while the majority still operate within a pro-growth model—Greece being one of them, as there have been little to no actions towards meaningful change with contemporary urban planning. To this end, Kaika, Varvarousis, Demaria and March (Kaika et al., 2023) sketch out five ideas for operationalising degrowth beyond its currently limited approach and application. These include to (a) emphasize the importance of historical literacy when engaging with degrowth ideas, (b) not evade engaging with planning institutions to formalise degrowth through policy and practices, (c) research further on how degrowth initiatives could be scaled up successfully, (d) highlight the relevance of spatial thinkers and (e) to address more explicitly issues of race, class, gender and labour when discussing the dependencies between Global North and Global South in degrowth thinking. Similarly, Savini (2025) pleads for the contestation of existing institutions that perpetuate extractivist, land-degrading and unjust pro-growth ideologies and to propose new institutions to “shape socio-ecological practices” (p. 2, p. 17). However, in order to further contribute to the operationalisation of the post-growth approach, it is important to examine why it has thus far received little response within contemporary urban planning. This can be attributed to a number of multi-faceted barriers, from operational, institutional or politico-economic dimensions. These barriers are explored by drawing from relevant post-growth literature, placing importance in the ones most relevant for spatial planning and relating to the case of Greece. At each barrier, the synergistic quality or opportunity presented by a bioregional approach will be explored. For a summary of barriers and opportunities, see the table below.

**Table: Barriers of the post-growth transition and opportunities offered through bioregionalism.**

| dimension   | barrier to post-growth transition | opportunities of bioregionalism |
|-------------|-----------------------------------|---------------------------------|
| operational | planetary agenda                  | site-specificity                |
|             | limited societal acceptance       | territorial place-attachment    |

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|                       |                             |                                           |
|-----------------------|-----------------------------|-------------------------------------------|
|                       | individual network reliance | regional cooperation                      |
| institutional         | lack of spatial visions     | bioregional imaginary                     |
|                       | bureaucracy                 | redefinition of administrative boundaries |
| politico<br>-economic | unemployment                | investment in relevant sectors            |
|                       | alternatives to GDP         | bioregional indices                       |
|                       | pension schemes             | resource-sharing and caring               |
|                       | political polarisation      | land-based approach                       |
|                       | public debt                 | non-economic performance                  |

### *From a planetary post-growth agenda to a network of site-specific agendas*

The first inherent barrier to operationalising the post-growth approach is the nature of its scope. As was examined before, it proposes an overwhelming agenda of ambitious societal, political and institutional changes in a planetary scale. It is challenging for planners and policy-makers to translate these planetary ideas to local actions. This is especially relevant for countries like Greece, that suffer from poor territorial management and are oftentimes unable to translate EU-level policies to the regional or municipal level. To this end, as explained by Savini (2023), the Doughnut Economy analytical framework is utilised as a tool for post-growth planning, allowing for a process of mapping overshooting sectors and identifying ones that are underperforming, e.g. Greece’s energy overshoot and underperforming social services. With the regional as the ideal scale for doing so, this approach recognises that there is indeed a need to understand the site-specific metabolic flows, both material and immaterial, as well as interdependencies between regions. Of course, as Kaika et. al. (2023) highlight, the dynamics between Global North and Global South should be considered in this process as well (p. 1204).

Such a process of analysing the region through a post-growth lens would be hindered by anthropocentric delineations of space, as they would fail to consider the continuity and complexity of natural and human systems. In this way, post-growth planning could benefit from bioregionalism, as a deeply local, place-based approach could allow for the bottom-up emergence of a network of spatial post-growth agendas that are both contextually relevant for the territory at stake—rather than generic, designed for an abstract regional entity—and democratically negotiated.



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### ***From limited societal acceptance to territorial place-attachment***

Another inherent barrier of any major transition is the limited societal acceptance—especially for the post-growth one as it requires ambitious changes in many levels; personal lifestyle, political, institutional etc. Limited acceptance of these ideas can be observed from multiple actors: scholars themselves, citizens, policy-makers, planners and governments. As an emergent ideology within academia, most of its rhetoric utilises economic terminology and scholarly language that is often hard for the general public to understand. Beyond the linguistics of post-growth and despite growth being a “fairly recent phenomenon which only picked up in the 19th century together with the industrialisation of Western economies” (Büchs and Koch, 2019, p. 160), the hegemony of growth-centric thinking today permeates people’s identities and life goals, shaped “by ideas of social progress, personal status and success through careers, rising income and consumption” (Büchs and Koch, 2019, p. 160) and remains “rooted in everyday imaginaries as the only solutions” (Kaika et al., 2023, p. 1205). Despite also the many recurring environmental catastrophes—like the flooding of the Thessaly region and wildfire of Evros in 2023—and the numerous human and non-human lives claimed, citizens and policymakers have not yet questioned “the imaginary of growth as a panacea for a better life” (Kaika et al., 2023, p. 1205). This growth dependency is also evident in governmental visions (exemplified through Greece’s energy overshoot, see Xanthopoulos, 2024, p. 74-77) and unfortunately planners themselves, as pointed out by Lamker and Schulze Dieckhoff (2022). In this way, pro-growth planning is disallowing climate adaptation measures and transitioning to self-sufficiency against an extractivist economy.

Despite this, an attachment to place, history and culture persists, even though it might usually be expressed on an individual level, rather than a collective one. Bioregionalism presents an opportunity to unite these fragmented attachments into a shared territorial consciousness—a territorial place-attachment—by linking local identity, knowledge and ambitions with bottom-up governance. Such an approach emphasises the shared risks and opportunities of living in the same territory and in this way could transform passive sentiments into active force, specifically with ecological preservation in mind. The concept of place-framing is relevant here, as analysed by Feola et al. (2023) in regards to sustainability transitions. It refers to an “exercise through which collective memories and future visions are connected and are co-constituted through collective processes of the socially constructed framings of place” (p. 3). A bioregional approach to post-growth planning could highlight the importance of understanding people’s existing connections to land and utilising them for the cultivation of ecocentric values necessary for the post-growth transition to be catalysed.

### ***From reliance to individual network to bioregional cooperation***

Despite its theoretical advancements, post-growth thinking has yet to be manifested physically or spatially in significant scales, aside from small-scale initiatives. These usually include “worker-owned and managed businesses” (Büchs and Koch, 2019, p. 160) or “cohousing, farmer’s markets, self-sufficient housing, non-commercial sharing, and urban

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gardening” (Savini, 2021, p. 1077). Such initiatives often rely on individual networks to be established and operate, and demand substantial investment of personal time and involvement. With the absence of formal support from institutions, they struggle to be up-scaled and gain permanence. On the contrary, they often face significant trouble securing land as well as political and economic resistance, as seen in the case of Amsterdam’s Lutkemeerpolder, in which grassroots urban farming efforts have been halted for decades due to market-driven policies (Savini, 2025). More broadly, such efforts remain dependent on “a relatively small, geographically dispersed, and highly intellectually diverse research community”, limiting their capacity to influence policy and public opinion (Crownshaw et al., 2019, p. 118). Any post-growth project imagined is inherently land-dependent, deeming it vulnerable to speculation from real-estate-driven policy shifts and market pressures.

Bioregionalism could offer an alternative framework to help overcome these challenges, by rooting them within ecological and territorial structures—bioregions with decision-making power—rather than individual networks. A bioregional approach to territorial planning emphasizes the importance of decentralized, community-led decision-making, which would in turn shift from the reliance of individual efforts towards collective, place-based strategies. In this way, by embedding post-growth initiatives within a bioregional framework would become more resilient against market pressures and policy obstacles, bringing together diverse stakeholders required for such a major shift: farmers, cooperatives, municipalities, policy-makers, citizens.

### *From a lack of spatial visions to bioregional imaginaries*

Now examining institutional barriers, perhaps the most important one would be the absence of spatial visions in planning—a barrier also linked with limited societal acceptance. While there is a great deal of thought about the role of post-growth planning in “debunking” or exemplifying the structural dependencies of growth and their spatial manifestations, there has been less emphasis on how an alternate planning paradigm would actually operate in practice. Post-growth planning is inherently future-oriented, as it proposes ambitious shifts and emphasizes long-term goals like ecological restoration, establishing resilient economies and networks of care. As Kaika et. al. (2023) illustrate, “degrowth can provide an alternative imaginary for the future” so long as it is translated into “spatial images, plans and practices for it to start having significant impact and effect” (p. 1205). Yet, in many contexts spatial planning remains short-sighted, driven by immediate profit and failing to critically engage with the future. Institutional inertia and “the embeddedness of the growth-based capitalistic economic system in these co-evolved institutions and ways of thinking makes it difficult to transition to a degrowth system”, “defuturizing” planning by constraining the openness of future possibilities and reinforcing path dependencies (Büchs and Koch, 2019, p. 160). This is particularly relevant for countries like Greece, where spatial planning has lacked long-term planning and has a tendency to degrade or outright cancel spatial visions—even since the state’s founding with the alteration of the 1833 Kleanthis and Schaubert plan for Athens. This growth-oriented mindset detaches ecological concerns from planning and displaces them to the realm of activism, benefiting from loosely defined regulations, lack of transparency and community participation. It has only recently been that the large-scale development in

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Ellinikon might show a shift towards intentional spatial planning, albeit still within a growth-driven framework. However, it does, in a sense, show an important moment in history for planning to critically engage with spatial visions, as in the absence of deliberate efforts to craft and perform post-growth imaginaries, the dominant, implicit vision of growth—primarily expressed through tourism—will continue to prevail.

National-scale visions are almost always bound to economic performance of GDP and usually fail to consider the intricacies and pluralities of place; thus are more susceptible to growth-oriented strategies. On the contrary, a bioregional approach to spatial planning would entail crafting critical, place-based visions by addressing contextual manifestations of growth and understanding local concerns, visions and ambitions, histories and knowledge—a bioregional imaginary. Through this, post-growth planning would be able to become spatially articulated, more relevant and engaging, to contest the hegemony of growth and to influence public opinion. Aligning with pleas for “prefigurative planning”, this approach could address the growing “sense of loss of the future” by “performing the future in the present” (Davoudi, 2023, p. 2278).

### *From bureaucracy to bioregional administration*

Bureaucracy is an often overlooked institutional barrier of the post-growth transition, despite being a fundamental hindrance. Post-growth planning would prioritise societal and ecological concerns and demand an immediate response to the urgencies of the changing climate, yet lengthy administrative procedures and fragmented governance structures would seriously obstruct such measures and actions. This bureaucratic inertia is incredibly prevalent in Greece, but also among many other countries in the EU and beyond. Lengthy procedures actively contribute to the “defuturizing” mentioned in the previous barrier. Again to contextualize this struggle in Greece, a striking example is the prolonged delay in updating the national climate crisis plan. The one currently in place was published in 2008, based on research from 2006 which utilised data from 2000. Efforts to draw up the new version started only in 2020 and for almost five years now have been stalled in governmental procedures due to repeated micro-adjustments (Lialios, 2023). This highlights a severe lag in policy implementation, which does not align with the demands of post-growth planning for swift actions.

Bioregionalism advocates for a decentralization of administration, doing away with governance structures that are slow and disconnected from local issues, and suggests enacting decision-making at the scale of the territory-at-stake and through its natural systems in mind. This could assist in overcoming such bureaucratic hurdles, bridging contextual needs and relevant actionable policies. To illustrate this point, a common Greek anecdote regarding water management can be utilised: “The example of manholes on the national road network is well known. The municipality has to clean the grate, the Periphery the barrel, and the Water Supply & Sewerage Company (EYDAP) the actual pipelines. This problem is even more difficult in cleaning the river streams. The Periphery has jurisdiction over the river bed, the municipality over the river slopes. These are things that at some point we will have to regulate holistically” (Dandogloy, 2023). Instead of this fragmented decision-making scheme, a bioregional administration would consolidate responsibilities under a single (bio)regional

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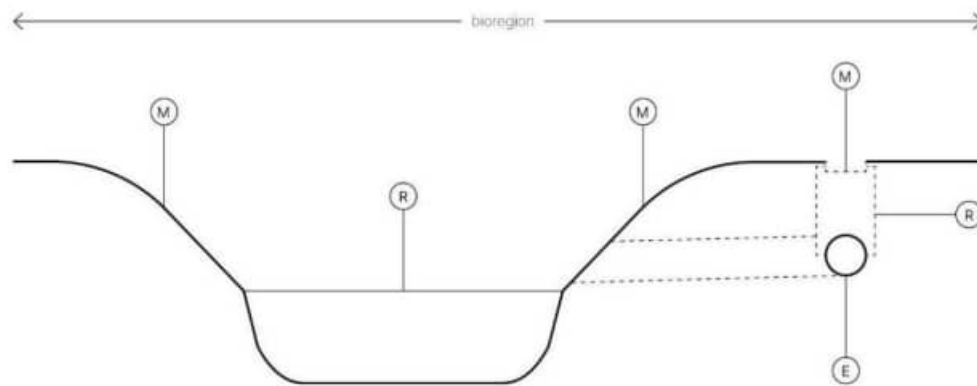
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entity, empowering local actors and allowing for responsiveness and flexibility in implementing post-growth policies (visualised at the diagram below).

**Diagram: Diagrammatic section of river and water administration. The decision-making power is distributed among many administrative bodies, causing confusion and inefficiency. A bioregional approach would unite this fragmented administration into a single decision-making entity.**

M: Municipality, R: Region (Perifereia), E: EYDAP (Water Supply & Sewerage Company)



### *Politico-economic barriers*

Various politico-economic barriers pose significant challenges in advancing the post-growth (planning) approach, as identified by Strunz and Schindler (2018), however bioregionalism could not address them explicitly and thus they will only be briefly examined, as they also do not pertain directly to the realm of spatial planning. First, the most pressing of them is unemployment, as economic growth is seen as indispensable for the creation and upkeep of employment opportunities, thus instilling fear about the loss of jobs. This may hold some merit, since a post-growth society would consciously transition away from certain types of employment that currently dominate western imaginaries—what David Graeber refers to “bullshit jobs”; mundane, corporate, unfulfilling and detached (see the ideas on reduction of work of Kate Soper, 2020). In a post-growth society, labor ought to be shifted to low productivity sectors, like nursing or public employment (Strunz and Schindler, 2018, p. 72). In a similar vein, bioregionalism emphasizes the need to care for the land and highlight the importance of increasing employment in agriculture, as well as environmental protection and restoration or the craft sector. Second, a major barrier is the dominance of GDP as the index of prosperity. Despite its widely recognised and studied failures to account for environmental and social well-being, there has been little effort to transition towards other measures. A bioregional approach could introduce localized indices that focus on environmental protection, resource use and social welfare. This would also be more tangible and more easily measurable on a (bio)regional scale, rather than the often misleading national level. If integrated with EU funding mechanisms for rural development could provide meaningful incentives towards a

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post-growth transition. Third, Strunz and Schindler (2018) highlight pension schemes as a significant barrier, as they “rely on economic growth to offset demographic change” (p. 73). When considering the many reductions to pensions in Europe—and particularly in Greece due to the austerity measures—politically supporting ideas about a post-growth economy would be unpalatable towards older voters. However, related to the barrier of unemployment, a post-growth society seen through a bioregional lens would allocate much more employment towards the elderly, potentially providing more meaningful, personal care towards the rising ageing population than growth-driven economies could through monetary means.

Political polarisation and debt are two other significant politico-economic barriers to the post-growth transition, especially for Greece. Political polarisation disallows garnering the necessary electoral support for ambitious and radical post-growth ideas. Soper suggests that a post-growth program would benefit from alliances between Labour and Green parties (Soper, 2020, p. 164) as a way to bridge this divide. Bioregionalism may stem from anarchist ideas, however in its essence is a matter-of-fact approach, calling attention to the pressing yet practical issues at hand, like floods or wildfires. In this way, unlike traditional political platforms, bioregionalism inspires cooperation by emphasizing the ecological and morphological characteristics of a region. Debt on the other hand represents a structural impediment for post-growth policies, as it prevents the implementation of alternate measures of progress that differ from economic growth. This of course rings very true for Greece. The need to achieve growth through GDP overshadows ecological and societal concerns, thus bioregionalism here does not suffice in offering direct solutions. However, it could provide a framework to ground economic prosperity within a bioregional scale, in which other forms of labour and performance could be best coupled with post-growth policies.

### **An exploration of bioregional administration for post-growth planning**

The examination of barriers and opportunities has illustrated the synergies between post-growth planning and bioregionalism: Overall, bioregionalism could translate planetary-scope post-growth ideas to tangible, contextual agendas, ground decision-making to local realities, foster collective engagement, enhance scalability of post-growth initiatives and advocate for flexible, decentralized governance structures. What is deemed most important is that bioregionalism suggests a conceptual, operational and regulatory framework required for establishing a post-growth planning paradigm. Thus, it could aid in operationalizing a sustainable, just and resilient transition, decoupled from and beyond growth. Now, moving from theory to design experimentation, in this segment I will briefly explore how these ideas could be spatially and institutionally manifested by utilising a case-study of a Greek bioregion that was developed in the context of my thesis *Another Rural* (See Xanthopoulos, 2024).

### ***Defining the bioregion***

Greece “remains one of the least decentralized administrative systems of the EU with local government” (Nikitas and Vasilopoulou, 2022, p. 5, Sotiropoulos, 2018, p. 393)—which when coupled with its dependency to pro-growth national politics, would make adaptation of post-growth policies incredibly challenging. There have been efforts to counteract this, like



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the merging of municipalities through the Kallikratis scheme in 2011, in order to create larger “economies of scale, decrease local government expenditure and establish local government units sizeable enough to marshal resources and skills useful for the absorption of EU funding” (Sotiropoulos, 2018, p. 396). However, any such effort has hitherto proven unsuccessful. Steering away from this dysfunctional system, the definition of the bioregion was firstly explored by looking towards non-anthropocentric, nature-based delineations: floristic regions, freshwater ecoregions, protected zones and climate zones (Xanthopoulos, 2024, p. 64 - 67). This brief literature exploration failed to reveal a suitable spatial framework for the application of post-growth planning. Instead, looking towards the pressing issues of lacking water management in Greece and the history of bioregionalism in the nineteen-seventies (Duží and Fanfani, 2019, p. 9), the watershed is chosen as the way forward. Rivers defy anthropocentric borders and administrative perceptions, and demand a holistic planning approach. In this experiment, the watersheds of the major rivers within the Greek territory are imagined as entities with administrative, decision-making power. This could be the result of joining small-sized municipalities, while allocating decision-making power from the administrative regions (περιφέρειες), as well as public-sector employees. For some cases, the existing administrative, municipal boundaries are not unlike the watershed territorial limits, making this transition easier to imagine bureaucratically. In a more extreme version, municipalities and regions would no longer be required. While this approach might seem overambitious for the Greek context, it is in some ways reminiscent of the Dutch Rijkswaterstaat, which holds much more administrative power than municipalities or regions in relation to water management—thus not entirely out of touch. Also, it highlights the importance of international cooperation, as river ecosystems span neighbouring Balkan countries. While this may be contextually relevant for Greece, it is not proposed as the panacea for imagining a bioregional administration system for post-growth planning—limitations of this approach will be explored in the end. Overall, such an approach could allow for post-growth policies and a planning paradigm to enact them by localising decision-making, bypassing paralyzing bureaucratic procedures and gaining public acceptance by targeting territorial issues, like floods and forest fires, that are in the public perception more than ever.

### *Understanding the bioregion through a post-growth lens*

From these imagined bioregional administrative units, the watershed of the river Spercheios is chosen as a case-study. It is a predominantly rural region located in central Greece, currently governed through two small municipalities—Makrakomi and Lamia. Geomorphologically, it is a valley surrounded by the mountains of Oiti, Timfirstos and Othrys, from which many streams feed into the main river, flowing to the Malian Gulf. The region faces complex issues of intense rural abandonment, frequent destructive flooding and dealing with an aging population, while agriculture remains the dominant occupation. Despite the region being used for food production for several millennia, it is only during our contemporary era of growth that human activities have disturbed the natural environment to this extent, and consequently our human habitats as well. The intensification of agriculture has resulted in immense loss of forest cover (which is crucial for flood prevention and ecosystem services), along with the vernacular agroforestry knowledge and techniques. Pro-growth planning contributed to this through short-sighted infrastructural projects, like the construction of a linear diverter, poorly-



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planned transportation networks and the expansion of agricultural land on the river territory and coastal marshland. At the same time, while the region is untouristic, growth-through-tourism remains deeply embedded in people’s perceptions of the future (often imagined through the revival of hot-spring tourism), even though most have little hope and trust in institutions.

Exemplified through the research framework explored here, a bioregional approach to post-growth planning assisted in the formation of contextual post-growth agenda by demanding a historicized approach in tracing spatial manifestations of growth and understanding the site-specific embeddedness of growth-thinking in public perception. Instead of solely focusing on critiquing the current planning practices or advocating for short-term goals and visions, a bioregional post-growth planning paradigm would allow us to focus on long-term and ambitious shifts, informed by local issues, visions and knowledge. Further research could entail how such a process would be formulated as an analytical tool for post-growth planning.

### ***Constructing a post-growth bioregional imaginary***

With an understanding of contextual problems and ambitions, formulated into a contextual agenda, the role of post-growth planning would be translating it to policies and local actions. However, a bioregional approach to post-growth planning would first engage with the construction of spatial imaginaries that are capable of counteracting the underlying yet dominant growth-based ones, emphasising the future-oriented role of planning. Foresight methods from the field of future studies could be utilised for this task, in order to envision these post-growth futures—something that has hitherto not been extensively researched. To visualize and democratically debate these future-oriented spatial imaginaries an alternative tooling approach might be required. Traditional planning media and processes would likely not suffice in doing so; their shortcomings are evident: they are often exclusionary, abstract and unclear, especially for contexts like Greece, where familiarity with drawings, masterplans and lengthy technical reports is limited from the general public. Instead, a bioregional post-growth planning approach could utilize storytelling, co-visioning and participatory methods, in order to construct tangible, engaging and critical plans. For example, *Another Rural* (Xanthopoulos, 2024, p. 142-195) entailed a narrative-based exploration of such a speculative distant post-growth future within the context of a rural bioregion, imagined through a combination of fiction and academic writing. This was conducted from a first-person perspective, by imagining a day in the life of a bioregional dweller, exploring ideas of employment, housing, ecosystem restoration, decision-making, from a multitude of scales; from the individual house to the role of the EU. Such a speculative and creative process of bioregional visioning could be pivotal for post-growth planning, by engaging disinterested citizens and allowing for future-jumps beyond typical, generic, disengaging visions of the future.

The next step is to move from such long-term visions to place-based, local actions—or for these far-away-future spatial imaginaries to be performed in the present. This could entail engaging with tactical design interventions, focusing on key-projects that would catalyse a post-growth transition through relevant policy implementation. For example, such a design project of *Another Rural* was the revival of traditional “περαταριές”, or make-shift wooden

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structures used to safely transport cargo or animals from one side of the river to the other up until the twentieth century. These were re-imagined as automated, seasonal connecting paths, coupled with water data collection technology, in order to provide seasonal access to the riparian zone and enhance connectivity within the valley, without resorting to large-scale, costly infrastructure that historically has not stood the tests of frequent flooding. Such a key-project bridges ancestral knowledge, vernacular techniques and lifestyles with new technologies and contemporary planning. This aligns with post-growth ideas of utilizing ancestral knowledge and vernacular techniques, questioning pro-growth infrastructural projects of transportation, proposing instead low-cost, nature-based solutions. Thus, instead of aiming for the application of abstract post-growth policies, a bioregional approach to post-growth planning could explore a network of catalytic projects to spatially translate them into actions.

### Reflections and Conclusions

This paper has attempted to illustrate that operationalising post-growth thinking would require more than just EU- or national-scale policies or small-scale experiments—it would require a spatial planning counter-paradigm, a deep ecocentrism and the formation of actionable agendas. However, current efforts remain limited as they face numerous barriers across operational, institutional and politico-economic dimensions. Bioregionalism emerges as a compelling framework to overcome these obstacles by fostering a bioregional administration paradigm, by enabling regional place-attachment and by shaping contextual spatial imaginaries. These synergistic relations could allow for a process of imagining post-growth futures and providing pathways to enact them through spatial planning.

However, certain pitfalls must be acknowledged in this approach. First, a bioregional approach to post-growth planning would rely on a high number of experts present: skilled planners, ecological and water management experts, as well as governance specialists. Aside from many countries like Greece currently lacking this capacity, there is a risk of technocracy if planning processes become overly dependent on such specialized knowledge. To circumvent this, bioregional post-growth planning should emphasize local knowledge and community participation, ensuring that expertise serves the community rather than alienating it, while still maintaining a critical position within a global context. Second, the emphasis placed in local, sustainable, land-based lifestyles could lead to unwanted fetishization of rural life. A bioregional post-growth planning ought to engage critically with the often harsh realities and structural challenges of rural living—not romanticizing the past but balancing historical awareness with an action- and future-oriented perspective. Third, a high degree of regional autonomy could lead to isolation or exclusionary tendencies, and thus to co-optation. Especially when we consider the rise of far-right politics around the globe, forming resilient trans-regional networks should be sacrosanct. These would enable exchange of knowledge and resource-sharing, fostering cooperation and communication. The above points are summarized in the diagram below, illustrating the conceptual framework proposed by a bioregional approach to post-growth planning.

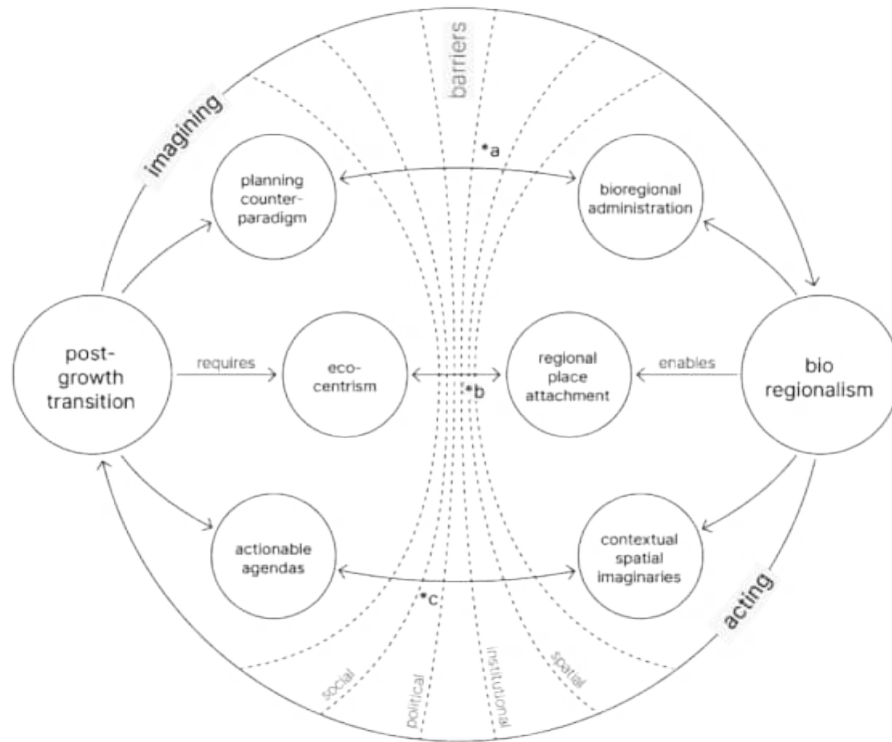
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**Diagram: The synergistic qualities between the post-growth planning approach and bioregionalism allows for a process of imagining alternative ways of living and acting upon them - however this approach has its potential pitfalls and limitations.**

a: technocracy, b: rural fetishization, c: co-optation



Looking towards the experimentation of this approach, few limitations need to be pointed out. The example of bioregional administration through watersheds that has been explored is mostly relevant for Greece's mainland, where territorial continuity allows for administrative restructuring. This approach emphasises Greece's agricultural heritage in order to distance itself from tourism-driven planning, however, in doing so it does not consider the many islands. These function as distinct bioregions with unique dynamics and given their embeddedness to Greece's growth-centric tourism economy and the many challenges they face today due to hyper-tourism, a different approach ought to be explored. Finally, looking ahead, further research is needed in investigating the role of spatial imaginaries for post-growth planning. This could entail comparative work through experimentation with diverse case studies throughout Europe, exploring both rural and urban regions, in order to understand how territorial visions could shape societal transitions away from growth-oriented paradigms. Further work is also required in exemplifying bioregionalism as a transformative planning approach, not only in envisioning post-growth futures, but also in bringing them into being.

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## **CLIMATE RESPONSIVE ENVIRONMENTAL DESIGN IN ARCHITECTURE STUDIES**

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### **Abstract**

Climate responsive architectural design, dated from antiquity, attracted attention in recent years due to climate crisis, and has been described by emerging terms with subtle variations such as bioclimatic, green, sustainable and resilient architecture. In architecture studies sustainable design considerations of solar exposure, shading, daylight, airflow, thermal insulation, material properties, construction methods, are included within design studios, technology courses, histories and theories. Detailed focus on environmental strategies and efficiency calculations based on technical data and computational tools is included in postgraduate engineering studies combined with architectural design or not.

A comprehensive integration of notions, concepts, methods, and tools of environmentally conscious design is approached at the Architecture Department University of Patras with a distribution of sustainable design courses of variant complexity, in the curriculum from the first to the final years of studies. First year theory courses introduce fundamentals of climatology, solar geometry, human comfort and building physics in relation to architecture and present key concepts and terms of the contemporary sustainability discourse, either evolving or subject to critical review including urban resilience, regulations, standards, certifications, research, technology innovations etc., complemented by short exercises. Basic theory, filtered and matured through two intermediate years, is applied in fourth year design studio exploring climate influences, sustainability strategies, site-specific applications, materials, techniques and revealing possibilities and obstacles. Two elective courses, in the fourth and fifth year include environmental design evaluation methodology, qualitative and quantitative criteria, analytic tools and monitoring, and an advanced design studio project on urban redevelopment, microclimate improvement and resilience strategies for public open spaces; such specialized skills are optional but offer deeper understanding and critical insights. This approach enhances architectural education by integrating climate-sensitive design principles across all pedagogic levels. It prepares future practitioners and academics to tackle environmental challenges effectively, fostering innovative sustainable solutions in the built environment.

**Key words:** sustainable design, architectural education, design studio, design evaluation methods, pedagogic strategies

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### **READINGS OF THE NATURAL AND BUILT LANDSCAPE OF LAKE TRICHONIDA - A GUIDE TO DESIGN INTERVENTIONS BASED ON POINTS OF INTERFACE (Thesis project)**

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#### **Abstract**

Landscapes are vital intersections of natural and cultural assets, each defined by unique characteristics that shape their identity and influence human interaction. As dynamic systems, they play a crucial role in urban regeneration, fostering connections between people and place while supporting sustainable development.

The present thesis investigates the identity of the landscape in the region of Aitolokarnania, focusing on the area surrounding Lake Trichonida—a diverse landscape of significant ecological value, characterized by distinct zones that reveal the dynamic relationship between natural and human-made environments. The project aims to study and interpret the landscape's unique characteristics through an architectural lens, promoting harmony between natural and urban dynamics, while redefining the relationship between visitors and the natural environment.

Extensive analysis and mapping was conducted to capture the area's physical, ecological, and cultural dimensions. By layering spatial data, key distinctions and relationships within the landscape were identified, leading to the definition of two main zones. These zones informed the establishment of two axes (transects), which function as tools for systematic landscape analysis. Acting as a coordinate system, the transects integrate regional insights with local conditions, guiding a comprehensive 'reading' of the landscape at both macro and micro scales. This approach facilitates the reevaluation of spatial models, enabling the incorporation of ecological and cultural values into the design process. At the local scale, it provides a framework for proposing site-specific architectural interventions that balance ecological preservation with cultural revitalization, thereby advancing place-centered sustainability.

By employing this structured methodology, the project bridges the gap between architectural theory and practice, offering a framework for interpreting complex landscapes and integrating their unique characteristics into sustainable architectural and urban planning practices.

**Key words:** Landscape identity, spatial analysis, Lake Trichonida, urban regeneration

**A LITERATURE REVIEW ON THE INTRODUCTION OF  
AUTONOMOUS VEHICLES AND ITS IMPACTS - PREPARING THE  
CITY OF THE FUTURE**

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***Abstract***

*Autonomous vehicles (AVs) are expected to transform urban life, not only through technological innovation but also by reshaping transportation systems and urban form and land use. This research conducts a structured, multidisciplinary review of the state-of-the-art literature, critically assessing AV impacts across six key domains: land use and urban design, transportation efficiency, environmental sustainability, safety and ethics, economic transformation, and travel behavior.*

*The paper synthesizes evidence from over 100 peer-reviewed studies and policy reports. Methodologically, it draws upon a range of existing reviews, meta-analyses, simulations, surveys, and scenario-based models to filter out empirical and theoretical knowledge.*

*Key findings highlight the potential of AVs to reduce parking needs by up to 90%, increase roadway capacity by 200%, lower greenhouse gas emissions by up to 94%, and enhance travel efficiency and accessibility. However, these benefits are contingent on governance structures, ownership models, and regulatory oversight. Risks include urban sprawl, induced demand, equity disparities, and labor displacement. The paper concludes that AVs are not a technological inevitability but a socio-technical phenomenon whose urban impact will depend on proactive planning and inclusive governance. The review aims to serve as a foundational reference for policymakers, planners, and researchers seeking to guide AV adoption toward more sustainable and equitable urban futures.*

***Key words:*** *Autonomous vehicles, impact of Avs, urban transformation, capacity, urban sprawl*

**1. Introduction**

The advent of autonomous vehicles (AVs) marks one of the most profound transformations in the transportation sector since the advent of the automobile. As a technology that integrates artificial intelligence, advanced sensors, machine learning algorithms, and real-time data processing, AVs promise to redefine personal mobility and the broader functioning of urban

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environments. Governments, industries, and research institutions around the world are investing heavily in AV development, driven by visions of safer, cleaner, and more efficient transport systems. These visions are underpinned by compelling narratives: AVs could dramatically reduce traffic accidents by eliminating human error, optimize roadway capacity through intelligent routing, decrease greenhouse gas emissions via electrification, and enhance mobility for populations currently underserved by traditional transport options.

However, the implications of AVs extend far beyond transportation efficiency or technological novelty. Their introduction raises complex questions about urban form, land use, governance, equity, labor markets, energy systems, and ethical responsibility. As vehicles begin to navigate public roads without human drivers, cities must confront a host of unprecedented challenges. Our research poses the following questions: Will AVs foster compact, transit-oriented development, or will they exacerbate urban sprawl? Can they sustainably reduce emissions, or will their convenience create increased travel demand? Will they democratize access to mobility, or widen existing socio-economic disparities? These are not merely technical questions, but deeply political and spatial ones, tied to broader debates about how we design, inhabit, and govern our cities.

The current discourse on AVs is growing rapidly, but it is also highly fragmented. While there is a wealth of technical literature addressing vehicle automation systems, navigation algorithms, and simulation models, there is comparatively less integrative research that explores the societal and spatial consequences of AV adoption in a holistic manner. Moreover, much of the mainstream discourse tends to emphasize the benefits of AVs, often downplaying or overlooking the risks, trade-offs, and governance dilemmas they pose.

This paper responds to this gap by offering a structured and critical review of the state of the art in AV research, with a focus on six major areas of urban impact. Our aim is to move beyond fragmented or overly optimistic interpretations, and instead offer a comprehensive analysis of AVs as complex socio-technical systems. Through a knowledge-based approach, we seek to inform both academic debates and policy processes, providing stakeholders with a robust framework for understanding and responding to the multifaceted challenges posed by AVs with respect to urban planning.

## 2. Related Literature

The literature on autonomous vehicles has expanded rapidly in recent years, spanning multiple disciplines and thematic areas. Within this growing body of research, several review papers have emerged that attempt to consolidate findings, identify trends, and highlight areas of uncertainty. These review studies have provided valuable groundwork for understanding AV implications but often vary in scope, methodology, and focus. In this paper, we build our foundation on fourteen key review articles that represent influential contributions to the field and serve as anchor points for our synthesis, while also studied and presenting key aspects of salient key papers of the literature.

Makahleh et al. (2024) applied a systematic coding approach using NVivo software to synthesize 41 peer-reviewed articles, identifying seven core themes: benefits, behaviors and perceptions, sustainability, legislation, infrastructure, climate mitigation, and adaptation. Their analysis is broad in scope but highlights a dominance of European and American case



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studies, with limited insights from the Global South. Key findings include strong support for AVs as tools for emissions reduction and mobility enhancement, alongside persistent gaps in public trust and regulatory clarity. The study concludes with a call for more geographically inclusive and behaviorally informed research. The article's theme is a comprehensive evaluation of AV roles in sustainable urban transport, executed through thematic coding of international literature with emphasis on regional disparities in research focus.

Olayode et al. (2023) conducted a comprehensive systematic literature review examining the applications, implications, and public perceptions of autonomous vehicles (AVs) in road transportation systems. The review highlights AVs' potential to improve road safety, reduce congestion, and lower emissions, while also recognizing barriers related to infrastructure readiness, ethical dilemmas, and human trust in automation. Drawing on global literature and using a thematic synthesis approach, the study explores perceptions and infrastructural needs in the context of diverse urban transport systems. Ultimately, the research frames AVs as a transformative but disruptive force, emphasizing the need for proactive planning and public education. The article's core theme is the intersection of AV technology and human acceptance, using systematic review methods to reveal the growing yet cautious optimism surrounding AVs worldwide.

Rahman and Thill (2023) explored the multifaceted impacts of connected and autonomous vehicles (CAVs) through a systematic review of 130 articles, analyzing short-, medium-, and long-term implications for urban mobility and the environment. Their methodology included SWOT analysis and a global literature scan, with findings primarily reflecting North American and European urban contexts. The review notes that while CAVs may enhance energy efficiency and reduce traffic incidents, they also pose risks such as increased urban sprawl and traffic volumes. Their results underscore the complex interplay between CAV deployment and urban form, highlighting the urgency of forward-looking urban planning. The article's central theme is the layered temporal impact of CAVs on city systems, evaluated through a robust literature review that anticipates both opportunities and structural challenges in future urban environments.

Kroesen et al. (2023) analyzed the evolution of expert opinions on AVs through a longitudinal panel survey, complemented by Q-factor analysis. The study focused on European experts involved in the WISE-ACT project and captured opinion shifts over time. Initially optimistic projections about AVs' benefits in emissions and congestion declined as experts became more skeptical about induced demand and real-world complexity. The findings reveal two distinct expert clusters: one optimistic and one critical, reflecting growing uncertainty around AV deployment. The article's theme is the evolving nature of professional consensus on AVs, methodologically grounded in expert tracking that underscores the fluidity of expectations in the face of emerging evidence.

Othman (2022) offered a holistic review of AV impacts across safety, public health, behavior, land use, economy, and their potential role during pandemics. The study uses a comprehensive literature scan combined with SWOT analysis to integrate findings from both developed and developing countries. Unique contributions include examining AV implications for public transit systems and the resilience of transport during health crises. The review identifies legislative gaps, ethical dilemmas, and infrastructural constraints as key

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hurdles. The article’s theme is an integrated assessment of AV societal impacts, using wide-ranging sources to argue for a cross-sectoral and globally inclusive AV strategy.

The New York City-focused policy review (2022) investigates secondary impacts of AV deployment beyond transportation, including safety, equity, data governance, and public engagement. The study synthesizes a diverse body of literature and uses New York City as a reference point to explore broader urban implications. It emphasizes the difficulty of statistically validating AV safety and critiques overreliance on disengagement metrics. The authors advocate for multidimensional testing protocols and participatory governance to guide safe and equitable AV adoption. The paper’s theme is the broader urban policy landscape surrounding AVs, with a localized policy lens on New York City, derived from cross-disciplinary literature that stresses the need for nuanced and inclusive regulatory frameworks.

Harb et al. (2021) adopted a naturalistic experimental design to project changes in travel behavior in an AV context. They found that comfort and convenience could lead to longer commutes and lower vehicle occupancy, reinforcing some of the concerns raised in previous reviews. Their methodological innovation—using virtual simulations to elicit real-world behavior—sets an important precedent for future empirical research.

Narayanan et al. (2020) shifted the lens to shared AV services, synthesizing the operational, behavioral, and regulatory aspects of mobility-as-a-service platforms that deploy AVs. They highlighted the promise of shared AVs in reducing vehicle kilometers traveled and parking demand but also underscored the barriers to adoption, such as user resistance, regulatory gaps, and infrastructure constraints. Their contribution lies in connecting AV technology with emerging mobility paradigms, though their review remains largely transportation-centric.

Faisal et al. (2019) provided a structured review of AV capabilities, potential urban disruptions, and the readiness of policy and planning domains. Through a systematic literature review approach, they examine global cases but pay particular attention to smart urban mobility initiatives in the Global North. The authors propose a planning-oriented framework linking technological drivers with policy interventions and uptake dynamics. Their findings show that although AVs could facilitate sustainable urban mobility, cities remain largely unprepared in terms of regulation, infrastructure, and strategic foresight. The article’s theme is planning readiness for AV disruption, grounded in a systematic synthesis of literature that underscores the lag between technological potential and policy implementation.

Freemark et al. (2019) examined the extent to which U.S. cities are preparing for AV deployment through content analysis of planning documents from the 25 largest municipalities and surveys from 120 city officials. Using statistical modeling to correlate preparedness with urban characteristics, they found that cities with higher populations and growth rates are more likely to engage in AV planning. Despite growing interest, most cities had yet to address AVs in zoning, infrastructure, or mobility policies. Officials expressed both enthusiasm and concern—highlighting potential gains in safety and efficiency but fearing increased sprawl and declining transit use. The article’s central theme is institutional readiness for AVs, assessed through empirical methods that uncover a readiness gap in American urban planning.

Soteropoulos, Berger, & Ciari (2019) review 36 modelling studies to assess how automated vehicles (AVs) may influence travel behavior and land use. The findings show that

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private AVs could increase travel distances and promote urban sprawl, while shared AVs (SAVs) may reduce car ownership and free up parking land. Outcomes for urban form vary—ranging from densification to decentralization—depending largely on policy choices and planning frameworks. The study emphasizes that the urban impact of AVs will be shaped more by governance than by the technology itself.

Milakis et al. (2017) offered a foundational review of the societal and policy implications of automated driving, organizing impacts into first-, second-, and third-order effects. Using a conceptual “ripple effect” framework, the study categorizes outcomes from direct changes in travel behavior to broader transformations in urban land use and public health. Although not focused on a specific city, the review is rooted in European transport policy discourse and emphasizes interdependencies between AV development and societal trends such as digitalization and the sharing economy. The authors conclude that while early benefits such as fewer crashes and improved efficiency are likely, long-term effects on equity and sustainability remain uncertain. The article’s theme centers on systemic societal implications, methodologically framed through a tiered impact model that encourages holistic policy thinking.

Finally, Duarte & Ratti (2018) explore how autonomous vehicles (AVs) could reshape cities, emphasizing that their impact depends on whether they are privately owned or shared. Shared AVs have the potential to reduce the number of vehicles, reclaim parking land, and enable more compact, livable urban environments. In contrast, private AVs may encourage longer commutes and lead to urban sprawl. The authors stress the importance of proactive urban planning to avoid repeating the mistakes of the 20th century, when cities were reshaped around the automobile with largely negative consequences.

While each of these reviews provides valuable insights, they often operate within disciplinary silos or narrowly defined themes. What is missing is a cross-cutting, impact-oriented framework that synthesizes positive, negative, and policy dimensions across major urban domains. This paper addresses this gap by offering an integrated analysis that categorizes AV impacts through a tripartite lens: opportunities, risks, and solutions. Our goal is not only to summarize existing knowledge but also to reorganize it in ways that are actionable for both scholars and practitioners.

### 3. Research Methodology

This paper is motivated by the need to reassess the state of the art (SoA) on autonomous vehicles (AVs) through a more integrative and policy-relevant lens. While a growing body of literature explores various dimensions of AV deployment—from technical performance to user preferences—much of the existing research remains thematically fragmented and lacks a consistent analytical structure that facilitates comparison across domains. Many review articles emphasize either the technological benefits or the challenges of AVs in isolation, often without linking these outcomes to broader urban systems, governance structures, or societal impacts.

Moreover, existing reviews typically adopt a domain-specific focus—examining, for example, the environmental effects of AVs, or their influence on mobility patterns—without integrating these perspectives into a comprehensive, cross-cutting framework. This narrow

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thematic orientation limits the utility of such studies for policymakers and planners who must weigh competing priorities and navigate complex trade-offs in the transition toward AV adoption.

This paper seeks to address that gap by adopting a more structured and impact-oriented approach. Specifically, it introduces a tripartite analytical framework for each of six key urban impact areas—(1) land use and design, (2) urban transportation: congestion etc, (3) environmental sustainability, (4) safety and ethics, (5) economic transformation and (6) travel behaviour. Within each impact area, we organize the literature into three dimensions:

1. **Positive Aspects:** highlighting the opportunities and anticipated benefits of AV deployment;
2. **Problems and Risks:** identifying criticisms, trade-offs, or unintended consequences associated with AVs;
3. **Policy and Planning Proposals:** presenting regulatory, institutional, or planning responses that have been proposed in the literature.

This format is intentionally designed to help readers understand not only what AVs may do, but under what conditions their effects may be beneficial or detrimental. By organizing findings in this manner, we aim to offer a critical yet constructive synthesis of current knowledge, one that is useful for both researchers and practitioners. The contributions of this paper are threefold.

First, it provides a comprehensive synthesis of AV-related impacts that draws from a wide range of disciplinary perspectives, including transportation planning, environmental science, public policy, and economics. Second, it introduces a consistent evaluative structure that can be applied to other emerging mobility technologies beyond AVs. Third, it identifies key areas where future research and policy development are urgently needed, particularly in governance, equity, and spatial planning.

Ultimately, this paper is not just a literature review; it is a strategic framework for understanding how AVs intersect with the critical dimensions of urban life, and how their deployment can be guided toward more sustainable, inclusive, and adaptable urban futures.

## 4. Societal and Spatial Impacts of Autonomous Vehicles

### *4.1 Impacts on urban land use and urban transformation*

#### ***Positive aspects***

Autonomous Vehicles (AVs) are poised to fundamentally reshape urban environments by reducing the need for parking, transforming street design and altering urban development patterns. The precision of AV navigation, coupled with their potential deployment as shared fleets, allows for a significant reduction in personal vehicle ownership and parking demand. AVs also due to enhanced road capacity enable more efficient use of curb space and support narrower, safer lanes, allowing for reimagined streetscapes focused on walkability and public life. These changes open new possibilities for transforming underutilized areas into green infrastructure, pedestrian plazas, or mixed-use development. Before summarizing the main quantified impacts available in the literature (see relative Table), potential impacts and risks related to land use are analyzed as follows:

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### ***Shared Avs and land use***

Shared Autonomous Vehicles systems offer significant spatial benefits. Fagnant & Kockelman (2014, 2016) and Boesch et al. (2016) show that shared AVs could replace 67–90% of conventional vehicles and reduce parking requirements by over 90% in some scenarios. These effects depend on the mode of automation, public transit presence, and user willingness to share rides.

### ***Parking modification and land reuse opportunities***

The anticipated reduction in parking demand is among the most well-substantiated impacts of AVs. AVs’ ability to self-park remotely or in compact formations and their use in shared fleets means fewer vehicles will be idle at any given time, especially in central business districts.

Numerous studies forecast a reduction of 40% to over 90% in parking land use, depending on AV adoption and whether vehicles are privately owned or shared (Narayanan et al., 2020; Milakis et al., 2017; Zhang et al., 2015; Kim, 2018; Chehri & Mouftah, 2019). Zhang et al. (2015) reported a 90% decrease in parking needs in Atlanta with only 2% AV adoption. Narayanan et al. (2020) estimated that AVs could reduce parking requirements by 48–90%, depending on deployment models. In Austin, Texas, Fagnant and Kockelman (2014) estimated an average reduction of 11 parking spaces per shared AV, while Zhang and Guhathakurta (2017) projected the removal of up to 20 parking spaces per AV and found that just 5% SAV adoption in Atlanta could yield a 4.5% decrease in parking demand, equivalent to a 90% reduction for the users served.

Urban simulations have highlighted even greater possibilities: the International Transport Forum (2015) / ITF Lisbon case suggested that AV deployment could allow cities to reclaim 20% of total road space projected that AV deployment could eliminate 80% of off-street parking in Lisbon and free up 20% of city street area. Technologies like valet-style autonomous parking (Li & Shao, 2015) enable AVs to find efficient parking paths, while remote drop-off models increase flexibility (Fagnant & Kockelman, 2015).

### ***Transportation system capacity and efficiency***

Autonomous vehicles (AVs) are poised to redefine the functionality and performance of urban and interurban transportation systems. Among the most quantifiable and critical outcomes of their deployment is the transformation of roadway and intersection capacity. Through the application of advanced communication technologies, coordinated driving behavior, and automated control systems, AVs can increase the effective capacity of existing infrastructure.

AVs are expected to enhance road capacity through vehicle-to-vehicle (V2V) communication, platooning, and cooperative adaptive cruise control (CACC). Research indicates that AVs can double or even triple existing roadway capacity under full market penetration scenarios (Tientrakool et al., 2011; Friedrich, 2016; SAFE, 2018). A CACC penetration rate of 40% has been identified as a tipping point for major capacity gains (Arnaout & Bowling, 2011). Friedrich (2016) calculated that at 100% AV penetration, lane capacity could increase to 3,900 vehicles/hour, compared to 2,200 for human-driven cars. Intersection capacity may also rise by up to 40%.



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According to Milakis et al. (2017), road capacity increases by over 10% with just 40% AV penetration, and by up to 200% at 100% AV adoption. This is due to improved driving uniformity and shorter headways. Similarly, Shladover et al. (2012) modeled CACC (Cooperative Adaptive Cruise Control) penetration and found that 10%, 50%, and 90% adoption could increase capacity by 1%, 21%, and 80%, respectively.

Even more dramatic findings were reported by Tientrakool et al. (2011), who estimated capacity improvements between 43% and 273%, facilitated by the integration of on-board sensors and communication systems. These allow AVs to maintain minimal gaps safely, increasing vehicular throughput.

Automated traffic and intersection control systems are predicted to increase intersection throughput by over 100%, and in some cases, intersection delay times dropped by 80% when AVs managed signal coordination, enabling more vehicles to pass per signal cycle. (Clement et al., 2004; Wagner, 2016; Kamal et al. (2015).

Advances in intersection control algorithms also contribute to capacity gains. Altche et al. (2017) developed a supervised coordination framework that mitigates collision and deadlock risk at roundabouts and merging areas, enhancing both capacity and safety. Dresner and Stone (2008) proposed an autonomous intersection control framework requiring 95% AV penetration to operate effectively. This concept eliminates the need for traditional traffic lights by enabling AVs to negotiate intersections via real-time communication, significantly increasing flow rates.

Meanwhile, Liebner et al. (2013) introduced intersection assistance systems, providing AVs with decision-making support to pass through intersections efficiently. Such increases in efficiency could justify cancellation or redesign of planned road expansions, offering opportunities to reallocate funds toward active and sustainable transport (Hendrickson et al., 2014).

### ***Thresholds of efficiency and forecasting and systemic capacity expectations***

Capacity improvements heavily rely on achieving certain penetration thresholds and levels of system cooperation as mentioned before. A meta-analysis involving contributions from Arnaout & Bowling (2011), Monteil et al. (2014), and Talebpour & Mahmassani (2016), among others, revealed that 40% penetration of CACC is a critical minimum for realizing more than 10% capacity gains. Full deployment, especially at Level 3 automation and beyond, can lead to a doubling or more of road capacity, contingent on homogeneity and coordination. That said, vehicle heterogeneity, particularly in transitional periods when both AVs and conventional vehicles share roads, can reduce flow efficiency—especially near interchange ramps and merging zones.

Macro-scale modeling by SAFE (2018) forecasts 50–70% capacity increases at 50% AV penetration, with gains rising to 320% at full AV adoption. However, as Milakis et al. (2017b) and Harb et al. (2021) caution, these theoretical improvements may be partially offset by increased travel demand, especially if private AV ownership remains dominant over shared mobility options.



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### ***Problems and risks***

While the potential for land reclamation and densification is substantial, the actual impact of AVs on urban form will depend heavily on policy decisions. Without proactive planning, AVs could encourage urban sprawl. The comfort and convenience associated with AV travel may increase tolerance for longer commutes, leading to dispersed settlement patterns. Freemark et al. (2019) show that most U.S. cities have yet to update zoning codes and planning frameworks to anticipate AV-related transformations. This institutional lag could result in missed opportunities for densification, public space regeneration, and equitable urban redevelopment.

### ***Urban form: densification vs. sprawl***

Autonomous vehicles may influence urban form in two opposing directions—encouraging urban sprawl or supporting densification.

On one hand, reduced travel costs and more comfortable commutes could encourage low-density development on urban fringes (Bagloee et al., 2016; Crayton & Meier, 2017). AVs could render transit services unnecessary in many suburban or rural areas (Zakharenko, 2016), contributing to green suburban expansion. Privately owned AVs may encourage urban sprawl by increasing the appeal of long-distance commuting and remote suburban living, reversing trends toward compact urban growth (Soteropoulos et al., 2019). Carrese et al. (2019) found that 40% of surveyed AV users in Rome were willing to relocate further from the city center. As travel time becomes more productive or comfortable, AVs may shift residential preferences, prompting some groups—especially younger households—to move further from the city center, while others may remain urban due to lifestyle or service needs (Soteropoulos et al., 2019). This dynamic raises concerns about increased land consumption and environmental impacts.

On the other hand, AVs could also contribute to urban densification, especially when paired with supportive policies. Reduced parking needs, improved accessibility, and enhanced mobility options could reinforce the role of central business districts and promote higher land-use efficiency (Childress et al., 2015; Zhang et al., 2015). Strategic policies—such as restricting zero-occupancy trips, encouraging vehicle sharing, and redeveloping parking infrastructure—can guide AV integration toward compact city goals (Yigitcanlar & Kamruzzaman, 2018; Staricco et al., 2020).

### ***Discussion-Policy and planning proposals***

Whether autonomous vehicles lead to urban densification or sprawl, Duarte and Ratti (2018) argue, will depend heavily on how cities regulate land use and mobility—if AVs are shared and supported by compact development policies, they may enable vibrant, denser urban cores; if privately owned and unregulated, they risk encouraging longer commutes and suburban expansion.

To harness the full urban design potential of AVs, cities must proactively update zoning regulations, reduce or eliminate parking minimums, and reimagine street and curbside design. Integrating AVs into broader smart city initiatives—such as real-time curb allocation and dynamic freight management—can ensure that reclaimed spaces are equitably and efficiently repurposed. Supporting Transit-Oriented Development (TOD), promoting mixed-use infill,

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and incorporating AV infrastructure into comprehensive land-use plans are essential steps for avoiding AV-induced sprawl and maximizing social and environmental gains.

Managing AVs' urban impacts requires robust governance and proactive policy frameworks. Researchers caution against unregulated zero-occupancy vehicles (Chase, 2014). Urban form, sustainability, and livability will depend on how AVs are regulated and aligned with long-term planning goals (Yigitcanlar & Kamruzzaman, 2018; Cugurullo et al., 2020).

### ***4.2 Impacts on urban transportation***

#### ***Positive aspects***

The studies mentioned above that describe the factors that lead to capacity improvements apart from the apparent impacts on road capacity have also an interesting impact on the reduction of congestion.

#### ***Urban congestion reduction and driven efficiency***

AVs leverage advanced control algorithms, sensors, and communication systems to coordinate movement, smooth flow, and reduce unnecessary braking and acceleration. Fernandes and Nunes (2012) introduced a platooning model that increases traffic capacity and flow stability through vehicle synchronization in dedicated lanes.

Similarly, Nilsson et al. (2017) developed a lane-changing algorithm that improves traffic homogeneity and efficiency, while Bai et al. (2017) demonstrated that cooperative lane-changing can further reduce congestion and improve roadway performance. Zhou et al. (2017) and Xie et al. (2017) found that ramp metering and freeway control systems enhanced AV efficiency by reducing speed variance and increasing vehicle throughput.

Numerous simulation-based studies confirm that AVs have the potential to significantly reduce traffic congestion. This reduction is attributed to vehicle automation eliminating human errors, optimizing space between vehicles, and improving coordination at intersections and on highways.

Morando et al. (2018), Olayode et al. (2022), and Severino et al. (2021) consistently found that autonomous mobility contributes to a reduction in traffic congestion and collisions, particularly as penetration rates increase. Fagnant and Kockelman (2015) estimated a 15% drop in freeway congestion delays at just 10% AV market share, while Atiyeh (2012) observed 35–39% lower congestion and 8–13% faster traffic speeds with 50% AV penetration.

#### ***Optimizing: Travel time, time value, travel delay***

Krueger et al. (2016) found that AV adoption depends heavily on service-level factors such as wait time, travel time reliability, and trip cost. Furthermore, Zhang et al. (2018) observed that when AV-related delays increase (e.g., 15 minutes), private car ownership drops from 9.5% to 12.3%, indicating sensitivity to trip efficiency.

A key performance area for AVs is their ability to reduce system-wide travel delay. According to Amirgholy et al. (2020), an optimal combination of lane management and high AV market share can cut travel delays by up to 78%, keep the travel time increase under 5%, and reduce delay costs by 66%.

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Carrese et al. (2019) reported travel time reductions between 10% and 19% at full market penetration of shared AVs (SAVs) and Levin et al. (2017) showed that personal AVs could cut travel time by 73% compared to conventional cars. This effect was further amplified when SAV fleets were scaled—160% SAV increase yielded a 70% time saving.

Though benefits grow with adoption, some studies caution against assuming linear improvements. Papadoulis et al. (2019) and Auld et al. (2018) found that 100% AV penetration could paradoxically increase travel time by 20%, especially if traffic management does not adapt quickly enough. However, this time is seen as more productive, with 30–50% reductions in the opportunity cost of travel time.

### ***Integration of autonomous vehicles with public transport***

As cities aim to modernize transport systems and enhance sustainable mobility, the integration of autonomous vehicles (AVs) with public transportation has emerged as a critical area of research and experimentation. Rather than replacing public transport, AVs—particularly shared autonomous vehicles (SAVs)—can serve as complementary assets, enabling seamless multimodal mobility, enhancing first-mile/last-mile connectivity, and reducing operational costs.

#### *1. Technological shifts and new mobility platforms*

Gao et al. (2016) emphasize the transformative potential of AVs, describing them as “game-changing” technologies that challenge existing operational paradigms. Bucchiarone et al. (2020) elaborate on the architecture of the Autonomous Shuttle-as-a-Service (ASaaS) model, which is structured into three layers: mobility coordination, operational control, and user interaction—highlighting the sophistication and adaptability of AV-based public transport systems.

#### *2. Public transit ridership and operations*

While AVs may complement public transport, researchers also caution that poorly planned deployments could cannibalize transit ridership. Zakharenko (2016) warns that AVs might render some public transit services redundant in low-density areas. However, Hagenzieker et al. (2020) and Wiesmayer (2019) observe high public enthusiasm for AV shuttles, albeit tempered by concerns about speed and service frequency.

Feller (2021) further argues that automated bus rapid transit (BRT) systems can carry similar passenger volumes as light rail but at significantly lower costs, making AVs a practical solution for corridor-based transit enhancements.

#### *3. Governance, equity, and local planning*

Effective integration of AVs with public transit requires strong municipal planning. Schaller (2007) and Freemark et al. argue that cities retain control over zoning, public space allocation, and transit operations, giving them critical levers to ensure AVs support rather than undermine transit. However, many municipalities have yet to engage with AV planning proactively.

WSP (2021) and Metz (2018) advocate for deploying AVs in controlled environments—such as bus depots or designated transit corridors—as pilot cases for more ambitious future rollouts.

#### *4. Integration of AVs - Travel demand and vehicle Kilometers travelled (VKT)*

The integration of AVs into public transit systems can have mixed impacts on travel demand. Tirachini et al. (2020) report that VKT may increase significantly with SAV deployment—

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between 7 and 10 km per passenger—whereas buses experience more modest increases (0.4 to 1.1 km/passenger). While this additional VKT raises concerns about environmental impacts, it may also reflect improved accessibility. Several studies (e.g., Childress et al., 2015; International Transport Forum, 2015) warn that AVs could induce greater travel demand through modal shift away from traditional public transport, with travel increases between 3% and 27%. However, these effects can be mitigated through dynamic ride-sharing models, coordinated AV-transit systems, and pricing mechanisms.

### ***Problems and risks***

When we analyze the integration of AVs with public transportation, we held the potential to revolutionize urban transportation, not by replacing public transit but by enhancing it. Moreover “Duarte and Ratti (2018) highlight a central uncertainty in the AV transition: whether cities will ultimately host fewer or more vehicles depends on the balance between shared and private AV adoption—shared use could dramatically reduce fleet size, while privately owned AVs might maintain or even increase current levels of car ownership.

### ***VMT/VKT and empty vehicle travel***

Despite the efficiency gains, AVs may result in increased vehicle kilometers traveled (VKT) due to zero-occupancy trips, particularly for repositioning, searching for cheap parking, or returning home after drop-off. Simulations suggest VKT increases between 5% and 60% depending on policy and pricing structures (Zhang & Guhathakurta, 2017; Hörl et al., 2016; Fagnant & Kockelman, 2014).

Garus et al (2024) argues that autonomous vehicle parking choices, especially sending cars home, risk increasing empty travel and energy use, challenging sustainable urban land repurposing goals.

Without mitigation—such as congestion pricing or shared-ride incentives—these trends could negate the environmental and congestion-reducing benefits of AVs. A large body of literature projects substantial increases in VMT under widespread AV adoption. Gelauff et al. (2019) estimated a 5–25% VMT increase, while Zhang et al. (2015) found a 15.3–62.3% rise in daily VMT, with a median household increase of 26.5 miles reported by Zhang et al. (2018). Even modest projections, such as Fagnant and Kockelman (2015), anticipate 2–9% growth in VMT under certain adoption models.

Empty VMT—vehicle travel without passengers—is a particular concern in shared AV systems. Childress et al. (2015) forecasted 11–20% more empty miles, while Loeb et al. (2018) found 19.6–31.5% additional vacant VMT with shared AVs. Hörl (2017) identified that empty VMT could comprise 28–30% of total AV fleet activity in urban taxi scenarios.

The extent of VMT changes is highly sensitive to whether AVs are shared or personally owned. Levin et al. (2017) showed that a single shared autonomous vehicle (SAV) could replace up to 3.6 private vehicles, and Carrese et al. (2019) estimated that 100% penetration of ride-sharing AVs could reduce VMT by up to 19%.

However, shared AVs may also require more repositioning and deadheading, which increases non-passenger VMT. This trade-off underlines the importance of operational strategy and fleet design.

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### ***Mixed-traffic complexities***

The transition to fully autonomous systems includes phases of mixed traffic, which introduces complexity. Studies by Hoedemaeker & Brookhuis (1998) and Gouy et al. (2014) show that human drivers may react unpredictably to AVs, potentially reducing traffic efficiency. Petit & Shladover (2015) also warn of cybersecurity threats that may disrupt traffic if AV systems are compromised. Mladenovic & McPherson (2016) explore AVs as a platform to incorporate social justice into traffic control systems, though they also note the need for inclusive infrastructure design.

### ***Discussion-Policy and planning proposals***

The integration of autonomous vehicles into urban traffic systems presents both immense opportunities and substantial risks regarding congestion and delay. When thoughtfully managed, AVs can dramatically improve network efficiency, reduce travel delays, enhance roadway capacity, and optimize user time and cost. However, without strong policy oversight and equitable planning, these gains may be diminished by increased travel demand, system misuse, zero-occupancy vehicles cruising or repositioning or lack of integration with broader transport networks.

To prevent AVs from worsening congestion, cities should implement VMT-based pricing, dynamic congestion fees, and curb management policies to discourage low-occupancy and empty trips. Chase (2014) highlights the danger of increased urban congestion if these trips are not taxed or regulated. Simoni et al. (2019) and Millard-Ball (2019) argue that AVs simplify congestion pricing implementation, providing public health and environmental benefits through reduced traffic density. Incentives for shared AV services and integration with high-capacity public transit systems can help redirect demand toward more sustainable modes. Strategic planning should also include dedicated lanes for shared AV fleets, real-time management of pick-up/drop-off zones, and mobility-as-a-service (MaaS) platforms that prioritize efficiency and accessibility over private vehicle use.

Autonomous vehicles hold the potential to revolutionize urban transportation, not by replacing public transit but by enhancing it. Their integration can expand accessibility, reduce energy use and increase efficiency in both service provision and land use. However, this potential will only be realized if AVs are implemented as part of coordinated multimodal systems, with thoughtful planning, regulation, and a commitment to public interest.

Realizing the full benefits of AVs will require not only technological advancement but also data-driven planning, progressive policy-making, and human-centered design that considers the needs of all road users.

## ***4.3 Environmental impacts and energy use***

### ***Positive aspects***

If properly deployed, AVs have the potential to significantly reduce greenhouse gas (GHG) emissions and improve urban air quality.



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### ***Reduction in greenhouse gas emissions- mitigation of air pollutants- increase fuel efficiency***

One of the most optimistic projections concerning AVs involves their potential to dramatically reduce greenhouse gas emissions. Milakis et al. (2017) estimate that with the synergy of vehicle automation, electrification, and shared mobility, GHG emissions could decline by up to 94%. This estimate is reinforced by Greenblatt and Saxena (2015), who modeled autonomous electric taxis in 2030 and found an 87–94% per-mile reduction in GHG emissions in multimodal systems when compared to 2014 internal combustion engine vehicles. Beyond GHGs, AVs also promise reductions in various air pollutants. Fagnant and Kockelman (2014) reported notable reductions across several pollutant types: 5.6–49% for GHGs, 34% for CO, 19% for SO<sub>2</sub>, 18% for NO<sub>x</sub>, 49% for VOCs, and 6.5% for PM (particulate matter). Similarly, Bose and Ioannou (2001) demonstrated that even modest penetration rates of ACC-equipped vehicles (10%) could reduce CO and CO<sub>2</sub> emissions by over 60% during rapid acceleration.

The link between congestion mitigation and fuel savings is well-documented. Manzie et al. (2007) and Ioannou & Stefanovic (2005) observed up to 33% fuel efficiency gains from AV systems using long-range traffic prediction and adaptive cruise control. Zohdy and Rakha (2016) further noted 33–45% fuel savings at intersections using AV-based control over traditional signal systems. Kopelias et al. (2020) synthesized 35 studies and found that AV-related emission reductions range from 5% to 94%, depending on vehicle type and usage patterns. CACC and platooning further reduce fuel use by up to 50% under highway conditions, particularly in freight and logistics contexts.

Capacity enhancement through AVs also yields environmental advantages. Zohdy & Rakha (2016) reported fuel savings between 11% and 45% depending on the control method applied (signalized, all-way-stop, or roundabout). Complementary findings by Ala et al. (2016) and Asadi & Vahidi (2011) show that trajectory optimization using vehicle-to-infrastructure communication can save up to 47% in fuel. AVs also optimize acceleration, deceleration, and routing, potentially increasing fuel efficiency by 10–45% (Milakis et al., 2017; Vahidi & Sciarretta, 2018).

Apart from the aforementioned direct GHS emission reduction impacts, the following facts on the potential reduction of energy use further indirectly affect GHS emission levels.

### ***Energy use***

AVs introduce substantial energy-saving opportunities. For example, Qi et al. (2018) report 12–22% fuel savings through the use of partial automation and intelligent human-machine interfaces. Brown et al. (2014) suggest that AVs could achieve over 90% energy savings in shared electric scenarios by 2030.

Moreover, Kopelias et al. (2020) found that connected and autonomous vehicle (CAV) systems could reduce fuel usage by 30–90%, while Narayanan et al. (2020) indicate that shared autonomous vehicle (SAV) models could slash energy consumption by 37–80%. These values are echoed by Moorthy et al. (2017) who show that AVs integrated with public transit for last-mile delivery can outperform private vehicle energy usage by as much as 37%.



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Yet, Wadud et al. (2016) present a nuanced picture: AVs could reduce energy use by 45% through eco-driving and reduced congestion, but increase energy consumption by up to 60% due to greater travel demand, comfort features, and speed.

Also, the combination of ride-sharing and AV technology presents one of the strongest cases for sustainability. Ross and Guhathakurta (2017) estimate that fully automated ride-sharing fleets could offer over 50% energy savings, with further reductions when powered by clean energy sources. Moorthy et al. (2017) estimate that that shared AVs, particularly electric ones, used in multimodal systems may also reduce energy consumption by 37% compared to personal vehicles.

Finally, studies (e.g., Martinez & Viegas, 2017; Fournier et al.) confirm that shared electric AVs are more cost- and energy-efficient than traditional internal combustion engine vehicles and public transit systems, especially when operated in well-managed fleets. These integrated systems require urban planning and infrastructure adaptation but offer significant environmental rewards.

### ***Problems and risks***

These gains are of course not guaranteed. Increased travel demand from zero-occupancy trips, longer commutes, and modal shift from transit could offset efficiency improvements.

Despite these positive projections, several studies highlight the uncertainties and rebound risks associated with AV deployment. Wadud et al. (2016) note that although automation might reduce energy use by up to 45%, increased trip-making, zero-occupant vehicle (ZOV) travel, and faster driving speeds could potentially increase energy use by up to 60%. Similarly, Wadud et al (2016) caution that AVs could either halve or nearly double emissions, depending on the behavioral response to lower travel costs and increased convenience.

### ***Discussion - Policy and planning proposals***

Autonomous vehicles have the potential to transform environmental outcomes across urban and regional scales. While many studies affirm considerable reductions in energy use and emissions, these benefits are not automatic, they depend on implementation choices. Without careful regulation and strategic planning, AVs could contribute to increased emissions and energy consumption due to behavioral rebound effects. Future research should continue to explore these trade-offs and optimize AV deployment for maximum environmental gain.

AV deployment must be aligned with climate policy goals. Governments should prioritize electrification, mandate energy-efficient fleet operation, and support integration with renewable energy sources. Limiting zero-occupancy travel through pricing or regulation can help ensure environmental gains. Infrastructure for charging should be planned with grid resilience and clean energy sourcing in mind. Furthermore, multimodal integration is key: AVs should complement rather than compete with public transit and active transportation.

Policy is a crucial lever in mitigating AV environmental downsides. Bonifacic (2021) highlights that California now mandates all new light-duty AVs to be zero-emission by 2030, a step toward decarbonizing automated mobility systems. Moreover, Sperling et al. (2018) advocate for emissions regulations, curbside pricing, and congestion-based tolling to steer AV deployment in an environmentally responsible direction.

#### ***4.4 Safety and cybersecurity***

##### ***Positive aspects***

AVs are widely expected to improve traffic safety by removing human error—the leading cause of road accidents.

A substantial body of academic literature indicates that autonomous vehicles (AVs) have the potential to significantly enhance road safety by addressing one of the predominant causes of traffic accidents: human error. According to the National Highway Traffic Safety Administration (NHTSA, 2008), approximately 90% of vehicle crashes are attributable to human error, which results in over 30,000–40,000 fatalities (NHTSA, 2012) and 2.2 million injuries annually in the United States (NHTSA, 2013). In light of these statistics, AVs are increasingly viewed as a promising technological intervention to reduce the frequency and severity of road accidents. Papadoulis et al. (2019) estimated a 94% reduction in vehicle conflict points in high AV-adoption scenarios.

Multiple simulation-based and empirical studies have demonstrated that autonomous mobility can lead to a significant reduction in traffic collisions and congestion. Morando et al. (2018), Olayode et al. (2022), and Severino et al. (2021) highlight that AVs are associated with improvements in traffic safety through the minimization of driver-induced errors. These findings are further reinforced by long-term projections. For instance, Winkle (2016) forecasts that AVs may lead to a reduction in traffic crashes by 10% in 2020, 50% by 2050, and up to 71% by 2060, with the possibility of total crash elimination by 2070. Similarly, Collingwood (2017) estimates that converting 10% to 90% of the U.S. vehicle fleet to AVs could prevent between 0.2 and 4.2 million crashes annually.

Advanced simulation models have revealed notable economic safety-related improvements. From an economic standpoint, the safety benefits of AVs translate into substantial cost savings. Fagnant and Kockelman (2015) report annual safety and efficiency benefits of \$2,000–\$4,000 per AV, including reduced crash-related costs and improved fuel efficiency [R2]. Complementary studies by Clements and Kockelman et al. (2017) further emphasize reductions in insurance, legal, and vehicle repair costs, with estimates of \$3,800 and \$1,357 in yearly savings per driver, respectively. AVs follow traffic laws consistently, avoid risky behaviors, and never drive under fatigue or intoxication, making them reliable agents in improving overall safety.

Technological advancements play a central role in enhancing AV safety. Research has produced a range of driver assistance systems such as adaptive cruise control, lane-keeping, and collision avoidance mechanisms (Hayashi et al., 2012; Lee et al., 2014; Gong et al., 2016). Advanced algorithms for path planning and intersection control have also been proposed to prevent crashes in complex traffic scenarios (Dresner & Stone, 2008; Ferguson et al., 2008). However, some studies raise concerns about behavioral adaptations and over-reliance on automation, which may introduce new risks (Rudin-Brown & Parker, 2004; Xiong et al., 2012).

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### ***Problems and risks***

While the safety potential of AVs is widely recognized, concerns related to cybersecurity, legal responsibility, and public trust remain significant. Studies by Kyriakidis et al. (2015) and Bansal & Kockelman (2018) indicate that users express apprehension about AV software reliability, liability in crash scenarios and potential hacking threats. Petit and Shladover (2015) also underscore the impact of cyberattacks on traffic safety, advocating for robust system security protocols. Ethical and legal implications have been explored by Hevelke and Nida-Rümelin (2015), who analyze responsibility assignment in AV-related collisions, and Liu (2017), who proposes a restitution-based liability framework.

Evaluation of AV safety requires rigorous standards. Kalra and Paddock (2016) argue that AVs must drive approximately 275 million miles without a fatal crash to statistically demonstrate a safety advantage over human drivers. Others, including Simpson (2021) and Shetty et al. (2021), call for the development of comprehensive safety assessment frameworks such as the Responsibility-Sensitive Safety (RSS) model and enhanced vehicle-to-vehicle/infrastructure connectivity.

More broadly, research recommends proactive regulatory policies to ensure AV safety while facilitating innovation. Nowakowski et al. (2015) highlight the importance of establishing meaningful requirements and standards for automated driving systems (ADS), while Milakis et al. (2017) advocate for continued investigation into the transitional dynamics between conventional and automated vehicles and the trade-offs between safety, comfort, and travel reliability.

Recent studies affirm that higher market penetration of AVs is directly correlated with greater safety benefits. Arvin et al. (2021) and Tafidis et al. (2021) conclude that increased AV presence on roadways is likely to reduce the rate of accidents, particularly those attributed to human distraction or impairment. In summary, while AVs hold considerable promise for improving road safety, their widespread deployment must be accompanied by rigorous technological validation, ethical governance, and robust public policy frameworks. Surveys (Kyriakidis et al., 2015; Schoettle & Sivak, 2014) reveal widespread public skepticism, particularly regarding system failure and hacking risks.

### ***Policy and planning proposals***

Ensuring safety and security in AV systems requires rigorous standards, real-world testing, and transparent governance. Docherty (2018) emphasize the need for data governance and public-sector control over urban mobility data. The Responsibility-Sensitive Safety (RSS) framework (Shetty et al., 2021) offers a structured approach to encoding behavioral limits in AV decision-making. Regulatory bodies must establish protocols for software validation, redundancy, fail-safe mechanisms, and cybersecurity. Public communication, transparency, and incident reporting will be vital for building user trust. Policymakers should also consider international harmonization of safety standards and collaborative approaches to risk management.

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### ***4.5 Economic impacts and labor market disruption***

#### ***Positive aspects***

AVs promise large-scale economic benefits through cost savings, efficiency, and the creation of new markets. Additionally, AV development is expected to stimulate job creation in tech sectors such as AI, robotics, cloud computing, and mobility services.

#### ***Reduction in travel cost and mode shift***

Cost efficiencies are among the most compelling benefits of AV deployment. Research by Fagnant and Kockelman (2014) suggests that shared autonomous vehicles (SAVs) can reduce average trip costs by 30–85%, while Greenblatt and Saxena (2015) estimate that SAV travel cost ranges from \$0.30–\$0.50 per mile, compared to \$0.80 per mile for privately owned vehicles. These studies show that lowered operational, parking, and time costs push travelers toward AV modes, displacing conventional vehicle and transit usage patterns.

#### ***Total cost of ownership and operational savings***

The overall economic appeal of AVs extends beyond trip costs to ownership and operation. Wadud (2017) found that full automation could reduce total cost of ownership by at least 15%, particularly when maintenance and insurance costs fall. Similarly, Compostella et al. (2020) project annual cost reductions of 4–10%, with per-mile savings of \$0.04 to \$0.06 when AVs are mass produced. The reduction in travel cost leads to a broader mode shift, as observed by de Almeida Correia and van Arem (2016) and Kröger et al. (2019).

Additionally, Narayanan et al. (2020) estimate annual household savings of \$5,600 and a 19% increase in operator revenue when AV systems are well-integrated into daily transport routines.

#### ***Other economic impacts***

Broader economic benefits arise through reductions in crash-related and environmental costs. Kockelman et al. (2017) estimate \$1,357 annual savings per driver from crash avoidance and safer AV navigation. Clements and Kockelman (2017) reported that a higher market share of connected AVs (CAVs) could save the average American up to \$3,800 per year, considering insurance, legal, and vehicle repair costs.

Fagnant & Kockelman (2015) also estimated annual per-vehicle savings of \$2,000–\$4,000, primarily through reduced crashes, lower fuel consumption, and minimized parking needs. The energy savings associated with automation also translate to indirect economic benefits. Vahidi and Sciarretta (2018) note that intelligent routing and eco-driving behaviors enabled by AVs reduce fuel usage by 2–50%, while Milakis et al. (2017) argue that battery-powered SAVs could cut energy use by up to 100%, depending on deployment conditions. Simulations add further support to the economic promise of AVs. Burns, Jordan, and Scarborough (2012) found that in Manhattan, trip costs could fall by up to 88%, from \$7.80 to \$0.80 per trip, using centrally coordinated SAV fleets. In Michigan, daily travel costs dropped from \$21 to \$2, reflecting a 90% reduction due to lower fuel, maintenance, and parking costs.

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### ***Problems and risks -Macroeconomic trade-offs and job displacement***

Despite these efficiencies, some researchers urge caution. Milakis et al. (2017) and Ross and Guhathakurta (2017) highlight the need for a comprehensive economic impact assessment, incorporating job displacement in driving professions, public health implications, and equity concerns for marginalized groups.

The transformation brought by AVs will disrupt labor markets, particularly in logistics, driving, and low-skilled sectors. Frey & Osborne (2017) estimate that up to 47% of U.S. employment is at high risk of automation. Simultaneously, others (e.g., Claypool et al., 2017; Crayton & Meier, 2017) foresee new employment opportunities in infrastructure, data science, and vehicle services.

Moreover, while shared AVs tend to improve revenue and utilization—as shown by Nunes and Hernandez (2020)—privately owned AVs can reduce profitability by up to 37%, illustrating how ownership models critically affect economic outcomes.

The disruption of labor markets—particularly for professional drivers—is one of the most immediate socioeconomic challenges posed by AVs. Millions of jobs in freight, delivery, taxi services, and transit operations could be displaced. Gittleman & Monaco (2020) argue that these transitions could exacerbate inequality without intervention. Workers in these sectors are often less likely to have the educational background required for seamless reemployment in tech-intensive fields. AV benefits may also be unequally distributed, favoring affluent users and large corporations unless proactive equity measures are enacted.

### ***Discussion-Policy and planning proposals.***

Autonomous vehicles offer substantial potential for lowering travel costs and improving the economic efficiency of transport systems. These benefits manifest in individual savings, societal gains from reduced crashes and emissions, and increased profitability in shared fleet models. However, these advantages must be carefully balanced with potential downsides, including infrastructure costs, job displacement, and equitable access. Policymakers and urban planners must consider these complexities in the long-term deployment of AV technologies. Governments must invest in large-scale retraining and workforce development programs. Public-private partnerships should be leveraged to align education with emerging job markets. Policies should also support equitable access to AV services, ensuring affordability and digital inclusion. Incentivizing local innovation, creating tax credits for inclusive hiring.

### ***4.6 The impact of autonomous vehicles on travel behavior***

Autonomous vehicles (AVs) are expected to significantly reshape individual travel behavior and overall transportation demand. As automation increases accessibility, reduces travel cost and effort, and allows for on-demand shared mobility services, travel patterns - including trip frequency, distance, and mode choice—are anticipated to shift dramatically. This paper synthesizes empirical evidence and simulation-based studies that explore the likely effects of AVs on travel behavior.



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### ***Changes in travel behavior due to automation - Social impacts***

The introduction of AVs reduces the perceived burden of travel time by enabling multitasking and reducing the cognitive load on drivers. As a result, individuals may be more inclined to undertake longer or more frequent trips. Gupta et al. (2006) noted early on that vehicle-oriented development and increased VMT directly influence travel behavior patterns.

Narayanan et al. (2020) reported that trip lengths could vary from a 15% decrease to a 14% increase, while VMT could shift between a 45% reduction and an 89% increase, depending on deployment scenarios. Also AVs are likely to lower the cost per trip, thereby encouraging greater usage. Such variability reflects the dual role of AVs in either reducing demand through efficiency or increasing it through convenience and accessibility.

Although AVs potentially reduce the value of time spent in travel by enabling productivity on the move, the effect is complex. Cyganski et al. (2015) and Yap et al. (2016) found that while some AV users value the ability to work during travel, others do not perceive it as a major advantage. In some cases, value of time may even rise when AVs are used for first/last-mile egress to transit.

The expansion of AVs will also affect system-level behavior and travel by underserved groups. Harper et al. (2016) estimated that newly enabled travel among seniors and people with disabilities could contribute to a 14% increase in annual VMT in the U.S. This is echoed by Childress et al. (2015) and Milakis et al. (2017), who found travel demand could increase between 3% and 27%, due to mode shifts and increased trip-making by previously constrained populations.

### ***Discussion***

The emergence of AVs will deeply influence travel behavior, resulting in complex and sometimes contradictory effects on vehicle miles traveled. While AVs offer cost efficiency, accessibility, and potential sustainability benefits, they are also likely to induce more travel, particularly in the form of empty vehicle movement and extended trip-making. The final outcome will depend on how AV systems are managed—especially in terms of ownership models, pricing structures, and integration with public transit. User acceptance of autonomous vehicles is shaped by a complex interplay of trust, perceived usefulness, legal assurances, demographics, and culture. Successful integration of AVs into society requires more than technological readiness—it demands responsive public engagement, policy support, and inclusive design that considers diverse user needs and expectations. Future development must prioritize public trust, tailor services to varied user profiles, and ensure transparency to foster long-term adoption.

## **5. Future Research Directions**

This review highlights both the promise and the complexity of autonomous vehicle integration in urban systems. Across the six major impact areas, we find that while AVs offer substantial potential benefits—ranging from increased road safety and environmental efficiency to new urban design possibilities—these gains are not guaranteed and are often accompanied by significant trade-offs. Risks such as induced travel demand, urban sprawl,



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labor market disruptions, and public mistrust must be proactively managed through well-calibrated policies and institutional innovation.

A key insight from this analysis is that the effects of AVs are highly context-sensitive. Urban form, regulatory frameworks, cultural attitudes, and infrastructure readiness all mediate how AVs are adopted and what consequences they produce. This suggests that universal assumptions about AV benefits or drawbacks are likely to be misleading. Instead, planners and policymakers should adopt scenario-based approaches that consider multiple pathways and adapt strategies to local conditions.

Future research should pursue several critical directions. First, longitudinal studies are needed to assess the real-world impacts of AV pilots and early deployments, particularly in diverse socio-economic and environmental contexts. This includes not only quantitative metrics like vehicle miles traveled or emissions but also qualitative dimensions such as perceived accessibility, community impacts, and trust in technology. Cross-city comparative studies can help reveal how institutional and cultural factors influence AV outcomes.

Second, there is a pressing need for cross-sectoral models that integrate AV planning with energy, housing, labor, and environmental systems. AVs do not operate in a vacuum; their deployment will affect and be affected by broader urban systems. Integrated models can help policymakers identify synergies and avoid unintended consequences. For example, AVs could facilitate compact development if aligned with land use policies but might accelerate sprawl if introduced without regulatory guardrails.

Third, more attention should be paid to governance and institutional readiness. As Freemark et al. (2019) noted, many cities have yet to revise zoning laws or mobility plans to accommodate AVs. Research should examine how different governance structures enable or inhibit policy responsiveness, and what institutional innovations are needed to manage AV transitions effectively. Participatory governance models that involve citizens in AV planning could enhance legitimacy and inclusiveness.

Fourth, equity and public perception remain underexplored yet crucial dimensions. Studies show that attitudes toward AVs vary significantly by age, income, education, and geographic location. Future research should explore how these disparities affect adoption rates and what policies can ensure that AV benefits are equitably distributed. This includes considering issues like affordability, accessibility for people with disabilities, and the digital divide.

Finally, methodological innovation is needed to keep pace with the evolving AV landscape. Traditional travel surveys and static models may not adequately capture the dynamic, data-rich nature of AV systems. Researchers should explore new methods such as agent-based simulations, digital twins, and real-time data analytics to study AV impacts in more granular and adaptive ways. Ethical frameworks must also evolve to address issues of responsibility, privacy, and algorithmic bias.

Concluding, the future of AVs is not predetermined. It will be shaped by the policies, values, and systems we put in place today. By adopting a critical, integrative, and forward-looking research agenda, scholars and practitioners can help ensure that AVs contribute to sustainable, equitable, and resilient urban futures.

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### 6. Conclusion

Autonomous vehicles represent a transformative force that intersects with nearly every aspect of urban life. From reshaping urban design to redefining labor markets and reconfiguring travel behavior, AVs will inevitably alter the ways we experience, govern, and plan our cities. While technological progress in AV development is advancing rapidly, societal readiness remains uneven, and the potential impacts are not yet fully understood. This paper has synthesized the current state of the art in AV literature through a tripartite lens—highlighting opportunities, risks, and policy solutions across thematic domains.

Over a century ago, the automobile emerged as an unanticipated remedy to the urban congestion caused by horse-drawn traffic and animal waste. Initially caught off guard, many city planners responded with short-term fixes. However, a few visionary figures—most notably Le Corbusier—envisioned the car as a transformative element in urban design. Inspired by such visions, numerous cities undertook radical changes, demolishing central districts to make way for expansive road networks. In time, this auto-centric development approach created a host of new urban challenges, largely attributed to reactive planning and flawed design strategies (Duarte & Ratti, 2018). Nowadays the introduction of autonomous vehicles signals a new turning point and a challenge for cities and transportation systems.

Our analysis underscores the importance of strategic governance, stakeholder engagement, and contextual sensitivity in guiding AV deployment. If proactively managed, AVs could serve as catalysts for sustainable urban transformation; if left unchecked, they risk reinforcing existing inequalities and environmental burdens. Policymakers and planners must act now to establish frameworks that can adapt to technological uncertainty while centering public interest. As AV adoption accelerates, continuous research, interdisciplinary collaboration, and real-world experimentation will be essential in ensuring that cities are not only smart, but also resilient, just, and human centered.

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## APPENDICES

**Table 1 : Quantified findings of research about impacts on land use.**

| Impacts on urban land use                                                                                                | Methods                                      | Source                                                                                   |
|--------------------------------------------------------------------------------------------------------------------------|----------------------------------------------|------------------------------------------------------------------------------------------|
| Average reduction of 11 parking spaces per SAV; 120% vehicle utilization; 92% parking demand reduction; 11% VKT increase | Agent-based simulation                       | Fagnant & Kockelman (2014); Rahman et al. (2023)                                         |
| 48% to 90% parking land area reduction                                                                                   | Literature review & simulation               | Narayanan et al. (2020); Lang et al.                                                     |
| −90% to −70% parking demand reduction (CBD); 94% in suburbs                                                              | Agent-based simulation                       | Kumakoshi et al. (2021)                                                                  |
| 90% of travel demand met by SAVs (50% single occupancy, 40% ride-sharing); population and land use constant              | Literature review                            | Silva et al. (2021)                                                                      |
| Parking demand reduction of −67% to −20% by 2035 with 20–61% SAV adoption                                                | Literature review                            | Simons et al. (2018)                                                                     |
| 62% to 87% average and max car-park demand reduction                                                                     | Agent-based simulation (Poisson-based model) | Nourinejad et al. (2018)                                                                 |
| 50% car-park space reduction using efficient AV layout (remote control, same-size cells)                                 | Accurate positioning information             | Azevedo et al. (2020)                                                                    |
| Up to 90% parking land reduction                                                                                         | Literature review & simulation               | Milakis et al. (2017); Olayode et al. (2023); Rahman et al. (2023); Faisal et al. (2019) |
| Up to 90% land reduction with only 2% SAV penetration; 8.6 spaces reduced per SAV                                        | Agent-based simulation                       | Zhang & Guhathakurta (2017)                                                              |
| 50% parking land reduction                                                                                               | Data-driven approach                         | Kondor et al. (2018)                                                                     |
| 40% parking reduction (estimated via extrapolated secondary data)                                                        | Logical estimation                           | Kim (2018)                                                                               |
| 40% total parking land reduction; 44% parking spot reduction                                                             | Literature review                            | Kim (2018); Chehri & Mouftah (2019); Rahman et al. (2023)                                |
| 4.5% parking land reduction at 5% SAV adoption; ~20 parking spots saved per SAV                                          | Simulation with real transport network       | Zhang et al. (2017); Rahman et al. (2023)                                                |

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| Impacts on urban land use                                                                                                                               | Methods                                         | Source                                          |
|---------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------|-------------------------------------------------|
| 40% parking reduction in urban areas; 15% fuel savings; \$1.2T economic impact in U.S.                                                                  | Synthesis of forecast models and secondary data | Clements et al. (2019)                          |
| 3%–27% increase in travel demand (longer trips, modal shifts, new users)                                                                                | Agent-based simulation                          | Childress et al. (2015)                         |
| Parking shift to periphery; density increases in city core; effect depends on empty cruising allowance                                                  | Urban land use model                            | Zakharenko (2016)                               |
| 80% reduction in off-street; 1.15 million m <sup>2</sup> freed on-street; 11% more VKT                                                                  | Literature review                               | ITF (2015); Othman et al. (2022)                |
| Daytime parking freed downtown; potential for dense, TTOD development                                                                                   | Literature review & forecasting                 | Heinrichs (2016)                                |
| Road space savings via platooning could be reallocated to bikes/buses                                                                                   | Simulation/platooning model                     | Fernandes & Nunes (2012)                        |
| AVs can either increase urban sprawl or promote urban densification                                                                                     | Literature review                               | Smolinski et al. (2016)                         |
| 19.4–62.9% increase in developable land in Austin (100% AVs)                                                                                            | Simulation-based urban model                    | Wellik & Kockelman (2020); Rahman et al. (2023) |
| 5% rise in real estate values by reusing parking; 2.5x more vehicles in stacked AV parking                                                              | Literature review                               | Othman et al. (2022); Audi estimate             |
| AVs increase urban radius by 3.5%, developed land by 7.1%, residential by 7.6%; may lead to 10–30% city growth; Rome and Austin relocation case studies | Meta-analysis                                   | Rahman et al. (2023); Faisal et al. (2019)      |

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## **LIVING TOGETHER: AN EXPLORATION OF CO-LIVING FROM THE NEOLITHIC ERA TO THE 21<sup>ST</sup> CENTURY**

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### **Abstract**

The economic and social conditions of each era shape all aspects of life, including housing. Nowadays, there is an increasing desire for a sense of community, with many individuals choosing co-housing over traditional private residences. To create high-quality co-housing that meets evolving needs, studying the history of this practice is essential. By understanding the past, we can design better spaces for the future.

This research, part of my research thesis at the School of Architecture in Patras under the supervision of Professor Alcestis Rodi, explores how communities occupy space, focusing on the arrangement of houses and communal areas. It investigates the factors influencing the design and organization of these spaces and their impact on social interactions and community life. Adopting a historical approach, the study examines a variety of outstanding case studies from worldwide, spanning a period of 8,600 years (6700 BC - 1900 AD). The primary objective was to understand why communal living has been a consistent human need and how spatial design has addressed it over time. A parallel goal was to identify recurring types in spatial organization, categorizing settlements based on shared features, particularly the arrangement of dwellings and common spaces, enabling a comparative analysis.

The survey was conducted in two steps: first an extensive review of academic sources on vernacular Architecture and on contemporary collective housing theories and examples; second, the selection of case studies, the recreation of their masterplans along with diagrams and a comparison to reach conclusions.

The research results show that the design of both private and public spaces has always aimed to meet survival needs, shaped by local factors like climate, soil, and materials. Over time, social, religious, and economic influences have further shaped dwellings and settlements. Recurrent patterns in spatial organization reveal how architectural forms evolve while maintaining core principles. The traditional wisdom from these examples offers valuable insights for designing modern co-living spaces. By revisiting these principles, we can address contemporary challenges, meeting both practical and social needs.

**Key words:** vernacular Architecture, community, public space, spatial development, traditional settlements, co-housing

### **Introduction**

Architecture, in its earliest form, emerged as an outcome of the effort to meet basic human needs, such as protection from weather phenomena and attacks by wild animals. The

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archetypal dwelling, a fundamental structure of simple construction, over time gave way to more complex buildings with more intricate functions. Therefore, we understand that the role of architecture evolved with human development.

Human progress in all areas has created new needs, many of which architecture once again responded to. Among these needs, which greatly influenced building activity, was the human need for interaction and social coexistence. Architecture responds to this need, not only by addressing the form of the individual space, but now by defining the relationships between individual-family homes and the formation of collective spaces.

In this research paper, starting from the observations above, an attempt is made to answer questions related to individual and, more importantly, collective habitation. The key questions are two: first, why does this need arise, and second, how is it addressed? Within the framework of this study, historical examples from all over the world and from the distant to the more recent past were examined. In this way, observations were made regarding what drives people to coexist, what factors shape individual, family spaces and collective spaces, and how the relationships between individual and collective shells are determined. Furthermore, conclusions were drawn about how spaces affect people's lives.

As in recent years there has been a 'return to the neighborhood' and significant changes in housing models, this research focuses on community, social organization, and the spatial forms of this need. Through the study of the past, an attempt is made to give answers for the future, as the need remains the same—the need to 'belong.' And architecture is once again called upon to resolve it.

### **Traditional settlements from the Neolithic era to the 19<sup>th</sup> century**

In his 1969 book *House Form and Culture*, Amos Rapoport writes: "The physical environment of man, especially the built environment, has not been, and still is not, controlled by the designer. This environment is the result of vernacular (or folk, or popular) architecture." Rapoport's observations highlight the importance of traditional architectural wisdom, which can offer valuable insights for designing modern co-living and public spaces. By revisiting and adapting these principles, we can address contemporary challenges and better meet both practical and social needs.

Below, we will analyze a variety of examples of settlements that developed between 6700 BC and 1900 AD in different regions of the world. We will examine how the community develops and how public and private spaces are shaped within it. What are the factors that influence the organization of these spaces, and who determines them? We will also explore the significance of these spaces for the community after their creation and the symbolic meanings they acquire. Finally, we will study how the spatial development and structure of the community affect life within it and how they often serve as a means of social education and social control for its members.

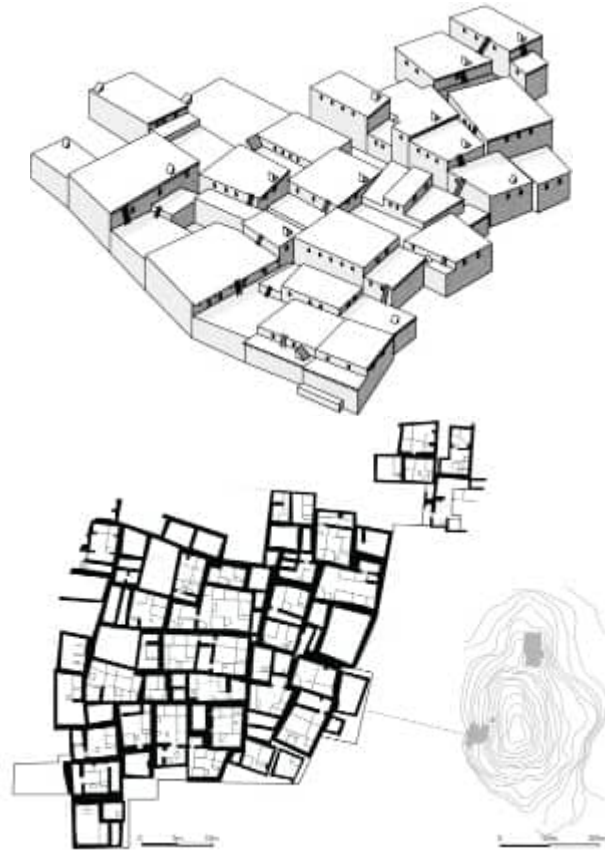
In the first case study, Çatalhöyük in Turkey, two seemingly contradictory spatial configurations emerge. At the lower level, there is a highly enclosed structure, while at the upper level, an open, communal space is prominently featured. The settlement consisted of clusters of rectangular family dwellings, interspersed with communal courtyards accessible from the surrounding homes. Entry to the houses was via a hole in the roof, with access

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provided by a ladder that led directly into the interior. Despite its compact form, which enhanced the settlement’s fortification, an unconventional circulation system and public space were created through the activation of the roofs—a level that typically lacked functional purpose.



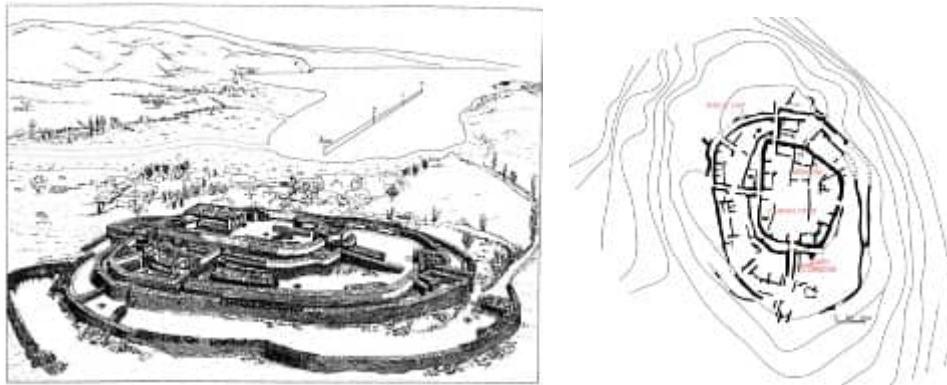
1. Neolithic settlement Çatalhöyük, South Turkey, 6700 - 5650 B.C.

The Greek Neolithic settlement of Dimini offers a clear example of how spatial organization reflects social structure. A hill was surrounded by six protective walls, creating a highly fortified center that housed the main open communal space, known as the Central Yard, along with the *Megaron*, the house of the Lord. Within the walls, spaces were dedicated to economic and administrative functions, while private dwellings were located outside, practically unprotected. The archon-centric system of governance was reflected in the settlement’s design, with administrative and authoritative spaces placed in central, prominent, and secure locations.

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2. Neolithic settlement Dimini, Volos, Greece 2400 B.C

The organization of Mycenae was also archon-centric, like that of Dimini. Within the Acropolis, surrounded by walls, stood the *Megaron*, temples, the king's graves, workshops, and warehouses where crops were stored. The residential areas, however, were located outside the main settlement, indicating that the core of the community was reserved for what was deemed most important by each society.



3. Mycenae, The Acropolis, 1600 – 1100 B.C., perspective view and masterplan

After the Mycenaean era, the form of settlements evolved with the shift in the administrative system. The first city-states of Ancient Greece emerged, and Democracy



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became the prevailing political system. As a result, communal spaces and public buildings became the focal points of the community, and houses were integrated into the urban fabric. The cities were organized on a grid layout, with public spaces and buildings positioned in prime locations, their placement determined by the function of each structure. Over time, residential areas developed around these central spaces. The democratic spirit of the era is also reflected in spatial organization. A notable example of this urban form is Ancient Olynthus.



4. Ancient Olynthus, 8th – 2nd century. B.C., Masterplan

Pile dwellings represent a very different type of settlement. In this case, there is no planned organization; the buildings are scattered randomly over the water. Despite the lack of urban planning, certain circulation and communal spaces are known among the inhabitants, whose survival in such a challenging natural environment relies on their cooperation.



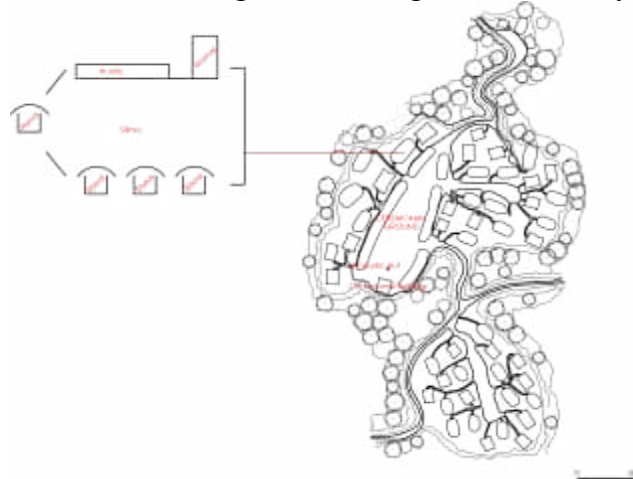
5. El Cienega Grande, pile dwelling, Colombia

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For the Papuans, religious beliefs play a central role in the development of villages. The heart of the village is the ceremonial ground, where religious buildings are located, and ceremonies are held. The houses are arranged in a circle around this central space. The structure of the settlement mirrors the design of the houses, with family life organized communally. Each residence consists of a cluster of buildings surrounding a central courtyard.



6. Maginpol, Papuan traditional village, New Guinea

In the settlements of the Iraqi moorlands, a distinctive feature emerges: hospitality was at the core of the community's value system. As a result, the most prominent structures were the *il mudhif* (guesthouses), which were built with exceptional care and luxury, standing above all other buildings. Over time, the function of the *mudhif* evolved, transforming into spaces for gatherings and ceremonies, further emphasizing their central role in the social and cultural life of the community.



7. Il mudhif of an Iraqi moorland settlement

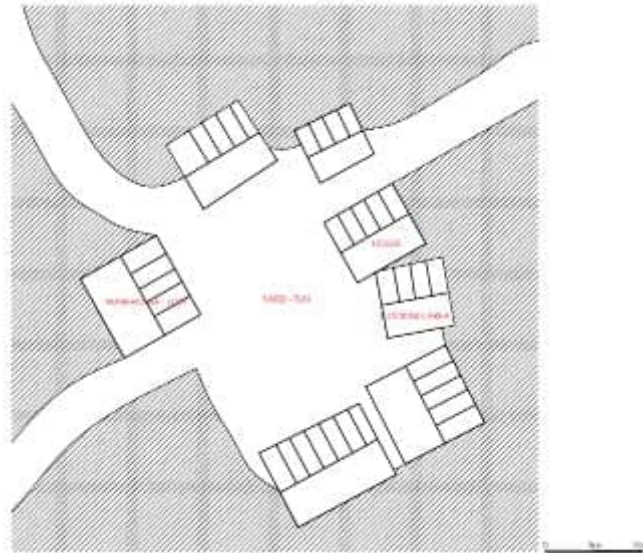
In Norway, the concept of community first emerged during the Medieval period, when multiple families came together to establish farms. Over time, the farms from the same region were consolidated to form villages. The farms themselves typically featured buildings arranged around a central yard, known as the *tun*, a layout that was preserved when the first

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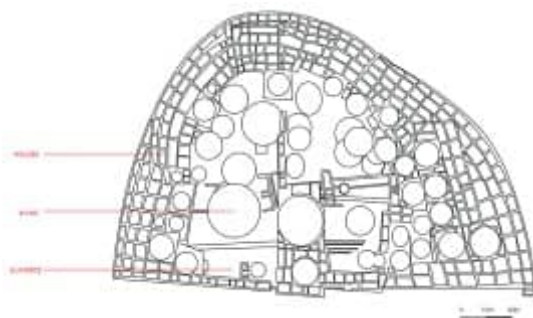
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villages were formed. The most important building within these communities was the cereal warehouse. As the largest and most prominent structure, it symbolized the agrarian nature of society at the time.



8. Norwegian farm, organization around the tun

A similar example can be found in Pueblo Bonito, an Anasazi village, where cereal warehouses held significant importance. Over time, these structures took on ceremonial roles, evolving into temples known as *kivas*. The kivas were centrally located within the settlement, and a square lay between them. Perhaps the most intriguing feature, however, was the creation of a dumpsite to the south of the square. Unlike the typical practice of removing waste from living areas, this dumpsite—a growing pile of garbage—became a landmark over time, holding cultural significance for the community.



9. Pueblo Bonito, Southwestern America, view after the excavations and masterplan

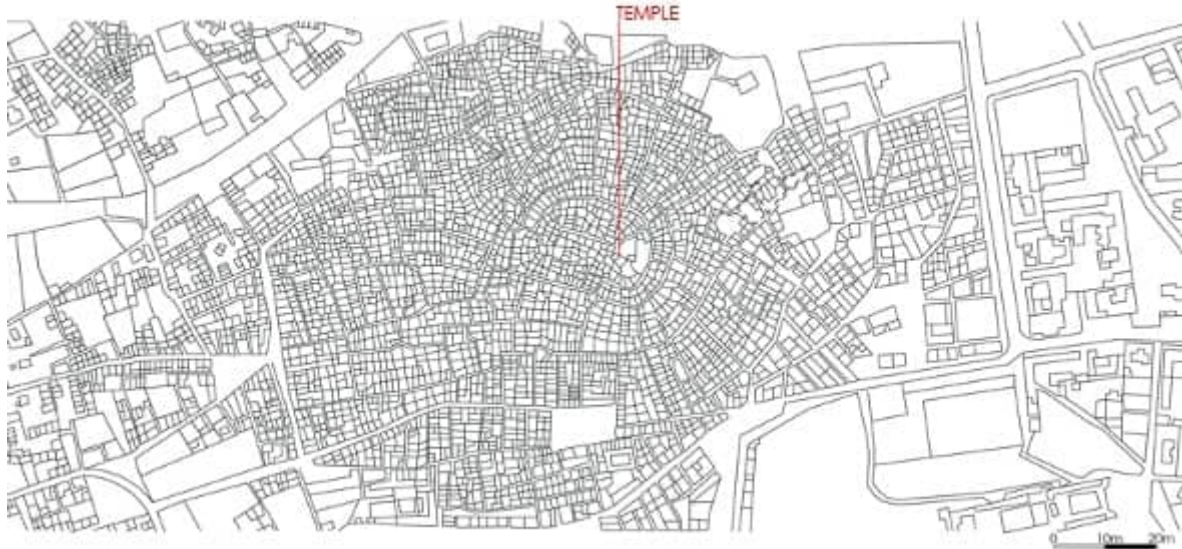
Ghardaïa is a typical example of a traditional West African settlement, where climate and religion played pivotal roles in shaping its spatial organization. The influence of Islam is evident in the settlement's design, particularly through its internally walled structure and the central placement of the mosque. The narrow covered streets and small public spaces reflect the strict social customs rooted in Islam, while houses were designed without windows facing

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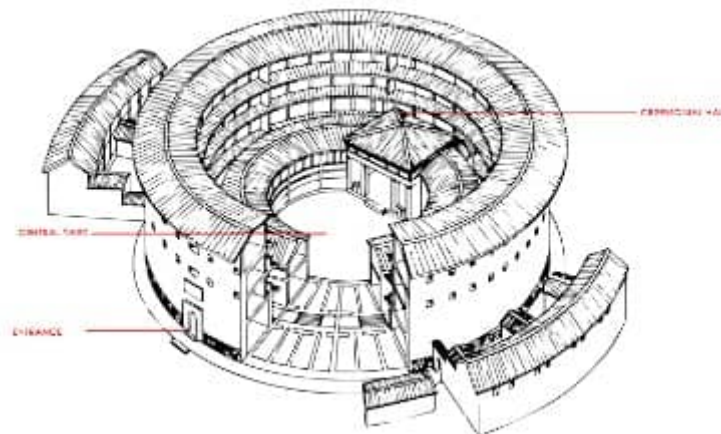
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the street. Another notable feature is the creation of a secondary circulation system on the roofs, reserved exclusively for women.



10. Ghardaia, Masterplan

To protect themselves, the Hakka people built the Tulou—large, circular structures that housed entire communities around a central courtyard. Within these buildings, all members of the community lived in shared rooms, creating a sense of equality by placing everyone on the same social level and challenging the traditional hierarchy. The courtyard itself served as the heart of communal life, accommodating spaces for schools, markets, and social gatherings.



11. Hakka Tulou, House— communities, China, 1100 - 1900 A.D.

The winter dwellings of the Eskimos, the igloos, are an interesting case, not only because of their suitability to the climatic conditions of the area but also because they are homes for entire communities. They are not inhabited by individual families, but by larger groups, sometimes as many as 50 people. At the farthest point from the entrance, there is a "sofás" (a kind of sleeping area) that is used for both sleeping and social gatherings. It is a distinctive feature that, for such a private activity as sleeping and the most extroverted activity of the

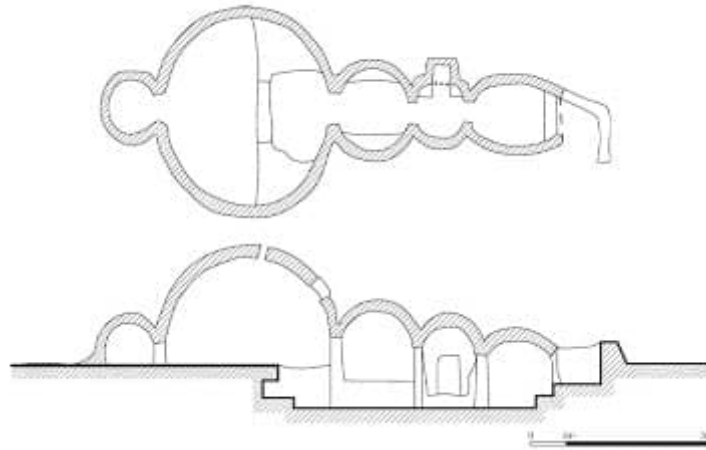


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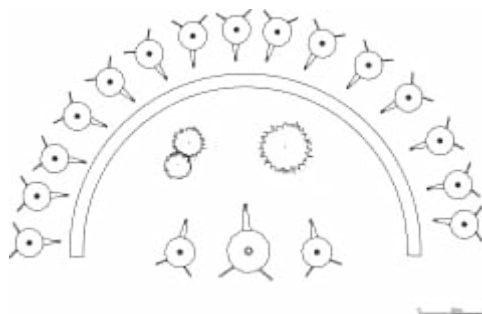
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community, the gatherings, the same space is used. This fact can be linked to the size of the group living in the igloo.



12. Typical floor plan and section of the igloo

The Sioux conical huts were arranged in a semi-circle, facing the larger, centrally located tent of the tribe's chief. For the Sioux, the design of the hut reflected their cosmic beliefs, with its circular shape symbolizing the idea that the universe itself is circular. Both the huts and the settlement served as an educational tool for the youngsters, as the values of the community were imparted through daily life.



13. Wigwam Village of the Sioux, Native Indians of North America

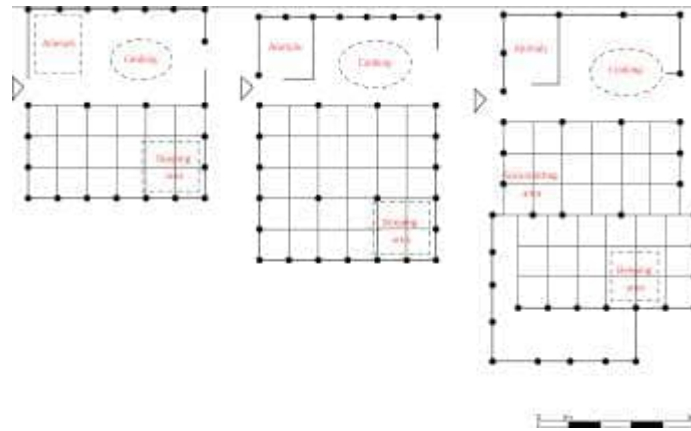
An interesting feature of 16th-century Japanese farmhouses is that multiple families lived together in large, open-plan buildings that accommodated everyday life, work, and social activities, including religious ceremonies.



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14. Japanese farmhouse “minka”, examples of floor plans

The domed buildings known as trulli in Alberobello are a unique case due to their perfect adaptation to the surrounding environment. Their use varies, from dwellings and living spaces to storage areas. The trulli were made from limestone, a material abundant in the region. They had few openings on the southern side, for climatic reasons and internally they were painted white to enhance the light. In the case where a trulli served as a residence, it consisted of a large central square room to which smaller rectangular rooms were attached. An increase in the size of the family led to an increase in the number of rooms, thus expanding the trulli, while maintaining its overall morphology and, consequently, the cohesive form of the settlement.



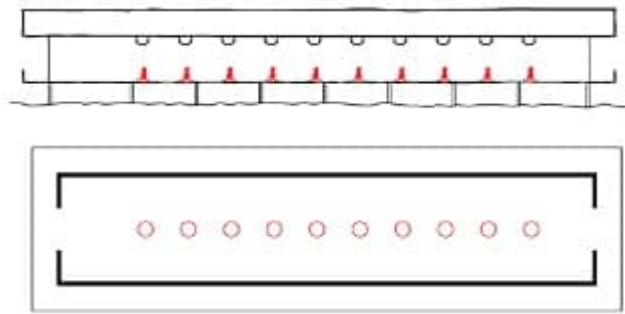
15. Alberobello

The Nishi, an Indigenous tribe, lived in longhouses—large wooden structures that housed the entire community. Privacy was nonexistent, and all activities, both daily and social, took place in the same open space around the twelve hearths at the center of the longhouse.

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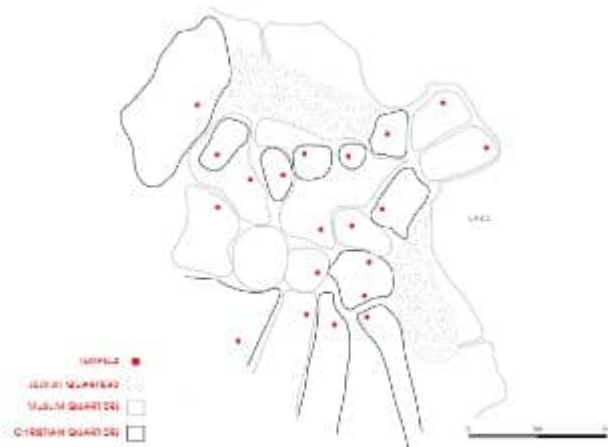
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16. Longhouse of the Nishi tribe

In medieval Ottoman cities, the market occupied the center, while different ethnic groups lived in distinct, separate districts. Within each district, the spatial layout was consistent, with houses arranged around a religious center that also housed a square, a fountain, and small shops. Ioannina is a notable example of this urban design. Finally, the traditional villages of 18th-century Greek islands offer another fascinating example. The need for security led to tightly packed settlements, such as the Chora of Mykonos. New dwellings were often added within the existing layout of the village, typically over shared spaces like streets, and always with the consent of neighbors. As a result, the evolution of these settlements was deeply intertwined with social dynamics, with each influencing the other.



17. Ioannina, 1850, a Medieval Ottoman City

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18. Mykonos, Chora , Masterplan

### Identification of similar patterns in the case studies

The examples studied represent different temporal and spatial expressions of the human need for cohabitation. For the philosopher Henri Lefebvre (Lefebvre, 1968) "the settlement is the projection of society onto the land", while the sociologist Manuel Castells views settlements as products of the social activity of people (Castells, 1972).

In all the examples of Vernacular Architecture, the main factor shaping the space and forms was the fulfillment of the survival needs of people in relation to the specific conditions prevailing in each area (e.g., climate, topography, natural phenomena, wild animals, hostile invasions, etc.). Living together was one of those needs. The available local materials were also playing a primary role. The solutions resulting from the above were influenced by myths, local traditions, religion, economy, family and social organization, customs, traditions, and any other social imperatives. The outcome was a result of a combination of all the aforementioned factors, with some of them taking precedence over others in shaping private dwellings and their arrangement to create settlements.

By studying these cases, we can identify four distinct patterns in how public space is created and how it influences the whole settlement design. The first pattern involves settlements centered around an open space, which serves as the core of social and public life. Key public buildings typically surround this space, with houses forming an outer layer. Two examples of this type are the Neolithic village of Dimini in Greece and the villages of Papua New Guinea.

The second pattern involves settlements organized around a central public building, which serves as the focal point of the community's culture and daily life. The function of this building varies depending on what each community considers important; in every case, however, the central building is the most important for it. This building may be the residence of the community leader and/or the administrative center, like the Mycenaean Palace. It could also be a religious building, such as the mosque in Ghardaia and other Muslim cities, or the religious buildings in Medieval Ottoman cities, as well as the kivas of the Anasazi.

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The third pattern features settlements that develop more freely. The public buildings and the shared spaces are scattered among the dwellings and stand out as places of social interaction, mainly due to their location being known to the residents. This scattering usually results from the topography and the specific land conditions of the area. A characteristic example is Olynthus, where we saw public buildings and spaces being formed where the land could accommodate them, leading to their dispersion among the dwellings. In this category, we can also include the pile settlements of South America, where the circulation and gathering spaces are well known to the inhabitants and serve as reference points for them, despite being scattered among the dwellings within the marshland. Another notable example of this is Ancient Olynthus.

The fourth pattern involves settlements where the entire community lives in a single building, sharing both everyday and social activities within the same space. The everyday life space is the same with that of social activities, and all aspects of daily life have a strongly collective character. Within the community building, the same space may be used simultaneously for both the most private and the most social activities, as we saw happening with the sofa in igloos, which serves both as a sleeping area and a gathering space. Of course, there are also cases where within the building there is a separation of areas, with each area being used for specific activity. For example, in the Longhouses of the Native Americans, which house the entire community, there are ten to twelve hearths in the center, associated with the communal preparation of food, thus forming part of the dwelling where there is greater interaction among the inhabitants. These settlements can be seen as early examples of communal housing, which influenced the development of modern collective living spaces.

### **Communal living since the industrial revolution until present**

During the Industrial Revolution, rapid population growth and urbanization brought large numbers of people into cities to work in factories. For the first time, living and working spaces were separated, coinciding with major economic shifts and social stratification. These changes gave rise to early socialist theories and the formation of workers' syndicates. In response, the first collective housing complexes were developed, both to accommodate workers and as utopian experiments.

In 1844, a group of workers established a shop to make essential goods accessible to everyone. This shop, named the Rochdale Equitable Pioneers Society, is considered the founding moment of the modern cooperative movement.

Later, the goal of bridging the gap between the rich and the poor—both physically and socially led to the Settlement Movement in England, which spanned from 1880 to 1920. This idea was physically embodied in Toynbee Hall, a charitable initiative where students and low-income families lived together in the East End of London, aiming to improve the living conditions of the latter.

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19. Toynbee Hall, 1902

The development of cooperative relationships to improve everyday life led to a preference of collective life. Between 1918 and 1923, poor residents of Vienna established self-sufficient settlements on the outskirts of the city after World War I. The residents cooperated with the municipality to create settlements based on the principles of the Garden Cities, residential complexes surrounded by gardens. This movement was called the Viennese Settlers' Movement. Among the first such residential complexes were those in Rosenhügel, Flotzersteig, Heuberg, and Hoffingergasse. Although the construction of these settlements was initially started by the residents, several well-known architects, including Adolf Loos and Josef Frank, involved in this movement.



20. Hoffingergasse Housing Estate Erich Faber, Josef Frank, 1921-1924



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Co-living complexes were also created to improve sanitary conditions for the poor. For example, in Copenhagen, a group of doctors established Brumleby, a settlement that included not only housing, but also a shop, a kindergarten, and public baths. Similarly, Jean Baptiste André Godin, an industrialist inspired by Charles Fourier's manifesto on the Phalanstères—utopian communities where 500 to 2,000 people live and work together in one building—constructed a building near his factory in 1864. This facility, called the Familistère, provided housing for his workers and included amenities such as a school, laundry rooms, a shop, and baths.



21. Brumleby Housing Complex, 1854-1856



22. Life in the Familistère, 1864

### Identification of collective housing typologies

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As in the first part, we can also identify distinct typologies of collective housing here. The primary distinction lies between buildings and settlements. Settlements are typically designed as garden cities, while buildings can be categorized into three different typologies.

In the first typology belong the complexes where multiple families live around a central yard. These are multi-story, enclosed buildings with apartments on each floor. The families' apartments open onto corridors with balconies facing a covered internal courtyard, which serves as a space for social interaction. However, no other shared spaces are included. An example of this is the *Familistère* we saw earlier.



23. Celebration in the central yard of Familistère, 1909

The second typology can be named “city within urban housing estates”. These buildings follow chronologically. They were built in the first half of the 20th century and incorporate into a large complex residences, schools, shops, medical and sports facilities, cultural spaces, and shared public courtyards and squares. Essentially, they aim to include all the functions of a city within a single building or architectural complex in an effort to make it self-sufficient. The *Unité d'Habitation* by Le Corbusier is the most iconic example of this model. There, the element of the city's streets is introduced through public corridors on every third floor, while public programs are integrated into the roof. The rooftop is transformed into a garden and includes sports facilities (a running track and swimming pool), a gym, and a kindergarten. Also, the Barbican in London, designed by Peter Chamberlin, Geoffrey Powell, and Christof Bon, and built between 1965-1976, is such an example. In addition to residential spaces, the complex includes underground parking, which frees up space for gardens and squares. It also integrates a theater, library, museum, schools, and shops—essentially, all the functions one might encounter in an entire city. Finally, Oscar Niemeyer designed the Edificio Copan building in São Paulo between 1952-1966. In this building, different housing typologies and shops are integrated into a single volume. There is a strong diversity of spaces and functions, as is the case in Brazilian cities. Such complexes, adapted to modern needs, are still being built today.

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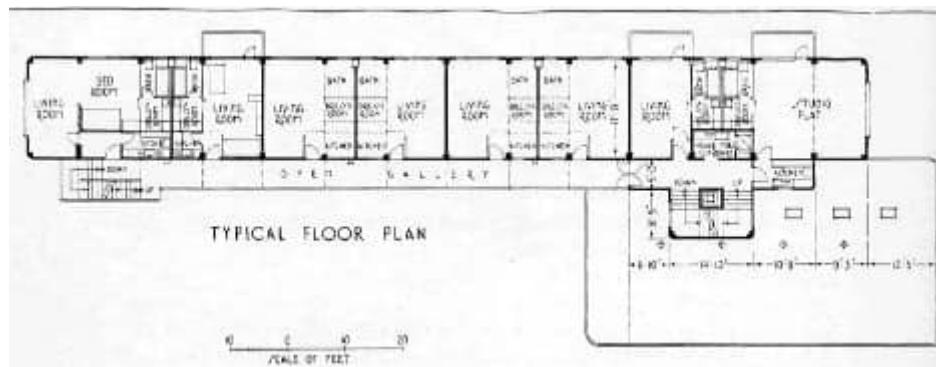
24. Unité d' Habitation, Le Corbusier, 1947-1952

In the third typology belong the housing estates with communal living spaces. In these buildings, each resident has their own private space, while communal areas are available for use at their discretion. Shared spaces like kitchens, living rooms, and laundry allow residents to connect and share aspects of their daily lives. One example of such a complex is the Isokon Building in London, designed by Wells Coates. It included 36 apartments with the minimum required living spaces and a small kitchen. The goal was for the residents to use the large, shared kitchen in the building, which was connected to the apartments via an elevator for transporting goods. Another example of such a complex is the Narkomfin Building by Moisei Ginzburg and Ignaty Milinis in Moscow. In this complex, apartment buildings are connected to smaller ones that house spaces for communal activities. These include a library, gym, shared kitchen, kindergarten, and laundry.

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25. Isokon Building, Typical floor plan

## Conclusions

In conclusion, the evolution of communal living reflects society's changing needs—from the quest for security and social cohesion to the drive for improved living conditions and shared resources. Whether through self-contained settlements, multi-functional buildings, or integrated communal spaces, each typology addresses the economic and social challenges of its time. These models of collective living have played a pivotal role in shaping both communal and urban life. As we now face the question of how to proceed in the field of co-housing, the principles behind these early experiments remain highly relevant, offering valuable insights into the potential for more sustainable and inclusive urban development.

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Session:

**“Smart Cities and Sustainable Development”**

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### **DIGITAL INNOVATION AND SUSTAINABLE DEVELOPMENT IN LOCAL GOVERNMENT. THE CASE OF GLYFADA MUNICIPALITY.**

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***“As contradictory as it sounds, AI can help cities become more people-centric”***

*Bruno Lanvin, President of the Smart Cities Observatory*

#### **Abstract**

Digital transformation is the vehicle to change how the state designs processes, implements actions, serves citizens and solves problems. Cities, the cell of human activity, utilize technology that is now an integral part of all. Digital innovation in local government can lead to the improvement of public sector services, reduction of bureaucracy, increased transparency, participation and efficiency.

Although technology is a necessary structural element for a smart city, technology is not what makes a city smart. The priority of the new digital strategy is transforming cities and communities into smart and sustainable ones in which citizens enjoy living and working. Smart, sustainable cities are a holistic approach to cities that harnesses the potential of technological development to achieve sustainable development goals.

A smart city that compromises the ability of present or future generations to meet demands by exceeding environmental constraints is not ingenious. The key functions of smart sustainable cities create local initiatives that improve the quality of life and finally this is a factor of competitiveness. The Municipality of Glyfada demonstrates successful digital innovation and sustainable development initiatives through the implementation of projects and actions providing sustainable solutions to local challenges to improve the quality of life of its residents.

**Keywords:** Information and Communication Technologies (ICTs); Digital Transformation; Digital Innovation; Digital Transformation Bible 2020-2025; Smart Sustainable Cities; Municipality of Glyfada.

#### **Methodological Approach**

This study adopts a qualitative methodology that combines a foundational literature review and digital ethnography to examine the role of digital innovation in promoting sustainable development within local government, with a particular focus on the Municipality of Glyfada.

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The article provides an overview of key frameworks and previous applications of digital innovation, sustainable development and local government by drawing on relevant studies and publications from both international and Greek sources.

Initially, a comprehensive review of existing literature was conducted using a variety of academic sources, including journals, books and conference proceedings, with keywords related to “digital innovation AND smart and sustainable cities” up to 2025.

More than 50 articles were identified, along with additional books and papers. Prominent authors in the field were noted based on the frequency of their publications. The literature review was further expanded by integrating additional resources, which enriched the study by providing a more thorough perspective on the topic. These additional sources include recent studies and data that enhance the understanding of the challenges and opportunities in smart and sustainable urban development.

Incorporating digital ethnography, the analysis focuses on examining the digital platforms of the Municipality of Glyfada, assessing online communication, citizen engagement and documents related to the municipality's strategic plans for integrating digital innovation in sustainable governance.

This methodological approach offers a preliminary understanding of how smart technologies and digital strategies are shaping sustainable local governance, providing actionable recommendations for future improvements.

### Objective

The objective of the study is to examine the role of digital innovation in sustainable development within local government, focusing on the Municipality of Glyfada. The aim is to assess the digital strategies and intelligent technologies used to promote sustainable governance, as well as to understand the impact of these strategies on citizen engagement and the achievement of sustainability goals. Specifically, the study seeks to explore how digital platforms and communication strategies influence governance and citizen interaction, identifying challenges and opportunities for improving digital governance at the local level.

### Sections' analysis

#### *Digital Transformation in Local Government*

The COVID-19 pandemic accelerated the adoption of digital solutions, highlighting the role of digital transformation as a tool for sustainable development and support for citizens and enterprises. By utilizing technologies like artificial intelligence, big data and the Internet of Things (IoT), efforts are directed toward optimizing processes and advancing the development of smart cities.

The National Strategy for Digital Transformation, as outlined in the Digital Transformation Bible 2020-2025, sets seven key objectives aimed at creating a more efficient and flexible public sector. Particular emphasis is placed on upgrading digital services for citizens, utilizing public data and promoting digital innovation on a broader scale.

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The Digital Transformation Bible serves as a primary guide for addressing challenges in digital governance, focusing on coordination to effectively implement a unified strategy and achieve common goals. By combining digital transformation with sustainable development principles, public authorities can enhance social well-being, economic growth and environmental protection. The synergy of digital innovation and local governance can foster smarter, more transparent communities, improving citizen participation and strengthening trust in public authorities.

The digital transformation strategy seeks to provide horizontal digital tools to all local government organizations while allowing each region, city or community to adopt a specialized digital strategy tailored to its local needs.

Digital progress in local government brings substantial reforms that improve citizens' quality of life. Examples include platforms for organizing and managing data, electronic payment systems for municipal fees, vehicle management, smart city guides, and cybersecurity infrastructure. These innovations enhance efficiency, promote sustainability and increase citizen engagement.

Cities like Switzerland and Sweden have developed apps that enable citizens to pay taxes and report complaints through mobile devices (Gigauri et al., 2023). Amsterdam stands out as a smart city promoting smart energy and resource management, collaborating with the private sector to develop green and digital infrastructures (Saeed, S. et al., 2023). Barcelona has integrated IoT technologies for traffic management, air quality monitoring and waste management, reducing CO2 emissions and promoting sustainability. Leaders in digital governance include Tallinn in Estonia and Singapore. In Tallinn, citizens use online applications for services such as tax filing, voting and accessing government services, while Singapore employs real-time monitoring technologies to manage emergency responses, such as natural disasters, ensuring citizen safety (Saeed, S. et al., 2023).

In Greece, the Municipality of Trikala stands as a model of digital innovation, featuring smart traffic management through IoT systems to reduce congestion, electronic platforms for citizen requests regarding technical issues and the pilot operation of driverless buses.

### ***The Smart City as a Model of Sustainable Development***

Technology, although a necessary structural element for a smart city, is not the defining factor that makes a city smart or intelligent. A smart city that compromises the ability of present or future generations to meet their needs by exceeding environmental limits cannot be considered truly intelligent. It's required continuous and intensive collaboration among political leadership, public administration, the private sector, voluntary organizations, and citizens. With the development of digital infrastructure and the collaboration of all stakeholders, smart cities can become models of sustainability and innovation, offering better services and prospects to citizens.

Leadership, citizen participation and technological innovation are the key pillars for achieving sustainability (Banerjee P.,2025). Smart cities arise from the utilization of communication and digital networking technologies and from understanding the city as an environment of creativity and innovation (Komninos, 2006).

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The term «smart city» is used to describe an area where the local innovation system is supported and upgraded through digital networks and applications. By using information and communication technologies, the innovation system gains greater depth and reach, while its functions become more transparent and effective. The city gains innovation capacity, which translates into competitiveness and prosperity. A smart sustainable city meets the needs of its current residents with the support of Information and Communication Technologies (ICTs) ensuring that the ability of other people or future generations to meet their needs is not compromised and thus local or environmental limits are not exceeded (Höjer M., Wangel J. 2014).

Technology is key of supporting the participatory processes and knowledge generation necessary for sustainable city transformations. Technological systems should serve as tools for engagement and learning, empowering citizens and city managers alike (Banerjee P., 2025). Two essential elements of smart cities are the innovation system (local/regional), which directs the creation of knowledge and technologies within local entities (such as businesses, universities, technology centers and incubators) and digital information and knowledge management tools, which enable information exchange, communication, decision-making, technology transfer, and collaborative innovation.

Furthermore, robust institutions assist public administration in minimizing corruption, encouraging participatory decision-making, improving effectiveness, efficiency and transparency, granting public access to information, promoting collaboration, and ensuring the enforcement of laws for sustainable and inclusive development. The institutional aspect is crucial, as institutions, by establishing a conducive administrative environment, can eliminate legal obstacles and convert a city into a smart one through integrated governance, transparent practices, strategic communication, networking and partnerships (Rodríguez-Pose, A. 2018).

Human capital is also a key element of the smart city. It is through human capital that the city acquires knowledge, skills, creativity and social awareness (Komninos, N., 2013).

A sustainable city provides safe housing, affordable transportation systems for all, protection from natural disasters, air quality management, waste management, development of green spaces, reduction of environmental impact, protection and preservation of natural and cultural heritage and ensures the quality of life for all, including vulnerable groups such as the elderly, women, children, people with disabilities, and the poor.

Essentially, it is a holistic approach to cities that leverages technological advancements to achieve the Sustainable Development Goals (SDGs). The role of cities is highlighted by the 11th of the 17 United Nations SDGs: “Sustainable Cities and Communities”. In 2019, the European Commission introduced the 17 SDGs of the UN as a core theme of its policy agenda under the name “European Green Deal” which plays a leading role in current and future reforms in Europe and is linked to its Digital Agenda.

### ***Smart City Index***

The Smart City Index is a global ranking of smart cities. This year’s index was created by the IMD World Competitiveness Center’s Smart City Observatory in collaboration with the World Smart Sustainable Cities Organization (WeGO) in Seoul, South Korea. The report



ranks 142 smart cities worldwide based on data analyzed by researchers and survey responses from 120 residents in each city.

The study provides an overview of how a city’s infrastructure and available technologies affect its performance and residents’ quality of life. This year’s index highlights that 7 out of the top 10 smartest cities in the world are in Europe, with the remaining 3 in Asia. In previous years, with the exception of Singapore, Asian cities were far from the top; however, they now seem to be gaining ground. Asia has 5 cities in the top 20, and their growth rate is becoming increasingly rapid.

With rare exceptions, the top 20 smart cities are located in regions with relatively stable social and economic environments, even amid global uncertainty. Additionally, the high rankings of these cities are associated with initiatives aimed at improving citizens' overall quality of life, such as the development of green spaces and the expansion of cultural and social interaction opportunities. The top-ranking cities implement innovative strategies to attract talent, promote sustainability investments, and address long-term issues related to geographic disparities and inclusion. This could explain why Switzerland holds 3 of the top 10 positions.

Athens’ results have become increasingly discouraging over the years, reaching an all-time low this year by ranking 120th. Athens’ indicators are dangerously low, with citizen participation, recycling, and education being pressing issues. Healthcare infrastructure and safety are also concerns for Athens’ residents.

At the same time, the Arcadis Sustainable Cities Index 2024 ranks Athens among the 100 most sustainable cities in the world, securing the 51st position. The 2024 Sustainable Cities Index by Arcadis evaluates 100 cities worldwide based on four pillars: Planet, People, Profit and Progress. The 6th publication of the report since its launch in 2015 includes 67 metrics that highlight the evolving understanding of urban sustainability. Key benchmarks include air pollution, waste management, and investments in low-carbon infrastructure, as well as factors such as economic performance, social equality and resilience to natural disasters.

The Greek recovery and resilience plan, Greece 2.0, includes an initiative with an investment in “Smart Cities” highlighting a national, European and global challenge related to both digital and green transitions. This initiative will fund 17 municipalities across the country, including 16 municipalities with populations over 100.000 and the Municipality of Trikala, which serves as a model “smart municipality”.

Table 1: Greece Smart City Ranking Over Time



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### ***Digital Innovation Strategies for Sustainable Development in Local Government – A descriptive introduction***

Digital innovation strategies are essential for achieving sustainable development in local government, focusing on the three pillars of environmental, social and economic sustainability. These strategies involve implementing technologies that promote sustainability and prosperity for citizens without harming the environment or social cohesion.

Key areas for digital innovation in local government include:

1. Smart Infrastructure Development: Implementing smart technologies in energy and lighting networks to improve efficiency, reduce emissions and conserve resources.
2. Digitization of Services and Governance: Streamlining public services through digital platforms to enhance transparency, reduce bureaucracy and improve citizen engagement.
3. Smart Transport and Sustainable Networks: Utilizing technologies for efficient traffic management and promoting electric mobility to reduce CO2 emissions and support sustainable urban mobility.
4. Environmental Management and Protection: Leveraging sensors and data analysis to monitor air, water and waste, enabling timely environmental protection actions.
5. Enhancing Citizen Participation: Using digital tools to involve citizens in governance, allowing them to monitor sustainability initiatives and provide feedback.
6. Supporting Innovative Business Models: Promoting digital innovation in businesses to develop sustainable business models and foster local economic growth.
7. Education and Training: Providing education on digital innovation to empower citizens and businesses, creating a strong ecosystem for sustainable development.

Successful implementation requires collaboration between local authorities, citizens, businesses and academic institutions. Effective governance and a unified strategy are crucial for integrating digital technologies into sustainable solutions, ensuring a prosperous and sustainable future for local communities.

### **Challenges and Opportunities from digital innovation in sustainable local development**

The Smart Cities harness innovative technologies for the sustainable development however the implementation is accompanied by certain threats and weaknesses that could negatively affect the effectiveness and sustainability of these initiatives.

A significant threat is cybersecurity, as digital solutions for managing smart cities increase their exposure to data security risks. Cyberattacks can impact critical functions and cause the leakage of sensitive data, undermining citizens' trust (National Cybersecurity Strategy 2020-2025).

Another serious threat is the limited financial budgets for the implementation of sustainable and smart development projects. Local authorities often face difficulties in financing technological solutions, which delays progress and limits innovations. Remaining on financial threats, it is worth mentioning the increasing cost required for the continuous monitoring of technological trends, as rapid developments in the technology sector render

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many systems outdated within a short period of time. In fact, the high cost of implementation and maintenance is a fundamental weakness. The application of digital technologies often requires significant initial investments, which may act as a deterrent for local authorities (Nam, T., Pardo, T. A., 2011).

A threat is also the lack of awareness or understanding of the advantages that smart cities offer, which can provoke reactions from citizens. Residents may feel their personal data being violated or fail to understand the usefulness of new technologies, leading to dissatisfaction (Nam, T., Pardo, T. A., 2011). The slow adoption of technologies and resistance to change from traditional systems to new technologies is another significant weakness. Authorities and citizens often hesitate to adapt to new technologies, which delays project progress.

Moreover, citizens may face employment inequalities due to unequal access to new technologies. Digital technologies may displace low-skilled jobs, while new opportunities are not equally distributed. Digitization tends to favor large businesses and high-income groups, exacerbating employment inequalities and access to services (Digital Progress and Trends Report 2023).

Thus, digital illiteracy constitutes a serious weakness. Unequal access to technology creates social exclusions, especially among the elderly, vulnerable groups, and residents of remote areas. Digital illiteracy limits the effective use of digital services by citizens (Van Deursen & Helsper, 2015). While internet access is increasing, the gap between high- and low-income countries is widening. Only 25% of residents in low-income countries had internet access in 2022, limiting development opportunities (Digital Progress and Trends Report 2023). Staying within the human resources aspect, the lack of skilled professionals for implementing digital innovation projects is a major weakness. Local authorities may struggle to find staff with the necessary expertise to manage and maintain digital systems.

Additionally, the rapid development of new technologies often exceeds the ability of legal systems to adapt, leading to unclear legal frameworks that may impact the effectiveness and legality of projects. Inadequate regulations and legal gaps can cause delays in project implementation and create legal uncertainties (Meijer, A. et al 2015).

Last but not least, climate change is a serious threat to smart city infrastructures, as extreme weather conditions such as floods, droughts, and heatwaves can cause significant damage and affect the functioning of smart city infrastructures (Bibri, S. E., Krogstie, J., 2019). To address these challenges, adaptation strategies must be developed that integrate climate change into the design and operation of infrastructures, enhancing city resilience and ensuring their sustainability in the future.

In contrast to the threats associated with digital innovation, there are also significant opportunities that can enhance sustainable local development. Smart cities have the potential to seize opportunities arising from technological progress, global sustainability trends and available funding. European programs provide significant funds to support sustainable innovation projects. This funding enables local authorities to implement smart solutions without burdening local budgets (European Commission, 2021). Global trends and commitments for sustainable development and emissions reduction create new investment opportunities in green and smart infrastructures. Local authorities can attract investments for projects that align with these policies (United Nations, 2023).

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The development of new digital services, such as waste monitoring, smart parking and energy management, can improve citizens' quality of life and reduce the operational costs of cities. The further development of cutting-edge technologies offers tools for optimizing resource management and allows for the prediction of problems and more targeted decision-making (Kitchin R., 2014). The use of technology to enhance transparency in local authorities' processes can increase citizens' trust and participation in decision-making. Citizens feel safer when they know decisions are made transparently (Nam, T., Pardo, T. A., 2011).

The implementation of smart cities through digital innovation provides significant advantages for local communities. Digital platforms reduce bureaucracy and enhance resource management, facilitating the daily operations of local authorities. Automation of processes leads to time and cost savings (Emilio Abad-Segura et al., 2020). Digital systems provide the ability to monitor and control processes and decisions in real-time. This transparency strengthens citizens' trust in local authorities (Meijer, A. et al 2015). Promoting participatory governance is achieved through tools such as smart city applications that allow citizens to actively participate in policy formation and solving local issues. This creates a more participatory form of governance (Nam, T., Pardo, T. A., 2011).

Smart infrastructures, such as lighting, transportation, and waste management systems, reduce energy demands and operational costs. These solutions contribute to improving citizens' everyday lives (Bibri, S. E., Krogstie, J., 2019). Public-private partnerships facilitate the implementation of innovative projects. Through this collaboration, public organizations can leverage the expertise, experience, and resources of the private sector, achieving higher quality and efficiency in the services provided. Public organizations can benefit from the expertise and resources of the private sector (Osborne S. P., 2010).

Compared to other countries, Greek municipalities face significant constraints at financial, legislative, and administrative levels. They are dealing with an economic crisis, lack the ability to legislate for the needs of their local areas, and their administrative flexibility is limited due to strict regulations from the Ministry of the Interior. Despite these challenges, municipalities can leverage modern technologies and participatory processes to innovate and improve their services, enhancing citizens' quality of life. There are many ways to innovate that do not require large financial investments. The Central Union of Municipalities of Greece has highlighted examples from international experience regarding “small smart cities” that achieve an upgrade in quality of life, enhance citizen participation, and promote local development, without the need for significant financial burden (Central Union of Municipalities of Greece, 2023).

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**Table 2**

**SWOT Analysis: Digital Innovation and Sustainable Development in Local Government**

Strengths

Increased Efficiency  
Enhanced Transparency  
Promotion of Participation  
Improved Quality of Life  
Public-Private Partnerships (PPP)

Weaknesses

High Implementation Costs  
Digital Illiteracy  
Limited Human Resources  
Slow Adoption of Technologies  
Legal Gaps

Opportunities

EU Funding  
Development of Digital Services  
Public Trust  
Climate Policies  
Emerging Technologies

Threats

Cybersecurity  
Limited Budgets  
Technological Obsolescence  
Citizen Reactions  
Employment Inequalities  
Climate Change

The challenges in the field of cybersecurity for local governments are significant, with the main issues being limited financial resources, technological vulnerabilities, human factors and the regulatory framework (Sk Tahsin Hossain, 2025)

## Case Study

### *Digital Innovation and Sustainable Development in the Municipality of Glyfada*

The quality of life in future cities is emerging as a key factor in competitiveness. In his analysis, Charles Tiebout (1956, Journal of Political Economy) argues that competition between local authorities leads to the optimization of the public goods they provide. As citizens have the opportunity to move to other cities offering better services, local governments are encouraged to meet the needs of their residents. This model offers solutions to the issues of revealing and aggregating preferences for public goods.

Glyfada, one of the most attractive areas in Attica, stands out for its location on the Athenian Riviera, its sea views, and its modern infrastructure. With quick access to central Athens via the Poseidonos and Vouliagmenis avenues and its connection to the tram, it offers conveniences for residents and visitors. The extension of the Metro Line 2 is expected to further enhance connectivity and increase the area's attractiveness. As a result, Glyfada continues to evolve as a dynamic, modern city that ensures a high standard of living for its residents.

The Hellenic Statistical Authority conducts a population census every decade, examining demographic and social characteristics, household composition, and living conditions. Over the past decade (2011-2021), the population of Glyfada grew by 2.63%, making it the second most populous city in Southern Attica, after Kallithea.

The city is a model for sustainable solutions it implements to address local challenges, utilizing partnerships with the private sector and civil society to achieve sustainable



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development. Its initiatives for digital innovation and sustainable development are communicated through the Municipality's website, social media and the viber group, encouraging active citizen participation in information and decision-making processes.

The use of digital technologies brings citizens closer to local planning and decision-making processes. The development of digital skills can act as a catalyst to strengthen democratic functioning and contribute to local development.

The vision for smart and sustainable cities is a challenge for local authorities. These cities integrate their technological, physical, social and economic infrastructures to harness their collective intelligence, aiming for greater sustainability, efficiency, resilience and justice (Bibri, S. E., Krogstie, J., 2019).

**Table 3**

Sectors and Actions of Digital Innovation in the Municipality of Glyfada

| <b>Sector</b>                                                                                                                        | <b>Actions</b>                                                                                                                                                                                                                                                                                                                              |
|--------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>IntelligentCity</b><br>Integrated digital services toolkit for public sector entities, focusing on Local Government Organizations | Includes a set of separate applications, each providing additional digital services for citizens, businesses, and municipal staff. The aim of the IntelligentCity applications is to provide the best possible citizen service and serve as a user-friendly tool for municipal services, contributing to their organization and management. |
| <b>CityCertify</b><br>Development of a unified digital services platform                                                             | Enables citizens to request and receive digital certificates without having to visit the Municipality or the Citizen Service Center in person.                                                                                                                                                                                              |
| <b>FixMyCity</b>                                                                                                                     | Modern electronic request reception and management system for citizens.                                                                                                                                                                                                                                                                     |
| <b>MarinaWatch</b>                                                                                                                   | Marina management application.                                                                                                                                                                                                                                                                                                              |
| <b>CemeteryWatch</b>                                                                                                                 | Cemetery management application.                                                                                                                                                                                                                                                                                                            |
| <b>StoreManager</b>                                                                                                                  | System for servicing health-related business offices.                                                                                                                                                                                                                                                                                       |
| <b>FixMySchool</b>                                                                                                                   | School management application.                                                                                                                                                                                                                                                                                                              |
| <b>SmartBus</b>                                                                                                                      | Transportation of citizens with a small municipal vehicle to one of the 11 predefined stops, taking them to their destination (within the city's limits) free of charge.                                                                                                                                                                    |

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**Table 4**

Sectors and Actions of Sustainable Development in the Municipality of Glyfada

| <b>Sector</b>                       | <b>Actions</b>                                                                                                                                                                                                                                                                                                                                           |
|-------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Environment – Recycling</b>      | Waste separation into 10 streams (e.g., branches, construction debris, metals, organic composting, clothes, batteries, paper, tires, lubricants), educational actions for waste separation and placement of recycling bins (blue, brown, yellow).                                                                                                        |
| <b>Infrastructure</b>               | Major redevelopment projects including pedestrian streets, bike lanes, parking lots, playgrounds, schools, kindergartens, squares, road maintenance, construction of a special school, elderly care home, over 30 sports clubs, Esplanade a bridge to the beach and underground parking to solve congestion issues for residents and visitors.           |
| <b>Civil Protection</b>             | Advanced fire detection system with fixed optical and thermal cameras, AI-driven monitoring, and water tank management on mountains, ensuring resource readiness for crisis prevention and response.                                                                                                                                                     |
| <b>Social Welfare</b>               | Social services like open centers for the elderly, "Help at Home" program, social grocery, pharmacy, clinic, canteen, tutoring, free health checks (e.g., Alzheimer's screenings, cardiological check-ups, rapid tests), anti-drug campaigns, sea baths for elderly, access to the sea for disabled individuals and animal adoption awareness campaigns. |
| <b>Education – Sports – Culture</b> | Summer camps, kindergartens, open university programs, municipal conservatory, library with daily cultural events including festivals, exhibitions, concerts, theater performances and tributes to notable artists.                                                                                                                                      |

Glyfada is on a dynamic transformation path, aiming to evolve into a sustainable and smart city. Its efforts focus on improving energy efficiency by utilizing smart infrastructures, such as low-energy lighting, as well as implementing technologies for upgrading urban mobility systems.

The implementation of digital platforms that encourage citizen participation and facilitate administrative processes is a central aspect of its strategy. In this way, Glyfada aims to reduce bureaucracy, enhance transparency, and provide improved services to its residents. At the same time, the city places emphasis on sustainable mobility, promoting the use of electric vehicles and facilitating access to public transportation.

Additionally, the integration of practices to monitor environmental indicators, such as air and water quality, are key goals to support sustainability. The use of data for decision-making is considered critical to strengthening the city's resilience.

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Despite these significant initiatives, more data is required regarding the effectiveness of these measures, especially in terms of long-term sustainability and citizen participation, as they are still in the development phase.

### Proposals and Conclusions

Above analysis focuses on the critical aspects of developing smart, sustainable cities, emphasizing the role of local government in digital transformation. Local governments must act as facilitators, coordinators and activators to promote collaboration among stakeholders, ensuring values such as transparency, accountability and responsibility are embedded within the city culture.

Key areas for digital innovation include energy management, environmental monitoring, green space upgrades, smart traffic management and pollution measurement. Enhancing digital skills in public administration is also vital to accelerate the digital transition, particularly in Greece, where challenges like limited broadband in rural areas and low digital literacy remain.

Greece's national plan includes a Smart Cities project, with a €5.1 billion investment aimed at improving connectivity, public sector digitization and digital rights protection. Environmental monitoring, particularly for coastal regions, is crucial for sectors such as tourism and marine biodiversity, with technologies like IoT and AI offering significant advantages for environmental protection.

The successful integration of digital technologies in governance optimizes resource use and enhances service quality. However, achieving the vision of smart, sustainable, and citizen-centered cities requires a collaborative approach involving political leaders, public administration, the private sector, volunteer organizations and citizens.

Cities worldwide, including Greece, align with the UN's Sustainable Development Goals (SDGs), particularly SDG 11, focusing on “Sustainable Cities and Communities”. Greece's efforts are showcased through initiatives like the Municipality of Glyfada, which continues to lead successful projects in both digital and green transitions.

In summary, creating smart cities is a complex but achievable goal that requires strategic planning, strong leadership and ongoing collaboration among various sectors to ensure sustainable development.

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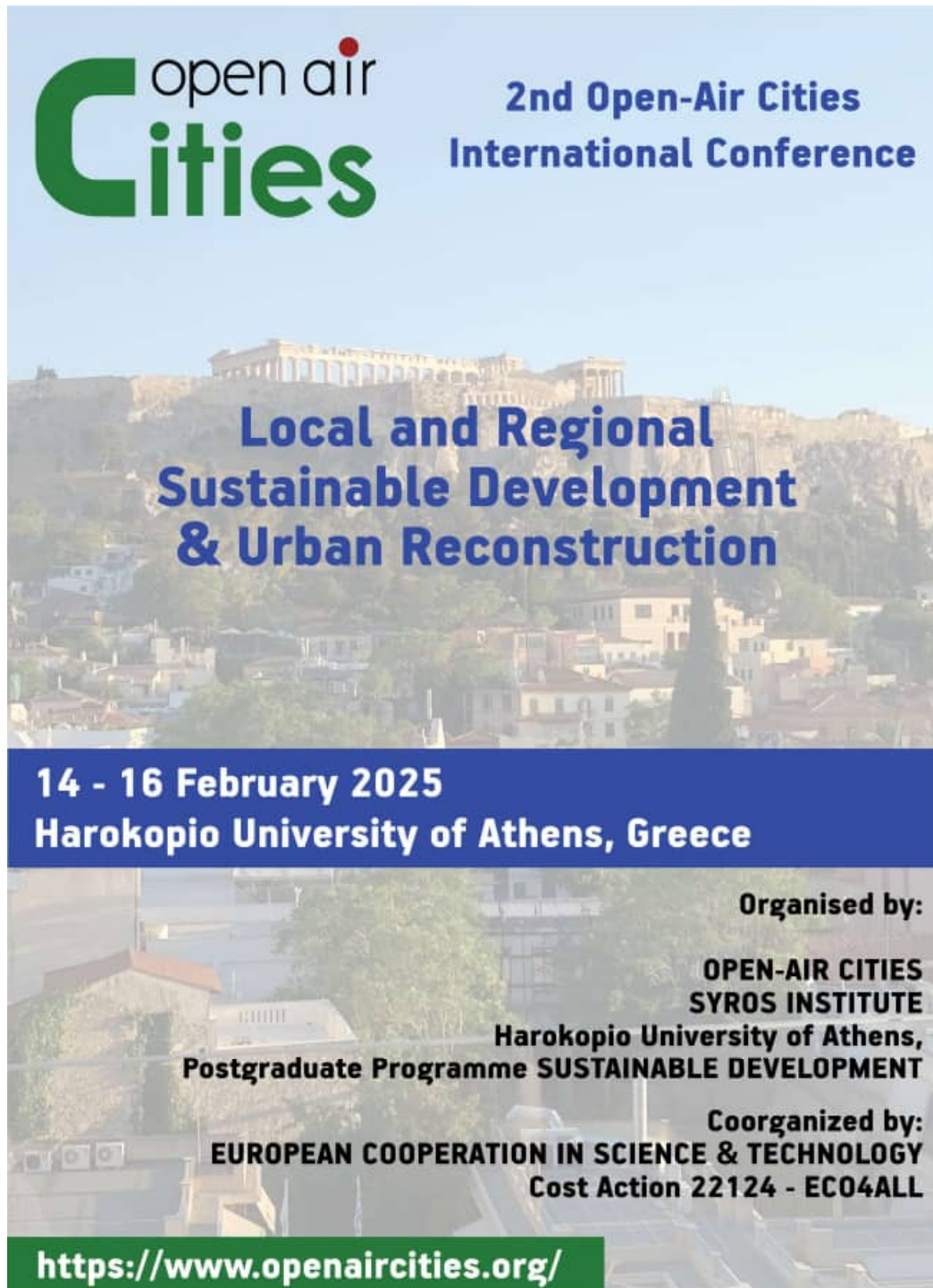
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### **OUR CITY IS SMART. WHAT ABOUT US? - THE CASE STUDY OF THE MUNICIPALITY OF PERISTERI, ATTICA, GREECE**

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#### **Abstract**

This paper examines the relationship between urban development and sustainability within the framework of smart cities. The study begins with a literature review of the concept of smart cities and then presents examples of European cities that have adopted smart practices. The success of smart cities is highlighted as a result of the interaction between technology and citizens, emphasizing the importance of technologically literate and participatory citizens.

In the second section, the study focuses on the Municipality of Peristeri in Attica, Greece, presenting general and historical information as well as its modern infrastructure supporting its transition to a smart city. Projects and initiatives related to digital reform, mobility improvement, and environmental sustainability are analyzed.

Following this, an analysis of survey results conducted among residents of the Municipality of Peristeri is presented to assess the level of adoption of smart city practices in their daily lives. Finally, the paper concludes with key findings and suggestions for further research, highlighting the need for continuous education and awareness of citizens to maximize the benefits of technological innovations and enhance social and economic well-being.

**Keywords:** smart city, smart citizens, Municipality of Peristeri, sustainability

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# A REVIEW OF SMART CITIES’ TECHNOLOGIES IN THE GOVERNANCE AND THE EVERYDAY LIFE OF CITIZENS IN GREEK CITIES

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## **Abstract**

In recent years, the integration of smart city technologies has transformed the governance and daily lives of citizens, enhancing urban sustainability, efficiency, and quality of life. This paper reviews the implementation and impact of smart technologies across Greek cities, focusing on how digital innovations influence urban management and citizen engagement.

Smart cities leverage Internet of Things (IoT), artificial intelligence (AI), and data analytics to optimize infrastructure, energy management, mobility, and public services. In Greece, initiatives such as digital platforms for municipal services, smart transportation systems, and environmental monitoring networks have gained traction, aiming to address challenges in urbanization, climate change, and resource efficiency.

Through an extensive literature review and case studies from cities such as Athens, Trikala, Ioannina and others, this study examines key applications of smart technologies in governance frameworks and their contribution to participatory democracy. Additionally, it explores how these advancements reshape everyday urban experiences, from improved access to public services to more sustainable mobility solutions.

The findings reveal that while significant progress has been made in integrating smart solutions, disparities exist in the adoption of technologies among cities due to varying socio-economic conditions and policy frameworks. Furthermore, the research highlights the importance of fostering citizen-centric approaches and inclusive governance to ensure equitable access and long-term sustainability of smart city initiatives.

This review provides valuable insights for policymakers, urban planners, and technology developers, emphasizing the need for strategic planning and citizen involvement to fully realize the potential of smart cities in Greece.

**Key words:** Smart Cities, Internet of Things, Digitalization, Greek Cities, Artificial Intelligence

**VIRTUAL WORLDS AND SUSTAINABLE ARCHITECTURE:  
NEW PATHWAYS TO SUSTAINABILITY IN THE ERA OF THE  
INDUSTRY 4.0**

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**Abstract**

In the Anthropocene era, architecture and construction confront the challenge of minimizing environmental impact, as cities and communities are tasked with addressing the pressures of the climate crisis, urban population growth, and the need for resilience. Simultaneously, the Fourth Industrial Revolution introduces new, cutting-edge tools and technologies, such as Artificial Intelligence and Virtual Reality, providing innovative solutions in architecture and urban planning. In this research, the dynamic connection between virtual worlds and sustainable architecture is explored, illustrating through literature review how digital platforms and simulations enhance citizen engagement, transparency, and governance, while facilitating the evaluation of strategies through real-time monitoring of environmental and social indicators. Examples are examined, such as the use of blockchain for sustainable urban planning, VR-based sustainability education, and resilience through virtual crisis simulations conducted in secure cyber platforms, all tested before real-world implementation to ensure their feasibility. In parallel, the conservation and proper management of essential resources within the circular economy framework is prioritized. Finally, the challenges of energy and data are analyzed, with proposals for the seamless integration of both innovation and sustainability. The merging of social sustainability and technological advancement is expected to reveal new viewpoints for the interaction between physical and virtual environments, leveraging the benefits of digital technologies and social participation and positioning sustainable construction as a key pillar for a fair and green future.

**Key words:** Virtual reality, digital technologies, sustainable architecture, urban planning, resilience.

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### Introduction

The aim of this research is to highlight the dynamic connection between Virtual World technologies and Architecture, focusing on the contribution of digital technologies in shaping a fair and green future. It is true that in the Anthropocene era, cities and communities are being called upon to address emerging pressures such as climate change, urban density, and the urge to strengthen resilience. On the other hand, the fields of architectural design and construction face challenges related to reducing the ecological footprint of the building stock and infrastructure. At the same time, the use of innovative tools of the 4th Industrial Revolution, such as Artificial Intelligence and Virtual Reality, offer state-of-the-art solutions to critical problems. The compliance of digital technologies with the principles of environmental ethics is a key factor in addressing contemporary issues, providing tools that promote sustainable practices by incorporating ethical and social parameters into the planning and long-term evaluation of intervention strategies.

The research follows a qualitative methodology, based on an extensive literature review of academic publications and case studies related to new technologies and architectural sustainability. By examining various scientific viewpoints and conclusions drawn from bibliography, the significance of digital tools and optimal methods as a means of environmentally friendly urban and spatial planning is highlighted. Furthermore, through the lens of analyzing the theoretical foundations of the Anthropocene period, the emphasis is placed upon the need for a redirection of current environmental policies and strategies to strengthen resilience (Biermann, 2014; Wilke & Johnstone, 2017). Additionally, some of the main sustainability certification systems for building constructions are presented, specifically LEED and BREEAM, evaluating their effectiveness in ensuring energy efficiency and the preservation of available resources.

The text is structured into five (5) distinct sections, each addressing multiple aspects of the collaboration between sustainable architecture and technological innovation. Initially, the concept of the Anthropocene is theoretically developed based on the prevailing theories in environmental sciences, as well as the pressures arising during this period for urban planning. The next section discusses issues related to climate change, energy poverty, and social inequalities, emphasizing the need for adopting and implementing strategies for green and resilient infrastructures. The section on Smart Cities and Digital Tools examines the contribution of digital innovation tools, such as AI, IoT, and Blockchain, to the enhancement of urban sustainability and spatial governance. This is followed by a specialized analysis of the collaboration between Virtual Reality and active Architecture, demonstrating how immersive technologies can be used for sustainable education, participatory design, and crisis simulation. The discussion then shifts to a comparative analysis of the International Standards for Sustainable Architecture Certification, LEED and BREEAM, their rating systems, and their impact on the global construction landscape. Finally, in the Conclusions section, a



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review of the key findings is presented, offering a perspective on the future of sustainable architecture as digital transformation contributes to the shaping of environmentally responsible urban communities. By linking technological progress with the principles of ecology, this research aims to highlight a holistic approach to the concept of sustainability, where digital tools act as catalysts for environmentally responsible urban development.

By linking technological progress with ecological principles, this study underscores the importance of a holistic approach to sustainability, where digital tools act as catalysts for responsible urban development.

### **Theoretical Framework**

The concept of the Anthropocene is used to define the “geological” period during which geotechnical and climatic changes in Earth's ecosystems result primarily from human activity. The term “Anthropocene” was coined in 2000 by Paul Crutzen and Eugene Stoermer to illustrate the profound impact of human activities on the environment on a global scale. By increasingly understanding and analyzing the ways in which industrial civilization affects ecology, climate change, and social justice, this term has since taken on new dimensions and revisions, as the carbon cycle, biodiversity, and geological processes are now influenced by human activity in ways that surpass natural processes. These activities include industrialization, deforestation, agriculture, the burning of fossil fuels, and the overexploitation of natural resources (Biermann, 2014; Crist, 2020). The growing intervention necessitates the redefinition of the human-nature relationship (Crist, 2019). Through the principles of the circular economy, the long-term management of available natural resources and energy sources is ensured, preventing their depletion and minimizing the generated pollutants (Bourdeau, 2004; Foster, 2017; Bibri, 2022).

Meanwhile, as a counterbalance to the aforementioned pathologies, the arrival of new technologies such as virtual platforms and simulation software improves transparency and decision-making by utilizing real data (Wilke & Johnstone, 2017; Allenby & Sarewitz, 2011). Applications of virtual reality provide the ability to simulate and control sustainability strategies before their implementation, while Blockchain ensures transparency in resource management and urban design in the field of economic and commercial transactions (Palmer et al., 2011; Zhang & Lu, 2020). The integration of these technologies strengthens the resilience of communities, with a focus on social and environmental parameters (Holloway, 2022).

### **Key Challenges of Contemporary Urban Design**

Urban planning, as a process concerned with the organization and development of urban areas, faces numerous adverse conditions in the era of the Anthropocene, including climate change,

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the degradation of natural ecosystems, and the scarcity of energy resources. Urban centers, as hubs of population density, bear the greatest responsibility for the environmental crisis. Furthermore, they are called upon to balance the social inequalities that arise, as the most vulnerable social groups are disproportionately affected by these phenomena.

The philosophy of sustainable development, as approached by the research of Holloway (2021) and Schlosberg et al. (2018), takes into account the necessity of considering the principles of environmental justice and the balancing of human interests with those of natural ecosystems. As Merchant (1987) emphasizes, the ecological revolution emerges through “changes, tensions, and contradictions that develop between a society’s mode of production and its ecology, and between its modes of production and reproduction.” The need for development based on sustainability and environmental protection requires the adaptation of cities to new climatic conditions through the design and implementation of infrastructure projects that are resilient to phenomena such as flooding and drought, including green spaces and transportation networks with a reduced environmental footprint, ensuring the adequacy of natural resources. Moreover, urban planning, in the context of eliminating discrimination, has the duty to adopt policies that will protect the poorest and marginalized social groups, ensuring their equal access to clean air, drinking water, and safe shelters.

The transition from the traditional model of urban development to sustainable infrastructures and high-energy-efficiency buildings requires, according to Biermann (2014), a fundamental revision of how the construction and operation of buildings are approached in the Anthropocene era. Energy efficiency, water recycling, and the use of renewable energy sources are no longer luxuries, according to Palmer (2017), but necessities. In the case of traditional buildings, the lack of modern energy systems and inadequate insulation often lead to significant energy losses. Furthermore, the operation of outdated heating, cooling, and ventilation systems, which do not meet modern energy-saving standards, further increases the environmental footprint. The implementation of green technologies, such as solar panels and renewable energy devices, as well as sustainable building materials for the bioclimatic upgrading of buildings, is not just good practice but a political move that prioritizes ecological and social well-being over immediate, environmentally harmful, and socially detrimental profit (Havlick, 2019; Polt & Wittrock, 2018).

Despite the benefits of promoting modern technologies for the energy upgrade of building stock and infrastructure, their application remains limited due to the complexity of these tools, as well as their high cost. As Droz (2019) emphasizes, the development of management tools and techniques requires, within the framework of environmental ethics, careful study of the “milieu,” the surrounding environment within which these technologies will operate. In the case of buildings, complexity consists of including numerous parameters such as energy efficiency, air quality, water usage, and recycling potential. Furthermore, social and educational inequalities present a significant barrier to equitable access to and use of these technologies by the majority of social groups (Robison, 2017). Handling these

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technologies often requires high-level technical knowledge and skills, making them difficult to use by small to medium-sized, untrained users (Knack et al., 2019). The need to employ specialized personnel for installation and maintenance significantly increases the cost for both businesses and employers. As Plumwood (1993) notes, the dominance of the capital in the distribution of energy goods and resources leads to environmental inequality, excluding poorer and technologically illiterate populations from accessing technologies necessary to reduce their carbon footprint.

### **Smart Cities Digital Tools and Innovation**

#### ***Technology and Innovation in Modern Urban Planning***

Cutting-edge technologies and innovation are crucial drivers of modern urban planning. Smart cities, in the context of reducing carbon footprints and improving the daily lives of residents, rely on information technology applications, the internet, and big data. The design of communities that will harness innovation and green infrastructure while reducing social inequalities is expected to contribute to the achievement of a more equitable and sustainable future (Bouzguenda et al., 2019). The integration of advanced tools from the 4th Industrial Revolution, such as Artificial Intelligence, the Internet of Things (IoT), and Digital Twins, promotes the continuous monitoring and management of urban infrastructure, enhancing efficiency and sustainability (Boyes et al., 2018). This is because these technologies have the ability to collect and analyze real-time data, allowing for immediate intervention, redirection, and the implementation of improved strategies for resource and energy conservation (Tapias et al., 2024; Kalemis, 2025).

#### ***Blockchain & Virtual Reality***

The use of Blockchain in the context of spatial development is a powerful example of enhancing and promoting transparency, as this technology enables the collection, storage, and processing of data, providing the ability for organized decision-making by communities and private individuals on critical issues, including resource allocation and environmental risk management (Hikal et al., 2024). At the same time, it facilitates the collection of reliable data, reducing the risk of economic fraud due to lack of transparency, while the decentralized nature of Blockchain allows for secure international transactions (Hollensen et al., 2022).

Meanwhile, Virtual Reality opens new possibilities by enabling the digital representation of applied sustainability strategies in a simulation environment, offering immersive educational experiences that enhance perception and knowledge about significant environmental issues. The application of these strategies is evaluated under simulated conditions, minimizing environmental costs and improving collective response. Through interactive experiences, VR creates the foundation for a more just and green architecture

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(Nikolić & Whyte, 2021), reducing environmental risks and enhancing public awareness and engagement (Jamei et al., 2017).

### ***Digital Design with BIM (Building Information Modeling)***

Building Information Modeling (BIM) is a multidimensional digital approach to design that incorporates geometric, material, and environmental parameters in data form, covering the entire lifecycle of a construction project. It allows architects and engineers of all specialties to create three-dimensional models, facilitating accuracy in design, simulation, and sustainability evaluation. BIM is recognized as a key element of the 4th Industrial Revolution, as it enhances automation, efficiency, and data integration across various phases of a project (Kamari et al., 2020).

One of BIM's key advantages is its ability to integrate technologies such as Geographic Information Systems (GIS) and Light Detection and Ranging (LIDAR), enabling precision in spatial analysis and urban planning. The combination of BIM with GIS allows urban planners to analyze the real-time effects of infrastructure projects, including their impacts on traffic patterns, air quality, and energy consumption (Pantazatos et al., 2023). Additionally, the increasing collaboration between BIM and Artificial and Augmented Reality platforms, enhancing project visualization, enables designers and real-estate professionals to simulate real-world environments, offering stakeholders immersive experiences that aid in decision-making and public participation. BIM supports real-time data analytics, allowing for continuous monitoring and adaptation of energy performance. The integration of Quantity Take-Off (QTO) techniques in BIM improves cost estimation and material efficiency, reducing waste and promoting circular economy principles (Kamari et al., 2020).

Another major advantage of BIM is its role in Life Cycle Assessment (LCA), which enables the evaluation of environmental impacts at every stage of a building's lifespan. BIM-based LCA models track energy efficiency, water usage, and CO<sub>2</sub> emissions, ensuring alignment with international sustainability standards such as LEED and BREEAM (Kourtesis, 2024).

Despite its advantages, BIM adoption faces challenges such as high initial costs, interoperability issues, and the need for specialized training. However, ongoing developments in Artificial Intelligence (AI), cloud computing, and digital twin technologies are expected to enhance BIM's capabilities further. Future advancements may lead to fully autonomous BIM-driven decision-making, improving the efficiency and resilience of smart cities (Kamari et al., 2020). Through continuous innovation, BIM remains at the forefront of digital transformation in architecture and urban planning, paving the way for smarter, more efficient, and sustainable built environments.

***Energy Simulations with Artificial Intelligence (AI)***

AI is transforming energy management in buildings by enabling real-time energy simulations, optimizing consumption, and reducing inefficiencies. As noted by Roblek et al. (2016), AI is essential for smart resource management, particularly in the development of predictive models that allow for early detection of performance issues and inefficiencies. As highlighted in research, plays a crucial role in predictive maintenance and energy simulations, enabling buildings to anticipate energy demands and preemptively adjust resource distribution. AI-powered Digital Twins—virtual replicas of physical buildings—offer architects and engineers an effective solution, as varied energy scenarios are digitally simulated, testing the effectiveness of sustainability measures, and optimize building operations before real-world implementation (Bielicki, 2024). By performing Machine Learning (ML) techniques, AI processes large volumes of energy-related data, allowing for predictive modeling and intelligent resource allocation. The running of data-driven simulations by architects and engineers is helpful as a means of refining building and infrastructure designs, ensuring energy efficiency and sustainability (Chowdhary, 2024).

One of AI’s most valuable applications is the ability to analyze sensor data from smart buildings. Integrated Internet of Things (IoT) devices, such as temperature sensors, occupancy detectors, and smart meters, collect continuous data on energy consumption. AI-powered systems process this information to identify patterns, detect inefficiencies, and recommend energy-saving strategies (Schmitt, 2022). These self-learning models adjust dynamically to weather conditions, seasonal variations, and user behavior, optimizing heating, cooling, and lighting systems in real-time.

Beyond individual buildings, AI also enhances urban-scale energy optimization. By aggregating and analyzing data from multiple smart buildings, AI enables cities to balance energy distribution, integrate renewable sources, and improve grid stability. This functionality is particularly relevant for district energy management and microgrid coordination, where AI can facilitate load balancing and peak demand forecasting (Droz, 2019).

Despite AI’s potential in energy simulations, several challenges hinder its widespread adoption. The high cost of implementation, the need for specialized expertise, and data privacy concerns remain significant obstacles (Plumwood, 1993). Additionally, equitable access to AI-driven energy solutions is a concern, as poorer communities and developing regions may struggle to afford such technologies (Warren, 2000). To ensure sustainable and inclusive adoption, policymakers and urban planners must implement regulations and incentives that promote AI-driven energy efficiency across all sectors.

Through continuous technological advancements, AI-driven energy simulations are set to become an integral part of sustainable architecture and smart city planning. By reducing emissions, cutting operational costs, and improving energy resilience by creating buildings that are both intelligent and environmentally responsible, AI will remain at the forefront of



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climate-responsive building design, fostering a built environment that aligns with global sustainability goals.

### International Sustainable Architecture Certification Standards

#### ***LEED (Leadership in Energy and Environmental Design)***

LEED (Leadership in Energy and Environmental Design) system for the planning, construction, and operation of high-performance green buildings. Developed by the U.S. Green Building Council (USGBC), it is one of the most widespread and reliable standards in sustainable architecture. The primary goal of LEED is to promote sustainable buildings that reduce the consumption of natural resources, improve indoor environmental quality, and minimize environmental impacts. Its implementation helps decrease energy consumption and carbon footprint while increasing building efficiency through innovative technologies, improving air quality, and enhancing user health.

**Image 1: The LEED rating system logo (Source: U.S. Green Building Council (USGBC). (2021) LEED v4.1 BD+C Guide).**



LEED offers a multitude of rating systems variations, depending on the type of building and its use. For example, LEED BD+C applies to new buildings and large-scale renovations, while LEED O+M concerns existing buildings aiming for sustainable operation and management. Additionally, there are specialized versions such as LEED ND, focusing on sustainable neighborhood development, and LEED Homes, which is dedicated to residential buildings. Certification is awarded based on a points system, where projects earn credits in categories such as energy efficiency, water management, material use, and indoor environmental quality. Depending on the total score, a building can achieve one of the following certification levels: Certified (40-49 points), Silver (50-59 points), Gold (60-79 points), and Platinum (80+ points).

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The implementation of LEED offers multiple benefits, both environmental and economic. It helps reduce CO<sub>2</sub> emissions and operational costs while increasing the commercial value of buildings and making them more attractive to investors. Additionally, LEED-certified buildings provide better air quality and natural lighting, thereby improving user health and productivity. Businesses that choose to follow LEED standards also benefit from tax incentives and government subsidies supporting sustainable development.

**Table 1: The primary LEED rating systems based on building type and use.**

| LEED Rating System                                     | Scope of Application                                                       |
|--------------------------------------------------------|----------------------------------------------------------------------------|
| LEED for New Construction and Major Renovations (BD+C) | Applies to new buildings or large-scale renovations.                       |
| LEED for Existing Buildings (O+M)                      | Focuses on the sustainable operation and management of existing buildings. |
| LEED for Interior Design and Construction (ID+C)       | Applies to office spaces, retail stores, and other interior spaces.        |
| LEED for Neighborhood Development (ND)                 | Focuses on the creation of sustainable and smart communities.              |
| LEED for Homes                                         | Designed for single-family homes and apartment buildings.                  |

LEED principles promote sustainable buildings through the integration of IoT sensors that monitor energy consumption and air quality, as well as the use of digital twins (Digital Twins) to optimize energy efficiency. Additionally, it can provide data analysis and personalized recommendations to reduce waste and improve building sustainability. Compliance with LEED standards contributes to achieving higher certification scores, improving performance, and making buildings more competitive in the green technology market.

In summary, LEED aims to provide a clear framework for the construction of energy-efficient and environmentally-friendly buildings. Its integration into building development and management through innovative technologies enhances sustainability, contributing to global goals assumed as a means of reducing environmental footprints.

### ***BREEAM (Building Research Establishment Environmental Assessment Method)***

BREEAM (Building Research Establishment Environmental Assessment Method) is one of the most recognized and widely acclaimed sustainability assessment systems for buildings in a worldwide scale. Developed by the Building Research Establishment (BRE) in the early 1990s, it is applied internationally as a sustainable development standard in the construction sector. The adoption of BREEAM principles aims to reduce the environmental footprint of buildings, promote energy efficiency, and improve indoor air quality. It can be applied both to

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new and existing buildings, as well as renovation and infrastructure projects, encouraging responsible management practices of natural resources, water, and waste.

**Image 2 The BREEAM rating system logo. Source: Building Research Establishment (BRE). (2022). *BREEAM In-Use International: Commercial Technical Manual (V6)*. BRE Group).**



The evaluation of a building through BREEAM is based on nine (9) key categories: management, health and well-being, energy, transport, water, resources, resilience, land use and ecology, and pollution. Each category receives a score, shaping the final classification of the building. The scoring system ranges from Pass (25-39%) to Outstanding ( $\geq 85\%$ ), with intermediate ratings such as Good, Very Good, and Excellent. Certification is awarded based on the building's overall environmental performance, enhancing sustainability and resilience to climate and environmental challenges.

**Table 2: The BREEAM rating system based on the total score a building achieves.**

| Score (%)   | Certification Level            |
|-------------|--------------------------------|
| $\geq 85\%$ | Outstanding                    |
| 70-84%      | Excellent                      |
| 55-69%      | Very Good                      |
| 40-54%      | Good                           |
| 25-39%      | Pass                           |
| $< 25\%$    | Unclassified (Not Certifiable) |

BREEAM includes various subcategories for the evaluation of different types of buildings and projects, such as BREEAM New Construction for new buildings, BREEAM In-Use for assessing the operation of existing buildings, BREEAM Communities for large-scale urban projects, BREEAM Refurbishment and Fit-Out for renovations, and BREEAM Infrastructure, applied both to civil engineering as well as infrastructure projects.

The implementation of BREEAM offers a multitude of benefits. Economically, certified buildings reduce their operational costs due to higher energy efficiency and elevate their commercial value, attracting investors. Environmentally, they contribute to reducing CO<sub>2</sub> emissions, optimizing natural resource management, and using recycled materials. At the

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same time, social benefits include improving air quality, natural lighting, and the general well-being of building users.

BREEAM principles are applicable through data analysis and the use of IoT sensors, improving the buildings' energy efficiency. Additionally, AI and Big Data collection are processed to provide personalized recommendations for sustainable practices, facilitating compliance with BREEAM standards by creating reports in accordance to the system's criteria, thus helping owners, managers and inhabitants achieve higher certification scores.

In summary, BREEAM is a comprehensive assessment system that promotes sustainable development in the construction sector, encouraging the adoption of green practices and ensuring a more sustainable and efficient building management.

## Conclusions

The integration of digital technologies into sustainable architecture and urban planning represents a transformative shift in addressing contemporary environmental and social challenges. As cities continue to expand and confront the pressing issues of climate change, resource depletion, and social inequality, the role of Blockchain, Virtual Reality (VR), Artificial Intelligence (AI), and the Internet of Things (IoT) becomes increasingly crucial in fostering resilient, efficient, and inclusive urban environments. This study has explored how these technologies contribute to enhancing transparency, citizen engagement, and sustainability in architecture, positioning digital innovation as a cornerstone of future urban development.

One of the key findings of this research is the importance of international sustainability certification systems, particularly LEED and BREEAM, in establishing standardized approaches to green building design. These frameworks have demonstrated their effectiveness in promoting energy efficiency, reducing environmental footprints, and improving overall building performance. However, their successful implementation remains contingent on the broader adoption of digital tools, which facilitate data-driven decision-making and real-time monitoring of urban systems.

Despite the considerable benefits that digitalization brings to sustainable architecture, challenges persist. The high cost and complexity of implementing AI-driven energy simulations, IoT-based smart monitoring, and Blockchain-enabled transparency mechanisms limit their widespread application, particularly in developing regions. Moreover, ethical and social considerations, such as digital accessibility and environmental justice, must be central to the development of smart city initiatives to ensure that technological advancements benefit all communities equitably.

Looking ahead, the convergence of technological innovation and environmental sustainability will continue to shape the future of urban planning. Further research is needed to explore interdisciplinary approaches that integrate environmental ethics, digital governance,

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and participatory planning in order to maximize the potential of digital tools in sustainable construction. The transition towards intelligent, green, and equitable cities requires continued collaboration among policymakers, architects, technologists, and local communities to develop solutions that balance innovation with sustainability. Ultimately, the digital transformation of architecture should not only enhance efficiency but also contribute to a more just and ecologically responsible built environment.

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# EXPLORING SOCIAL PATTERNS AND CHALLENGES IN ADOPTING SMART HOUSING SOLUTIONS: THE HUNGARIAN CONTEXT

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## Abstract

Smart housing solutions, particularly those aimed at optimizing energy use, hold significant promise for enhancing energy efficiency and reducing environmental impacts. However, disparities in access, knowledge, and usage skills create pronounced social inequities in the adoption of these technologies. This research investigates the patterns of adoption, knowledge, and attitudes towards smart housing solutions, with a focus on the societal challenges and opportunities they present.

Grounded in theories such as the Technology Acceptance Model (TAM) and the Unified Theory of Acceptance and Use of Technology (UTAUT), the study applies an open innovation framework to emphasize the alignment of technological advancements with societal needs. Drawing on global challenges like climate change, energy shortages, and housing crises, it highlights the role of stakeholder collaboration in fostering socially beneficial innovation.

The findings, based on a national representative survey of 1,000 individuals in Hungary, reveal significant barriers to adoption. Key determinants include financial considerations, trust in technological benefits, and demographic factors such as age and education. The research also identifies concerns about system reliability, cost, and the required knowledge for operating smart devices, alongside varying levels of information-seeking behavior among users.

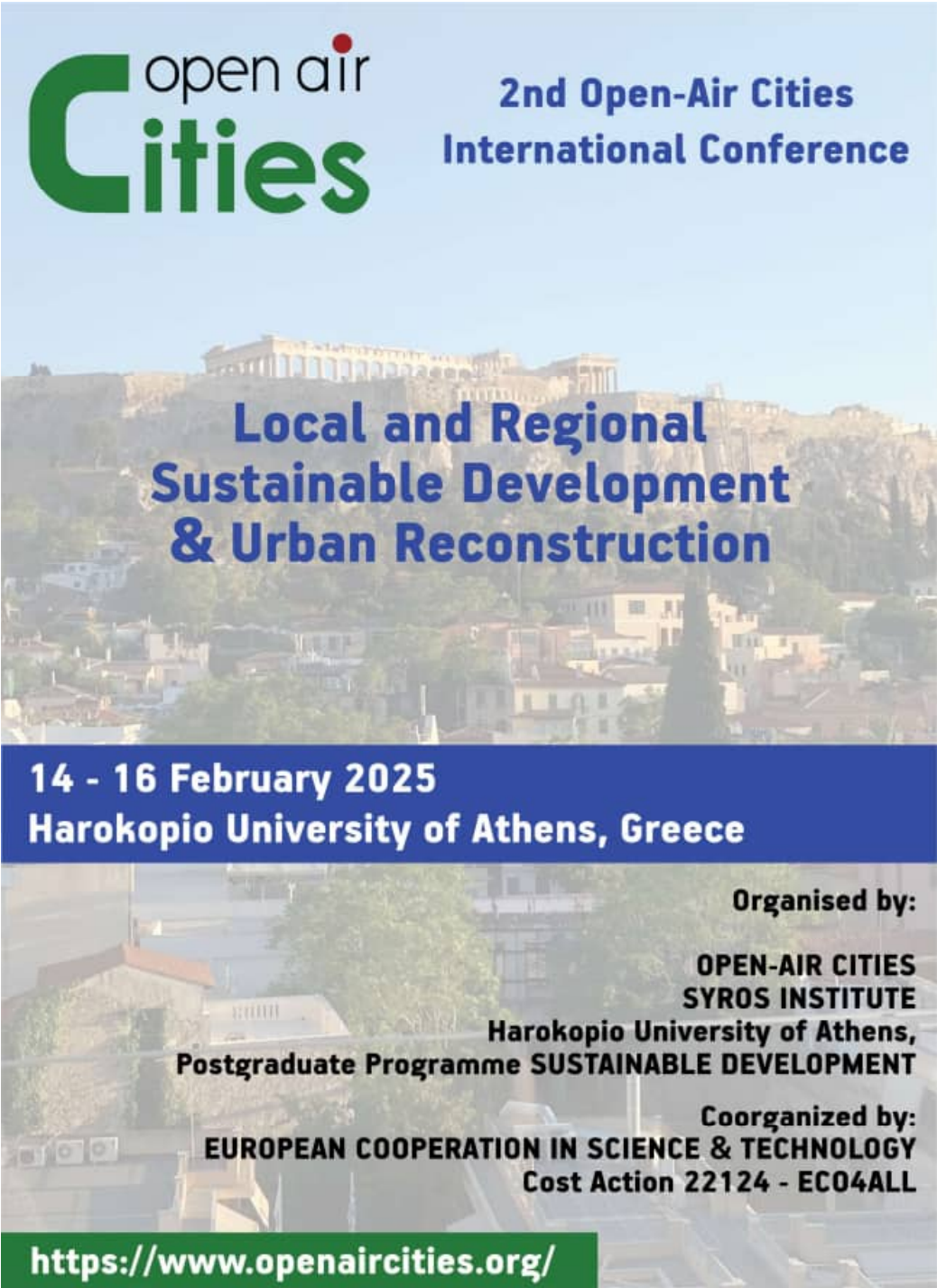
By addressing these challenges, this research contributes to the discourse on sustainable housing and energy use, offering valuable insights for policymakers, technology developers, and social scientists. It underscores the importance of inclusive, adaptive strategies to bridge social inequities and enhance the societal impact of smart housing solutions.

**Keywords:** smart housing, technology adoption, social inequality, energy efficiency, sustainable housing, open innovation, smart home technology

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Session:

**“The Physiognomy of cities”**

***Organized by Prof Joseph Stephanou***

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# URBAN LANDSCAPES OF SUSTAINABLE COEXISTENCE THE DIALECTICAL RELATIONSHIP BETWEEN THE TIMELESS AND EPHEMERAL CHARACTER OF A PLACE

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## Abstract

Usually, the term "sustainability" is related to the development of a place, with an ultimate goal the sustainability of that particular place.

In this case, we investigate **sustainability as the ability to withstand** the changes that arise in the cities' urban fabric, due to crises, violent and uncontrollable political, social and economic events (a war, a pandemic), natural or man-made environmental impacts, without excluding the ideology of the tourism industry as a driving economic force.

These changes and their effects concern both the material and the immaterial (psychological and symbolic) dimensions of the host places, as they are practically and experientially perceived by their permanent and occasional residents. We consider that these changes are related to the **Carrying Capacity of the Places and Landscapes**, resulted either from the settlement of refugees and immigrants around a first core, or from waves of tourists in buildings of the historic center, changing the original use. Therefore, the place acquires a **transit character** –a place of **temporary residence**.

The urban areas function as a "calm" & stable attractor, a limit cycle, the timeless limit of an archetypal urban landscape. The points of intersection, of the liminal circle, of a timeless urbanity, with the helical lines (arrivals and/or departures of immigrants, refugees, tourists), of an ephemeral residence, inside and outside the liminal circle, could illustrate the **dialectical relationship between the timeless and the ephemeral character of a place**.

These "reception enclaves" enable the exploration of spatial conditions for promoting communication and development through practices of lawfulness, justice and peace for the **sustainable coexistence of people**.

**Key words:** place, bearing capacity, attractor, timeless, ephemeral.

## INTRODUCTION

In the title of the present essay, "Urban Landscapes of Sustainable Coexistence," is understood as the presence of human beings in the same space for a specific period - a



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condition capable of developing relationships between them, which does not necessarily mean that those relationships are sustainable. We consider that the sustainability of a relationship **provides its members, beyond their survival, the ability to evolve or co-evolve**. Regarding the spatial level, the term "sustainability" is associated with the development of a place, aiming at the long-term sustainable development of that place.

In the subtitle, "The dialectical relationship between the timeless and ephemeral character of a Place," the question already arises concerning the **sustainability of coexistence** of permanent and occasional users of a place, both on physical and mental - psychological levels.

Therefore, as basic framework of this study we could set **"Sustainability as the ABILITY TO RESIST CHANGES that occur in existing spatial conditions, have a temporal duration, affect established ways of living, and are imprinted on urban tissue"** arising from:

- Unpredictable (uncontrollable and/or violent) events from exogenous factors.
- Natural and/or anthropogenic situations.
- Uncontrolled tourist development.

Despite the widespread opposite view that we live in a world of Euclidean regularity - a linear perception of cause and effect - we daily experience the consequences of multiple continuous changes, which make any certainty deceptive. Especially, when changes are large-scale and occur during periods of crisis, they leave a strong imprint on the structure and function of urban centers, as happened in Greece with the social, economic, political, and cultural crises of the last 20 years!

- The economic crisis, unemployment, poverty, and homelessness were imprinted in images of hopelessness, desolation, abandonment, and devaluation of the city itself.

- Due to unpredictable (uncontrollable and/or violent) events in their country, refugees and migrants were led to settle in some temporary structure (an open or closed shell) - a square or an initial core of residence.

- The excessive emphasis on tourism, the ease of "Airbnb," and the so-called "gentrification" - the "ennoblement" of buildings in the Historic Center and other urban areas<sup>86</sup> - created conditions for altering their physiognomy, oriented towards international aesthetic standards.

The impacts of these changes are imprinted both in material (measurable) and immaterial (psychological and symbolic) dimensions, as they are practically and experientially perceived by the regular/permanent or occasional users of the host places.

We argue that, under these conditions, the place loses its urban character and becomes a place of short or longer-term, but temporary stays and acquires transit characteristics - it becomes, now, a space of passage.

**A place of temporary stay is in complete contrast to urban areas** characterized by elements of stability, order, hierarchical organization, and measure, incorporating the condition of their founding act - **the initial conditions** - and functioning as a **"calm" stable attractor**, a limit circle, the timeless limit of an archetypal urban landscape.

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<sup>86</sup> Buildings, which with a change of use and the necessary architectural and aesthetic changes, become suitable as entertainment spaces and tourist accommodations.

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The points of intersection of the limit cycle of a timeless urbanity with the spiral line on the attractor (arrivals and/or departures of migrants, refugees, tourists) of temporary stay, inside and outside the limit cycle, could illustrate the dialectical relationship between the timeless and ephemeral character of a place.

The usual patterns of thought, in unprecedented conditions of unusual events, recycle the problem by creating limit cycles at the same level, while shades of doubt and uncertainty created at the bifurcation point may provide the solution at a new level of reference - a completely new perception<sup>87</sup>. Therefore, we consider that the multiplicity of conditions **requires a non-linear approach**.

Through this non-linear perception, we will attempt to approach **"Sustainability" as a relationship of limit cycles**.

The terms we have already used to describe these two conditions mainly come from the scientific field of Chaos Theory, Fractal Geometry, and Quantum Physics - a space where the primary tool is the computer, and the method is repetition, the feedback.

What is the relationship that this science of abstract fractal equations can have with the things we consider important in our world? Yet, the strange laws of Chaos are behind many (if not most) of these things: from weather prediction models and coastline measurements to the depiction of brain function, insect populations, and the tongue-twisters of children's games!

Even the origin and evolution of life itself are subject to the laws of chaos, which, however, create order, and that order disintegrates into chaos, and so on. Two aspects of the same Truth, whose **connecting link is Myth** and - for modern researchers - **the level of consciousness of the Observer**. A perspective that encourages researchers to shift "their attention from the quantitative features of dynamic systems to their qualitative properties."<sup>88</sup>

Therefore, the goal of this study is to establish **a theoretical framework**<sup>89</sup> for approaching the topic in terms of Modern Physics and Philosophy, to answer the question of whether and to what extent we can indeed attribute, by analogy, spatial changes resulting from the transformation of an urban place into a transit space to limit circle diagrams, and to what extent this change is imprinted on the urban landscape.

## THE THEORETICAL FRAMEWORK

"Creation takes place in the blurred dividing line between Order and Chaos. It is the region of boundaries, where Dionysus lives as Zagreus - the face of Order - and as Bacchus - the face of chaotic frenzy."<sup>90</sup>

## THE ATTRACTORS

For scientists/researchers, a phenomenon or a system has Order if its changes are explained based on the "cause-effect" scheme and can be described by a differential equation. In a

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<sup>87</sup> J. Briggs, F.D. Peat (1991) *«The disturbed mirror»* ed. Katoptro

<sup>88</sup> J. Briggs, F.D. Peat (1991) op. cit.

<sup>89</sup> We clarify that this presentation concerns a part of a broader, ongoing study reflected in the title and subtitle.

<sup>90</sup> J. Briggs, F.D. Peat (1991) op. cit.

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dynamically evolving system, which remains stable for some time, exhibiting a significant degree of Order, small changes at some critical point (of its evolution) can cause a large abrupt change - a discontinuity. An explosion, an earthquake, or a collapse from exceeding the breaking limit of structural materials, a critical population value for **the carrying (bearing) capacity**<sup>91</sup> of a place, which can rupture the social and urban tissue," and alter the expected outcome.

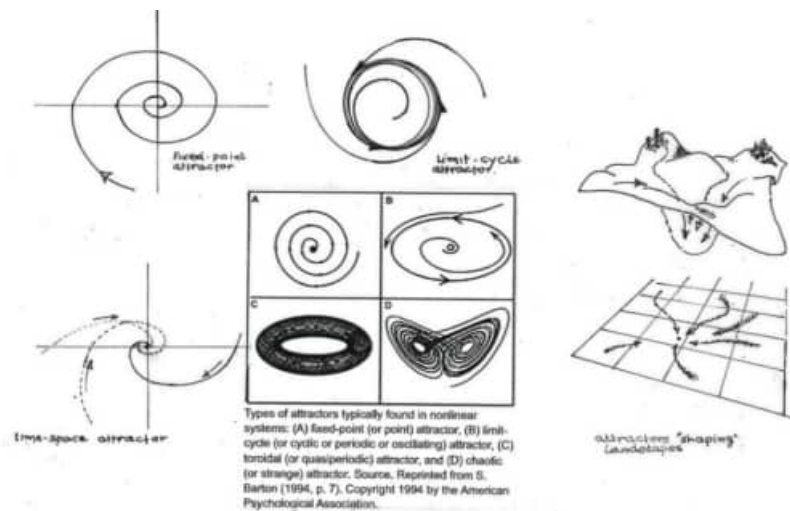


Fig. 1: Forming a limit cycle attractor (Drawings copied from the Greek edition of J. Briggs & F.D. Pit - book "The Terbulant mirror")

The mapping of an area or the recording of changes in graphical representations, in addition to geophysical and spatial planning information, can simultaneously indicate the "presence" of attractors<sup>92</sup>.

**An attractor (from the verb "to attract") is defined as a set of states towards which a system tends to evolve, starting from an (traceable or not) initial condition.** An attractor is a point or, depending on the scale, a structure, a place that attracts like a magnet, a movement, a state, or - by analogy - a behavior. Attraction to a point, in a primary condition of calm, presupposes a periodicity: the repetition of a movement, a state again and again.

A characteristic attractor is the pendulum, just as an attractor is a spatial system, e.g., a monument. If an additional push is applied to the pendulum (without friction) or, correspondingly, if the monument is charged - repeatedly - with mental-psychological energy and actions during anniversary ceremonies, then the movement is imprinted as a closed line perceived as a circle or ellipse in the **imaginary space of phases**<sup>93</sup> and is characterized as a limit circle, and the attractor -the pendulum or the monument - as a **limit cycle attractor**. (Fig. 1)

<sup>91</sup> Stefanou J, «*The Physiognomy of a Greek City*» NTUA - "The carrying capacity of a Place is its potential ability to cope with needs, requirements or pressures without affecting its cultural values, natural resources, and, in general, the possibility of its sustainability"

<sup>92</sup> J. Briggs, F.D. Peat, (1991) op. cit.

<sup>93</sup> J. Briggs, F.D. Peat, (1991) op. cit. The phase space is the recording, the graphical representation of the dynamics of changes—the ways in which a, naturally or violently changing, system moves and transforms. The phase space includes as many variables as required to describe the motion (position and velocity).

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The diagram that emerges in cases of spatial attractors illustrates the **map of evolution - the landmarks and time marks of the system within a condition of space - time - behavior.**

However, since we refer to "normal conditions," friction forces act, and the pendulum's oscillation diminishes, and the pendulum comes to rest at point O (zero). Exactly this is the concept of the "attractor," this **strong point** that attracts one or more trajectories and is called a **"stable point attractor."**

A stable point attractor can equally refer to the mapping of more limit cycles that describe elastic boundaries and record events (of order or chaos) in some area of the urban tissue. A Sacred Place is a strong point attractor. Also, limit cycles are formed around some spatial element/reference point or from a use, or from a wider area of special interest, in various temporal phases or states of the system<sup>94</sup>.

The limit cycles formed at intervals of various temporal phases create relationships of **contact, coupling, superposition, intersection, etc.**, and imprint the **dynamic stability** of a calm development or a strong founding act or the change caused by a new – extreme - event that creates a new limit circle which disrupts the stability of the original one.

The stability of a system, achieved over time and having duration and order, already bears unstable states of dispersion and chaos. When a seemingly insignificant event ruptures the limit cycle, causing new circles that intersect the limit cycle and are simultaneously attracted by the original attractor. After some disturbances and repetitions, the system returns to an initial (almost) normality.

Considering that the way we perceive the results of changes depends on the observer's level of consciousness - if we wish to approach the concept of **the Attractor more philosophically - we could consider that it pertains to the deeper purpose of our lives: What draws us towards a direction, our Virtue, what inspires us, suits us, what we ultimately ARE.**

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<sup>94</sup>We clarify that during the coupling of systems, some of them are linear (e.g., a significant landmark/monument). Their coupling with a non-linear system (e.g., arrival/departure of tourists) makes the whole NON-linear.

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The phase space (where each "phase" is understood as a way of life and a state of space, time, and behavior, imprinted in a limit cycle), within which overlapping circles are mapped from the interaction of different systems around a point of attraction, creates a shape

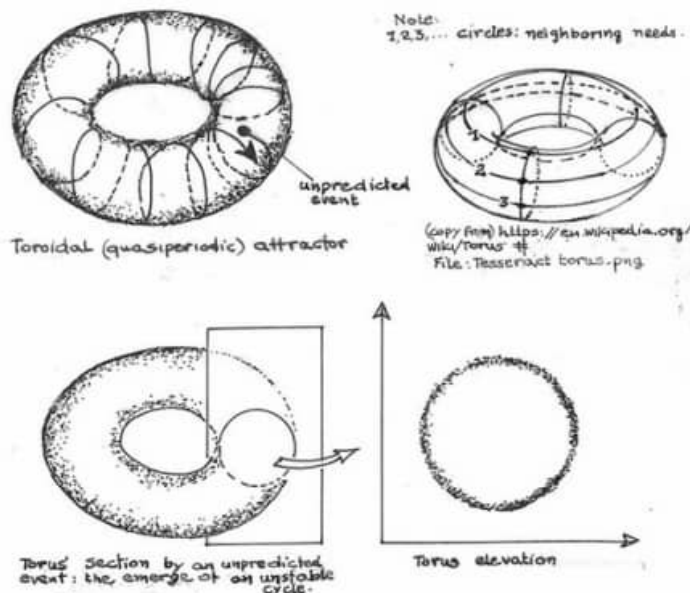


Fig. 2: Torodial & strange attractor (Drawings copied from the Greek edition of J. Briggs & F.D. Pit - book "The Turbulent mirror")

**neighboring needs**<sup>95</sup> consists of overlapping limit cycles of mythological, historical, functional, administrative boundaries, etc., as well as elements of individual, collective, and overall perception of the place and the landscape. From these, a common boundary<sup>96</sup> emerges, **a calm, stable attractor** that imprints the character of the place and the physiognomy<sup>97</sup> of the broader area - the neighborhood.

If a section is made in the torus of a system (historically, spatially, temporally, psychologically, urbanistically, socio-politically, and culturally established) by an event that threatens and ultimately may shatter the existing structure of the attractor, then we are faced with a critical turning point of the **Carrying Capacity of the Place and, by extension, the landscape.**

resembling a "donut", a "torus", which in turn transforms into a **"toroidal attractor."** (fig. 2)

If a new system "meets" the torus - either randomly or intentionally - even if we do not have sufficient information about it—"it will move spirally somewhere on the surface of the torus and will not wander randomly in the phase space... and the ends of its trajectory will never coincide" (J. Briggs, F.D. Peat 1991, pp. 42-43).

Does this mean that this system will never be able to fully integrate into the torus system and synchronize with it?

Example:

**Victoria Square** functions as a strong attractor for the surrounding neighborhoods, and the torus formed by the

<sup>95</sup>Petratou S. (1978), "The Neighborhood" NTUA, Chair of Urban Planning, Lecture - Neighboring needs are: Survival. Security. The familiar / Certainty. Education / Work. Identification. Projection. Communication. Transcendence: Religion and Art.

<sup>96</sup>Petratou S. (1979), "Looking for the Neighborhood in the Urban Environment" NTUA, Chair of Urban Planning, Diploma Thesis.

<sup>97</sup> Stefanou I. (1998) "The Physiognomy of the Greek City," NTUA, Laboratory of Urban Composition



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"When instability - e.g., an economic crisis - reaches a critical point, the social system either collapses or transforms into a new state of dynamic stability. These critical 'turning points', the intersection that determines the cultural Carrying Capacity of societies, places, and landscapes, lead the dominant system to disintegration or - as Ervin Laszlo characterizes it - to a phase of macro-transformation (change), where the system will be forced **to branch out, to bifurcate**<sup>98</sup> and either collapse or manage to fulfill its cultural role. (fig. 3)

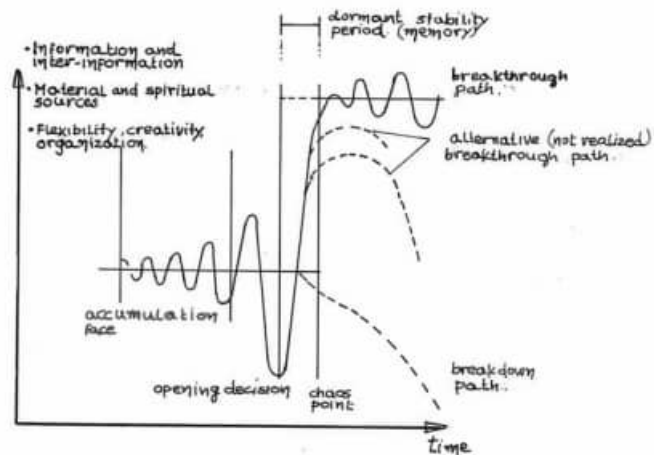


Fig. 3: Basic branching - bifurcation (Drawings copied from the Greek edition of Laszlo's book "Quantum shift in the Global Brain", 2008)

Successive repetitions of events (e.g., the repeated "emptying" of refugees in Victoria Square in 2020, 2023) feed successive bifurcations towards chaos, which, however, **in the midst of a random fluctuation, appear as periods of stability and predictability, an archive -an almost "living" MEMORY** that, in non-linear complex systems of space -time - behavior, concerns:

- The primary point attractor, the founding act.
- The initial limit circle, the archetypal circle.
- The individual attractors that compose the system, the torus.
- The **bifurcation points at the intersections of the torus** and the limit circle of the event.

**The emerging memory shows that in a system, the entire field of change, the inherent order, may be present.**

We have already considered that an area, **the place of a neighborhood**, is a complex attractor of space, time, and behaviors, a torus that has emerged from **forms of relationships** with other accompanying limit cycles. If the torus intersects with the limit cycle of a random or intentional event (e.g., refugees in Victoria Square), the conditions for one or more branching are created, depending on which of the torus's limit cycles (e.g., "historical elements") the limit cycle or the event's spiral intersects. We observe that:

The event intersects the torus in the shape of an open circle, or ellipse, or spiral, and the points of intersection mainly **concern temporality, thus the enduring or ephemeral character of the results of the intersection - the transit element of the research**. It therefore intersects the limit circles that concern "daily" actions, such as residence, dining, movements, commerce, policing, relations with neighbors, etc. Simultaneously, the overall

<sup>98</sup> From chat GPT online site. The term bifurcation is used to describe the point where a system suddenly changes behavior, as if branching into new states. This usually happens when a parameter of the system passes a critical point. Then a "change of course" occurs. We consider that the idea of bifurcation (branching) can be better symbolized by the Greek letter "Y" - a mystic sign of the Orphic - Pythagorean philosophy.



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experience of the past, individual and collective, is transferred **to every present moment** and emerges in the dynamics of the new system! (see fig. 2)

### SELF - SIMILARITY - SELF-REFERENCE

Understanding **the memory** inherent in the process of change leads us to investigate two strange - almost metaphysical - concepts that originate from Chaos Theory and Fractal mathematics. These are **Self-Similarity and Self-Reference**<sup>99</sup>.

**Self-Similarity** is defined as the ability to "see the image of the whole in a region, in a part of it", a property of Fractals, which could analogically be transferred to the field under investigation. The word itself means "similar to itself" and could be traced back to the analogous similarity to the **Archetypal Idea of Platonic philosophy** or - based on Chaos



*Fig. 4:  
Cycladic clay  
pan-shaped*

Theory - to **the detection of the system's unique characteristics in its initial conditions.**

Therefore, the change resulting from any section of the torus by the limit cycle of the event now concerns the overall and collective perception that could emerge from the **image of a complex landscape - a new condition of space, time, and behaviors.**

In direct correlation with self-similarity is Self-Reference, a concept based on the repetitiveness of a process that is perceived at small, even very small scales. Where repetition (or feedback) involves the continuous feedback (and folding of results) of the initial system.

Self-Reference, which is lost behind the glamour of self-similarity, lies at the root of the most unexpected everyday applications and situations. We could call it **"Repetitive Magic"**<sup>100</sup> as it appears almost everywhere:

- In weather systems.
- In the toilet flush, the flutter.
- In phrases - tongue twisters.
- In the froth of Greek coffee.
- In Cycladic clay pan-shaped vessels. (fig. 4)
- In the prayer of the hesychasts of Mount Athos, in the mantras of the Hindus, in the koans of Zen Buddhism.

**Mainly, however, Self-Reference appears in Mythology: where every tragedy requires "imitation of a serious and complete action" again and again until the heroes are led to the "catharsis of these passions."**

And in Oedipus, the question is posed again and again: "What is human being?"

Self-Similarity and Self-Reference show us the **change of a system that owes its stability, not to some permanent or static quantity, but to a dynamic, circulating quality or to some repetitive process that aims at the transition from one state to another.**

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<sup>99</sup> Basios V. and Adamopoulos I. (1992), "Introduction to the World of Fractals," 2nd edition, ed. Anubis and Cleick J. (1990), "Chaos, A New Science" ed. Katoptro.

<sup>100</sup> J. Briggs, F.D. Peat (1991), op. cit.

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### TIME AND THE LOST INFORMATION

We often perceive that "the game is played in the cracks." Symbolically, this is where **"lost information"**<sup>101</sup> escapes – those subtle, imperceptible clues about initial conditions. In reality, the information is "lost" from the framework of my space and time, that is, **the way I feel and think each time, the way I try to represent the (my) World**. Alternatively, to be more specific, information is not "lost", but "camouflaged," remaining visible in **the energetic ocean of the Aether**<sup>102</sup> (per the Orphics, Pherecydes, Pythagoras) or the **Akashic Field**<sup>103</sup> (per Taoism, Zen Buddhism, and modern physicists like Ervin Laszlo and Fritjof Capra). It emerges as a THOUGHT from this ocean of information.

"Thoughts don't just unfold as causal chains but arise from the information ocean as self-organizing potentials", but they emerge from the ocean of information as requested for self-organized order.

#### **Could this be a path to observer self-knowledge?**

Even city development stems from self-organized structures, where **all growth information pre-exists in the Place's Aetheric Field**. Among permanent/temporary residents (refugees, migrants, tourists) in a city's torus, seemingly random behaviors reveal:

"The concept of communication/information is deeply tied to how random behavior leads to complex feedback coupling and spontaneous order<sup>104</sup>".

Thus, information about a Place's founding (initial conditions) and evolution connects to random/intentional user behaviors, mentally – psychologically coupled with **the Place's temporal continuum**.

"Time isn't 'something'... it only exists as a mental human construct. Time is a sensation and concept: It is a Human Time" (Tabakis 2012).  
It is the time for **Maturity of Conditions** required.

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<sup>101</sup> J. Briggs, F.D. Peat (1991), op. cit. and Cleick J. (1990), op. cit.

<sup>102</sup> Petratos-Fragkiadaki S. (2013), *"Therapeutic Places"*, Sustainable Development Journal: Culture-Traditions, vol.1, "The world, filled with forms, is structured through the coexistence, interaction, and analogous blending of four elements: earth, water, air, fire, and a fifth - the Aether. Every form's manifestation from its Ideal concept to its realization (materialization) level, requires the presents of an activating element, that vitalizes and correlates forms to each other, an etheric "substance": Aether is the shining air. The very element that philosopher Pherecydes describes as a dynamic field of the Wholeness. This energetic element vitalizes matter and correlates forms across material, psychic/intellectual, and spiritual levels, given that 'every form contains part of all other forms'."

<sup>103</sup> Dr. Laszlo Ervin, (2006). *"The New Science and the Akashic Field"*, Archetype Publ. - "The Akashic Field: The concept that information exists throughout nature... is new to Western science. It recognizes information not as abstract but as 'inter-information' with its own reality. Since it permeates nature, we should conceptualize it as an extended field." (p.67)

<sup>104</sup> J. Briggs, F.D. Peat. (1991) op. cit.

## THE PHYSIOGNOMY OF A PLACE: THE PART IS THE WHOLE

Despite the fact that modern physics deals with abstract conditions of space and time, we believe that we can proceed with an analogous application at the level of neighborhood / broader area / city and approach **the changes in the landscape of the "strange attractor" in terms of "place physiognomy"** as established by J. Stefanou, of **the Place considered as an ENTITY**<sup>105</sup>. We refer to the changes that occur in the urban tissue of cities and their impacts, which concern both the material and immaterial (psychological and symbolic) dimensions / properties of host places that acquire a **transit character** - becoming spaces of passage and/or temporary stay.

We will therefore seek the **changes in spatial forms**, as they are evolutionarily imprinted, **through the recording of ways of appropriating space**, both by permanent and occasional users in the various phases of changes (time and condition).

We have already mentioned how vital it is for a system to have periods of stability where MEMORY is involved, which originated from a critical event in a place, at a nodal point. Then, the system is forced to branch out, and either it will collapse (if it does not have sufficient energy), **or it will adapt to a new cultural role**.

The bifurcation points are **landmarks (time marks and place marks)** in the evolution of a system and crystallize its history: they determine **the RELATION** between the elements of the system and the events of the branching and **give the place a psychological and material shape**. The perception of this shape, this form, this image is the landscape.

Benoit Mandelbrot, wanting to emphasize **the role of the observer as consciousness and as position**, introduced qualitative measures (magnitudes), the **"active dimensions"**<sup>106</sup> of dynamic systems versus quantitative magnitudes. We believe that the analogy holds for all scales, from a piece of furniture to a city, through the repetition of **a module**, a measure<sup>107</sup> - the human as body and spirit, or a simple geometric ratio of (meta)formation, or a structural model. What is the module: We consider it the initial condition, the cause, the analogy, the absolutely necessary, the Archetype, the Logos of Existence.

In anonymous traditional settlements, it was a **minimal structural unit**, the hut, the single-room dwelling - a prototype, the repetition of which - based on a free synthetic

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<sup>105</sup> Stefanou J. (1998) op. cit. – "As a Place, it is understood as an open system of elements of space, time, and behaviors, which concern individual or collective expressions and are observed in action, movement, or stance. The specific—experientially—space is constituted by the set of unique characteristics of the forms that fill it and give it the substance of being. And the place as BEING has a physiognomy. The Physiognomy concerns the uniqueness, the identity—the personality—ultimately, of a place, as it is formulated and manifested through the characteristics of its landscape."

<sup>106</sup> J. Briggs, F.D. Peat, (1991) op. cit. - Benoit Mandelbrot believes that the dimensions of an object depend on the RELATIONSHIP between the object and the observer. E.g., what dimension does a ball of yarn have? Zero? Three-dimensional? One-dimensional? Flat? Multi-dimensional?

<sup>107</sup> Michelis, P. (1973). *"Architecture as Art"*, ed., Panagiotis and Efi Michelis Foundation, 4th ed. "The judgment of every architectural work is based on three measures: the external, which defines the scale of the work, the internal, which defines its rule, and the absolute, which defines its reason".

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principle - gave complex forms of buildings and residential complexes, functionally and aesthetically uncompromised, from the microscopic (e.g., the traditional oven) to the macroscopic scale (e.g., the entire settlement). Everything bears the unique characteristics of its synthetic minimal module, emphatically confirming that: **THE PART IS THE WHOLE** and the physiognomy of the Place is imprinted everywhere!

## THE INTER-INFORMATION

Like other sacred stones, the Omphalos of Delphi was symbolically depicted on a marble phallic column, on the surface of which spreads the "**argenon**"<sup>108</sup> a relief complex of threads and knots. The argenon was also the mantle that the oracle wore.

Or, to use terms from modern Physics, the argenon could be considered a (quantum) **dynamic field**, an environment, where any change in a knot or thread, no matter how insignificant, "informs" and affects all the others. In other words, behind "reality," as we perceive it, there is not only matter and energy but also a more subtle, yet equally fundamental factor: the "formative information" or "**inter-information**." This dynamic, diachronic, and inter-place information, Archetypes, and Symbols constitute the background of communication among peoples and cultures. They are the decorative patterns that adorn the Sanctuaries and Altars of the Celts, dating back to the Stone Age, as well as the spirals on the clay pan-shaped vessels of Cyclades.

According to Jung, these patterns are Archetypes - universal structures in the collective unconscious of Humanity - **the deep wisdom of our common language**.

"Some images and ideas - universal symbols and archetypes - appear and reappear in the culture of all civilizations, modern and ancient, regardless of whether their peoples communicated or even knew of each other's existence" (Laszlo, 2006, p. 50).

**But what is inter-information**<sup>109</sup>?

"It is a subtle, semi-instantaneous, non-transient, and non-energetic **connection between things located in different positions in space and events occurring at different moments in time**. Such connections are called 'non-local' in the physical sciences and 'interpersonal' in consciousness research. This formative information is not information in the scientific or current definition of the term. 'Active information - in the sense of knowledge about things and events - can be transmitted through inter-information' (Laszlo, 2006, p. 67), **in a vacuum**,

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<sup>108</sup> Encyclopedia "*Papyrus-Larous-Britannica*" entry argenon or argenon. R. agra > pursuit / capture of prey / pursuit / persistent search > Zagreus Dionysus.

<sup>109</sup> Dr. Laszlo, Ervin (2006). "*The New Science and the Akashic Field*," ed. Archetype.

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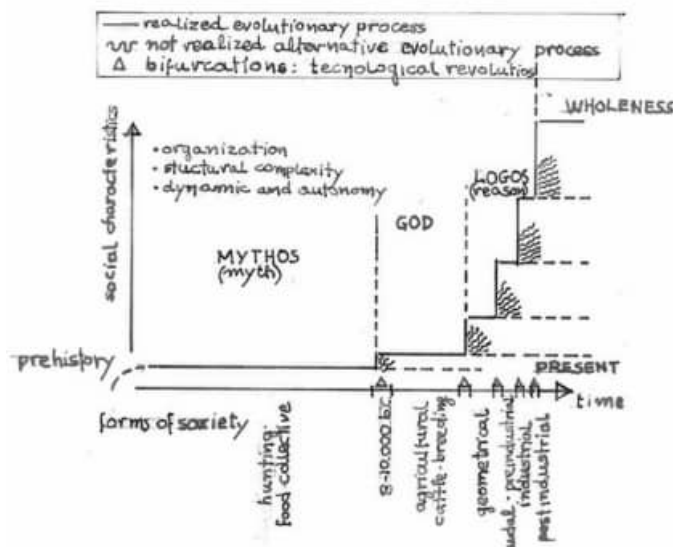


Fig. 5: Main cultural characteristics of old civilizations and the challenge of a new culture able to lead towards a universal civilization (Drawings copied from the Greek edition of Laslo's book "Quantum shift in the Global Brain", 2008)

### Coincidence: Being and Becoming.

By analogy, concerning human groups, societies, cultures, their evolution, more than from violent competition, emerged from **cooperation and the way they self-organize and mature as cultures and CO-EVOLVE** <sup>111</sup>. (fig. 5)

Could we, perhaps, claim something similar for **the different cultures/backgrounds of events** that fix their phases - their time marks - within the framework of the material reality of a (peaceful or violent) temporary installation/integration, in a reception enclaves? We believe that a process of coexistence/integration is already imprinted (as intention and as possibility) in the Aetheric field, as a synchronization of vibrations - the unique oscillation of the individual systems.

We refer, on the one hand, to the Aetheric of the Place (of reception), as it is shaped by its natural and anthropogenic elements, the mythology and historical events that have marked it,

a dynamic physical void, the Quantum Void, which is essentially a Cosmic Fullness, the amorphous "Aetheras" of Pherecydes, the matrix of all Forms, the Platonic Chora: The Quantum Field<sup>110</sup>. And in consciousness research, we perceive inter-information as 'transference,' as 'sensitivity,' as 'receptivity'.

However, although **the world exists because there is coherence** (and not necessarily "logical" consistency and temporal "sequence"), **evolution occurs mainly thanks to synchronicity**. Events that do not seem to have a causal relationship appear and contribute to the bifurcation points, where, although the relationship has been forgotten they essentially embody the primordial memory of their creation in the traces from the initial conditions - **the Root of**

<sup>110</sup> Capra, Fritjof, (1982). "The Tao and Physics," ed. Aurora. - The quantum field is recognized as a fundamental physical entity. A continuous medium that is present everywhere within space, where particles (of matter) are considered as local concentrations of the field, accumulations of energy, which from a certain point onwards lose their "personal" character and dissolve into the unified and omnipresent field. Einstein says about this: "Thus we are forced to consider matter as a composition of regions of space where the field appears with a particular intensity... In this new kind of physics, there is no place for the field and matter. The only reality is the field."

<sup>111</sup> J. Briggs, F.D. Peat, (1991). op. cit.



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the works of its inhabitants, and the thoughts, emotions, and dreams with which people invest this Place.

And on the other hand, to the individual and collective Aetheric of the temporary visitors, which is disturbed by the anxiety of survival and the fear of the unknown or the expectation of "live your Myth" and collides or simply meets with the Aetheric of the Place.

## THE APPROPRIATION OF SPACE

Henri Lefebvre, in his seminal work "The Right to the City," focuses his attention **on relational approaches to diversity**<sup>112</sup>. Where, as agents of change in the urban pattern, he sees not only the working class but also migrants (in this case, also the refugees), who, through elementary, even, practices of transformation and appropriation of space, attempt to confront their alienation from it, with the hope of an expanded perception of social justice that recognizes the right to preserve their ethno-cultural differences. Is this right - the philosophical stake of Henri Lefebvre - a characteristic of a transit place?

"Genuine urbanity, the essential society of the city, is a society of continuous construction of otherness, a struggle between the potential and the existing, imagination and daily routine, through practices of space appropriation and forms of (self)management (of material and intangible resources)<sup>113</sup>."

A potential possibility of "BELONGING."

The temporary presence of migrants/refugees in public spaces constitutes the cornerstone of their survival within the urban tissue. The public character of a square makes it a fundamental place that functions as a survival refuge and a space of self-protection - especially under conditions of homelessness<sup>114</sup>. **And despite the lack or prohibition of access to rights and goods, the way they appropriate the space makes the square a creator of new social dynamics.**

Therefore, by giving more emphasis on human activities and not on reactions to environmental stimuli, the understanding of the environment's impact is achieved by highlighting the processes that occur "through" the individual - the distinction between the natural and psychological views of reality. Just as in physics, the natural or anthropogenic environment, a discrete element of spatial dimension, **a quantum of space**, is always present<sup>115</sup>. We believe that we can correlate the quanta of space with the active dimensions of a minimal structural unit - **a repeated module**.

Example: a quantum of space in Victoria Square could be a bench! Potentially, then, spaces - the environment, are considered as primary elements for understanding the actions that people "place" in it: the setting of a role, rules, and codes.

The use of space by individuals or groups means that (mainly permanent users) through codes of common perceptual systems and similar experiences - "stable space codes" - **have**

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<sup>112</sup> Arapoglou, V. (2013) *"Theory Travels to Cities."* - European Urban and Regional Studies.

<sup>113</sup> In parentheses, the interpretation of the author.

<sup>114</sup> <https://www.lifo.gr>, Ervin Sehu "The Migrant in the Square" article, LIFO 20/04/2023.

<sup>115</sup> Canter, D.,(1988). *"Environmental Psychology,"* ed. University Studio Press.



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**some sense of the prototype of activities** which, as expected actions/behaviors, are anticipated in this place.

Therefore, the way the environment is perceived and the use of space by occasional users, even if it gives it a transit character, presupposes the establishment of some behavioral rules, aiming at temporary or occasional **harmonious coexistence**, which is influenced by the roles that, intentionally or inductively, both permanent and occasional users serve in this place.

In conclusion, public spaces (streets, squares, designed communal spaces, groves, etc.) are transformed, changed, and evolved by the action and presence of "**strangers**", but also by the dynamics that arise from their relationship with the local society, determining the terms of inclusion in the urban fabric and the life of the city: a difficult and sometimes catalytic process. An extreme, perhaps, example, but indicative of the catalysis of the urbanity<sup>116</sup>. of Victoria Square is the "installation" of the refugees under unimaginable living conditions: sometimes the planting beds were turned into toilets.

How do we define "urbanity":

**Urbanity is the unique characteristic of the Urban Landscape, which is imprinted in the Mythical Analogy, the Logical Consistency, and the Internal Harmony and Order of the Place - the City.**

**It is detected**

- In the Name, the Monuments, and the History of the city.
- In the coherence of structures and the continuity of the urban fabric, i.e., in the existence of networks.
- In the positions, scales, sizes of forms (open and closed shells) and their interconnections, which shape natural, functional, cultural, psychological, and mental boundaries and limit circles.
- In the accesses, movements, distances.
- In the city center (core) and the individual centralities and their radii of influence.
- In the landmarks, time marks, and events, as well as the happenings in the present.
- In the hidden dimensions of the city - of the Place, the materials, the smells, the tastes, and the sounds.
- In the totality, the fullness, and the dynamic of change of a living organism.
- In the realization of Self-Similarity and Self-Reference of the whole to the initial condition, the Archetypal Module.
- In the functional coverage of the Needs of the user, at the level of Justice, Goodness, Beauty, in other words, at the level of culture.

**It is recognized** in other formal units - individual landscapes.

**It creates relationships** of coupling or disjunction with the individual landscapes, with the broader natural environment, with other forms of use.

As an example, we would say that the urban character of Victoria Square<sup>117</sup> is imprinted

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<sup>116</sup> Petratou-Fragkiadaki S. (2019), "*Exploring the Natural and Anthropogenic Conditions of Maturation of the Three Great Civilizations of Syros*", 9<sup>th</sup> Interuniversity Seminar on Sustainable Development of Culture and Tradition. Syros Institute.

<sup>117</sup> [https://el.wikipedia.org/w/index.php?title=Victoria\\_Square\\_\(Athens\)&oldid=10518999](https://el.wikipedia.org/w/index.php?title=Victoria_Square_(Athens)&oldid=10518999)

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- In the name and historical elements, in its location - a strong landmark of the urban tissue - and its relationship with the nearest significant landmarks and their radii of influence.
- In its quintessential unique characteristic of recreation/entertainment, surrounded by coupled forms of use (residence, education, dining, commerce, etc.) and the limit cycles of their functions.
- In the neoclassical buildings and the buildings of notable architecture that frame it and in the design of the square, whose significance is reinforced by the significant sculptural complex "Theseus Rescuing Hippodameia."

All these make Victoria Square an urban landscape with elements of romanticism, characterized by the participation in the form of this place of a series of **psychometric magnitudes**<sup>118</sup> (such as the force of imposition, recognizability, the possibility of orientation) which are carried as denotes in specific forms and functions of the square and **determine the degree of space appropriation** by the permanent users: (fig. 6)



Fig. 6: Victoria square. The Statue of Theseus rescuing Hippodameia



The Refuges ('20-'23)



This place **holds a position** (ideological, mental - psychological, metric) within the urban tissue of Athens. What happens when it is transformed into a transit space?

But what about the occasional users of a reception enclaves - the square, in this case? Seeking "a place in the Sun" and, perhaps not a site in the place? **How is their relationship with the Place determined? In what way can a degree of space appropriation be achieved** in unbalanced living conditions, in a state of uncertainty and expectation, under conditions of space, time, and behavior pressure, within a framework of limited freedom?

The physiognomy of a Place - an entity - is expressed through the characteristics of its landscape and is specified as a formal unit, articulating an aesthetic judgment.

**Given that the physiognomy of a Place is a fundamental cultural value, we believe that its preservation pertains to the Carrying Capacity of that Place**, in terms of utility, suitability, significance, connection with other forms and uses, organization, and order, both in terms of utility and temporality. The question arises as to how the physiognomy of a Place is affected when, for some (limited or longer) period of time, it acquires transit characteristics.

In this context, reception enclaves (as islands) may be indicative of their carrying capacity, especially with emphasis on the temporality that derives from the differentiation of the characteristics of a place that, for some time, acquires a transit use - it acquires a transit property.

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<sup>118</sup>Stefanou, J. (1984), "Notes on Urban Composition – Urban Approach," NTUA Chair of Urban Planning A'.

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"The Carrying Capacity of a Place at the physical level is quantitative and measurable. However, concerning the ideological and psychological level, any counter-text (human presence, natural or anthropogenized elements, or constructions) placed in an area - a Place, changes the Carrying Capacity because it changes the conditions for the development of the Myth, which is usually interwoven with the Place," says J. Stefanou<sup>119</sup>.

And such an intervention (placement) obviously differentiates the initial formal unity, which could be a torus of properties, a set of limit cycles of functions, forms, and uses. The presence of a limit cycle arising from an event of a "foreign" element intersects the torus, creating relationships of analogy, coupling, or disjunction, coordination, and finding a rhythm of coexistence through the **maturation of conditions of ethical, logical, and emotional order**. (fig. 7,8,9)

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<sup>119</sup>Stefanou, J. (2004), "*Anthropological Approaches to the City*" Postgraduate Program, Winter Semester. "The development of a Place aiming at its sustainability (and its evolution at the level of collective consciousness) is related to the teleological substance of space (the initial condition), which determines the Carrying Capacity—the Response of the Place to the Receptivity of the users," says Joseph Stefanou. (8/11/2004. Notes from the lecture and the parentheses, by the author).



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Fig. 7: The neighborhood around Victoria square. Kids, 11y.o. (Petratou S. (1979) "Searching



Fig. 8: The neighborhood around Victoria square. Girls, 15y.o. (Petratou S. (1979)



Fig. 9: The neighborhood around Victoria square. Adults (Petratou S. (1979) "Searching for

Interventions arising from a perhaps completely different cultural condition could be assimilated through neighboring relationships in an effort to find **a commonly accepted way of appropriating space<sup>120</sup>** and **a sustainable rhythm of life**, in which time has the first say, because "people and societies seem to be 'nailed' to a very different sense of time" than that of clock time<sup>121</sup>.

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<sup>120</sup> Stefanou J. (1984), "Notes on Urban Composition – Urban Approach," NTUA Chair of Urban Planning A'.

<sup>121</sup> J. Briggs, F.D. Peat op. cit.

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In our view, the coordination of these different systems is a matter of synchronicity<sup>122</sup>: when events that occur simultaneously or almost simultaneously and seem to be experientially, meaningfully, or symbolically related to each other converge in a specific place, without any causal relationship." But how?

The answer, we argue, lies in the transformation that occurs when a random behavior becomes collective. When, that is, a strong Need arises, such as that of Neighboring. Here, my place - the "unfamiliar" for the refugee, the migrant, the tourist - becomes OUR PLACE, and my time - the difficult time of the other - becomes OUR TIME, the chronical we will write together. **When a psycho-intellectual and practical approach is achieved so that the ephemeral and the enduring meet dialectically and are experienced individually and collectively, then chaos transforms into a sustainable OPPORTUNITY, and the urban landscape of the reception pocket acquires a new aesthetic character.**

## THE MATURITY OF CONDITIONS

This practical and mental - psychological approach means a mature, open communication between permanent and temporary residents, a maturation of coexistence conditions with terms of Justice (Dike), Good Governance (Eunomia), Peace - names of the Hours<sup>123</sup> of the deities who oversee human works.

**Dike (Justice).** It is Justice, the higher moral order, the evaluation of individual and collective actions. Above all, it is the right to life, not only as survival but as the possibility of transcendence. It is expressed through mutual respect for the rights of permanent and temporary residents entry Horai < hora – hours The Horai in Mythology. Daughters of Zeus and Themis, goddess of justice, Deities of moral order, protectors of the hours, seasons, the maturity of fruits, the beauty of Nature. Their responsibilities included guarding the Gates of Heaven and Olympus, but also the Gates of Hades. They impose justice and equality among people, but mainly they are responsible for overseeing human works.

**Eunomia (Good Governance).** It is legality, good governance, alignment with the natural law, coordination with the Aetheric field of the place. It is integration into the existing social framework. Respect and preservation of customs, traditions, and elements of tangible and intangible cultural heritage.

**Peace.** To live without violence, without haste, following the rhythm that arises from trust in the vibration of the present moment, the condition of coexistence of all these people. It is the deep sense of security and certainty that good neighboring within reception pockets could ensure.

A conscious - social networking that practically, mentally-psychologically, symbolically, and spiritually creates structures at the level of neighborhood, broader area, city. A network - a mantle of protection and inter-information. However difficult it may seem to understand this in the scales and times of everyday life, we live in a world of imperceptible indeterminacy, where the observer's level of consciousness plays a major role in its perception.

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<sup>122</sup> Term introduced by C.G. Jung

<sup>123</sup> Petratou-Fragkiadaki Smaragda "Exploring the natural and anthropogenic conditions of maturation of the three great civilizations of Syros" Syros Institute, 11th Seminar

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Einstein<sup>124</sup> had said that "space and time are not absolute conditions" to conclude that "within the 'material frameworks,' each 'observer' defines - individually and collectively - their own place and time." Their own place and era. And we have already mentioned that the time during which an event unfolds seems to have greater significance than the spatial framework. We could refer to something similar for the different cultures/backgrounds of events that fix their phases, their time marks within the framework of material reality - the reception pockets in this case. The process of coexistence/integration, we believe, is imprinted, potentially outside place and time, in the Aetheric field as a synchronization of vibrations - the unique oscillation of the individual systems.

If we project the points of intersection or interaction of the limit circles of two or more systems into two or more different frames of reference, we approach what Arthur Koestler, in his classic work "The Act of Creation," characterizes as "bisociation"<sup>125</sup>. Under the influence of an insignificant event or "a lost piece of information," the line formed by these points, as part of a new limit circle, branches out as a new way of thinking<sup>126</sup> at a new level of reference, where an identical and simultaneously different landscape is mapped. (Fig. 10)

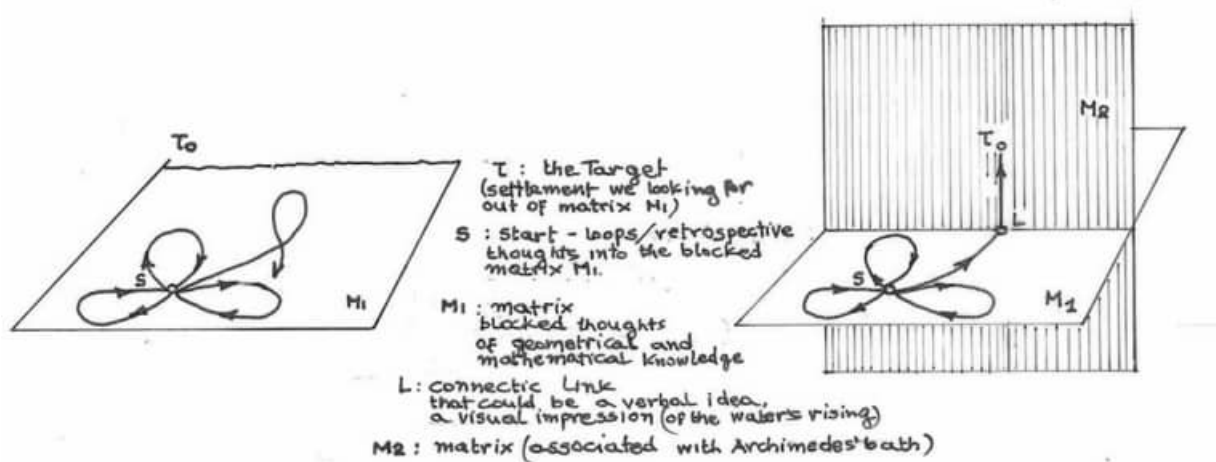


Fig. 10: The mechanism of bisociation

Taking as a model the event that made Archimedes exclaim "Eureka!" Arthur Koestler writes: "It has been said that a new idea, a discovery consists in the revelation of an analogy that no one else had seen before." A discovery breaks down the rigid patterns of a mental structure to achieve a new synthesis. A blocked access to the goal, and every thought revolves around it - returns again and again to the starting point.

In the case of the coupling of two levels of reference<sup>127</sup> - bisociation of two matrices, as Koestler calls it - the process that led to the formulation of his principle is analyzed:

<sup>124</sup> J. Briggs, F.D. Peat op. cit.

<sup>125</sup> Koestler Arthur "The act of creation," ed. Chatzinikoli 1976

<sup>126</sup> Petratou-Fragkiadaki S. (2019), "From Hermes, to Hermou" Syros Institute (SDCT journal, vol.1A 2019)

<sup>127</sup> simplified for understanding



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Archimedes knew from the beginning that when immersed in his bath, the water level rises accordingly, yet, until then, he had not consciously formulated it within himself.

The bisociation resulted in the discovery of the hidden rules governing the two different systems (matrices) concerning the "golden crown" system and the "bath, water level rise" system or "the lost information". Luck, insight, and the sudden illumination of a long unconscious process provided the connecting link created by the line of the limit circle that "escaped" from the pull of feedback to meet a completely different matrix, which "falls" vertically onto the blocked problem of the horizontal plane. Just as the hand that repeats the line again and again in the same shape gives the "solution" to the architectural design!



*Fig. 11: Thematic graffiti*

Extremely successful examples of dialectical coexistence (inter-information and bisociation) are the large thematic GRAFFITI<sup>128</sup>, where a work of Ephemeral Art dialogues with the large blind walls of old apartment buildings, on the adjacent plot of the old continuous system, changing the urban landscape. (fig. 11)

However, for this synthesis to succeed, the term "maturation of conditions" must be fulfilled, a necessary, but not sufficient condition (the observer must also have a keen perception!).

"...(today) we are on a more solid empirical ground to approach the problems of Consciousness and Time. We have stepped onto the Theory of Experience of Invariants – a specific way of perceiving reality... ...a way of the human brain to represent the World – to create representations, to compare them and to search for their common invariant elements." (Tambakis 2012, p. 205)

By comparing the "Representations of the World" of permanent and occasional users of a place, we searched for their common elements. These - if they exist - compose an objective representation – what mathematicians call Topologically invariant properties<sup>129</sup>. Which means that this "reality" is a function of the stage of evolution of both occasional and permanent users of the Place – an Inner Landscape.

It's the Landscape that is shaped by the view of the Unchangeable – the Archetypes. What is recognizable by the Other Human, can be the familiarity's common background with the place. The time of maturation required for this, creates conditions for the synthesis of a new culture, on a daily basis, a culture of CO-EVOLUTION.

From the research of the condition of "sustainable coexistence" we are led to a landscape that has emerged from a joint appropriation of urban space (an "by-appropriation"! ) where the importance of the relationship between permanent and occasional users with each other and with the place in which the ephemeral and the timeless coexist is also evident. As timeless characteristics, we consider Myth and Logos (Reason) – the unchanging elements

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<sup>128</sup> Petratos S., Stefanou I., "Graffiti as a Target of the Physiognomy of Cities" Ed. NTUA and Ypechode 2001

<sup>129</sup> Tampakis N. (2012), "The Time of Man", Govosti Publishing House.

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of Place, and as ephemeral elements we record those that arise from the practical and psycho-intellectual processes of appropriation, which cause alterations in the structure, the form and the function of the place.

Their dialectical relationship emerges when Myth and Logos of a Place remain – despite possible alterations – recognizable in the image/representation of the Place and in the landscape itself.

## CONCLUSIONS

With this essay, which forms part of a broader research effort, we have outlined the framework of a theoretical approach, through which we examine Spatial Sciences via Modern Physics and Philosophy.

We proposed certain methods for visualizing urban data as limit circles - for instance, the total limit circle/torus of an urban area. We considered that certain (uncontrolled) events result in the occasional presence of "outsiders" within reception zones. The line drawn by the points of intersection (of interest) between their actions and the limit circle of the reception zone marks the way space is appropriated and the resulting coexistence between permanent and temporary users.

We examined the **Carrying Capacity** of reception zones of significant cultural importance, within the framework of perceiving the **Physiognomy of Place** and the articulation of **Landscape**, which emerges through the interplay of boundary circles.

At the points of intersection, we sought the common elements between permanent and temporary users of a place by comparing their "Representations of the World."

However, since we did not conduct experimental field research (questionnaires and on-site documentation), we cannot draw definitive conclusions that either confirm or reject our working hypothesis. We reserve judgment on this matter.

We highlighted the importance of the "**observer's degree of awareness**" in how they experientially perceive and practically engage with a **Place**, as well as how they describe the **Landscape** based on its distinctive characteristics and physiognomy. We emphasize that the observer's level of consciousness allows them to gain insight into the **internal landscape**—the one shaped by their inner **Attractor**, a **Representation of their World**, yet one that remains embedded within a transient, finite world of stay and wandering. Thus, they themselves resonate with Empedocles: "*...Now I am a wanderer, an exile, god-sent...*"

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### CO-CREATING PLACE IDENTITY: PARTICIPATORY WORKSHOPS FOR PLACE BRANDING ALIGNED WITH LOCAL VALUES

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#### **Abstract**

Place branding has emerged as a powerful tool for enhancing local identity and fostering sustainable urban and regional development. However, effective place branding should transcend promotional campaigns, engaging deeply with the cultural, historical, and social values of the community of the place. This research investigates a participatory approach to place branding that integrates local voices, ensuring the alignment of a place's identity with its inhabitants' perceptions and aspirations.

Our study focuses on two medium-sized cities in Greece, characterized by rich cultural heritage and a vibrant local community. The methodology combines desk research on the cities' historical and cultural assets with participatory focus group workshops involving residents, local stakeholders, and institutional representatives. Through structured dialogues, participants reflected on their emotional connection to the place and identified key elements that shape its identity. For drafting the final proposal, a strategic visioning workshop was held with local participants, showing both the prospects but also the difficulties of creating a common vision/brand for the city.

Findings reveal that integrating participatory methods in place branding not only fosters inclusivity but also strengthens the authenticity of the brand. Key outcomes include:

1. A shared understanding of the place's core identity.
2. Consensus on branding elements that resonate with cultural and historical narratives.

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3. Recommendations for communication strategies that reflect community values.

This project underscores the importance of a bottom-up approach to place branding, advocating for practices that prioritize cultural sustainability and community engagement.

**Key words:** Place Branding, Community Engagement, Participatory Workshops, Cultural Identity, Sustainable Development, Local Values

## Introduction

In recent years, place branding has emerged as an essential tool for cities and regions aiming to define and promote their unique identities. Traditionally linked to marketing strategies designed to attract investment and tourism and stimulate economic growth, place branding has evolved to encompass a more comprehensive approach. This approach recognises that a place's identity is closely connected to its cultural heritage, historical narratives, and residents' lived experiences. This evolution has resulted in a growing interest in participatory place branding, a methodology that actively engages local communities in shaping the identity and strategic vision of their areas.

Researchers emphasise the significance of incorporating local voices and lived experiences into place branding processes to ensure authenticity, inclusivity, and long-term sustainability (Kavaratzis & Kalandides, 2015). A branding strategy that emerges from within the community not only reinforces a place's cultural identity but also strengthens social cohesion and civic pride. When branding initiatives align with residents' perceptions, historical narratives, and collective aspirations, they foster a sense of co-ownership, encouraging active participation in shaping and promoting the city's image. This bottom-up approach contrasts sharply with top-down branding strategies, often presenting an oversimplified or market-driven version of place identity, neglecting the complexities of a city's social and cultural landscape. Such externally imposed narratives risk creating a disconnect between official representations and local realities, leading to branding efforts that feel inauthentic, exclusionary, or even contested by the very people they aim to represent (Zenker & Beckmann, 2013). As a result, successful place branding must move beyond mere promotional tactics and embrace participatory, adaptive, and context-sensitive methods that allow cities to develop identities that are rooted in their histories yet responsive to contemporary challenges and opportunities.

This research investigates a participatory approach to place branding by focusing on two historically and culturally rich medium-sized cities in Northern Greece, Xanthi and Komotini. Both cities are characterised by a diverse social fabric, shaped by centuries of multicultural interaction, with Greek, Muslim, and other communities coexisting and contributing to their distinctive identities. Their vibrant cultural landscapes, which include traditional architecture, long-standing festivals, and dynamic creative industries, provide fertile ground for examining how place branding can be co-developed with local communities rather than imposed by external actors. By exploring the role of participatory workshops in these cities, this study seeks to understand how collective engagement can shape authentic, community-driven branding strategies that reflect the lived experiences, cultural values, and aspirations of



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residents. Additionally, given the cities' geographical and socio-economic interconnections, the research provides insights into how participatory place branding can function in regions with shared histories yet distinct local identities, contributing to broader discussions on regional identity and governance.

The study aims to address the following key questions:

- ✓ How can participatory workshops enhance the inclusivity and authenticity of the place branding process?
- ✓ What challenges and opportunities arise from integrating community perspectives into place branding strategies?
- ✓ In what ways do cultural heritage and local narratives influence the branding of medium-sized cities in Greece?

To investigate these questions, this study employs a mixed-method approach that integrates desk research, interviews, focus groups, and participatory workshops. The research began with an extensive review of the cultural, historical, and socio-economic contexts of Xanthi and Komotini, followed by on-site visits and interviews with key stakeholders, including municipal representatives, cultural organisations, and residents. A SWOT analysis was conducted to assess strengths, weaknesses, opportunities, and threats related to place identity and branding strategies. However, the core of the research methodology centered on focus groups and participatory workshops, which played a crucial role in capturing community perspectives and fostering collective place-making strategies. These interactive sessions encouraged participants to articulate their perceptions of place identity, discuss challenges, and co-develop branding proposals. Through structured dialogues and collaborative activities, residents, cultural actors, and policymakers engaged in a co-creative process, identifying key branding elements rooted in local narratives and shared experiences. The participatory workshops, in particular, served as a platform for bottom-up governance, ensuring that place branding strategies were not imposed externally but instead emerged organically from within the community. This methodology underscores the significance of inclusive, community-driven approaches in shaping urban identity and branding strategies by prioritizing active involvement and co-creation.

The findings of this study will contribute to broader discussions on place branding, participatory urban governance, and the right to the city, emphasising the need for inclusive, community-driven approaches in urban development. By integrating local voices and co-creation into the place branding process, this research highlights the importance of aligning branding strategies with residents' lived experiences, cultural narratives, and collective aspirations. Rather than viewing place branding solely as a tool for economic promotion and tourism attraction, this study underscores its role as a mechanism for strengthening local identity, fostering civic engagement, and reinforcing a sense of belonging. Furthermore, the research supports the argument that sustainable place branding extends beyond visual aesthetics and marketing campaigns—it requires long-term community participation, institutional support, and policy integration to be truly impactful. In this context, the study advocates for branding strategies that prioritise cultural sustainability, social inclusivity, and democratic participation, ensuring that urban identity is shaped not by external market forces but by the people who inhabit and experience the city daily.

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### **Literature Review: Towards a Participatory Approach to Place Branding and Co-Creation of Urban Identity**

Over the past two decades, place branding has developed from a practice driven by marketing objectives into a multidimensional, strategic tool used by cities and regions to define, communicate, and develop their unique identities. Traditional place branding strategies were focused on enhancing the competitiveness of a place through economic growth, investment attraction, and tourism development (Metaxas, 2009), often based on top-down approaches, promoting idealised representations of place that often distorted the complexity of everyday experiences and social dynamics of local communities (Anholt, 2007; Kavaratzis & Ashworth, 2005 ). It is worth mentioning that a successful place brand needs to be anchored in the identity and authenticity (staged or real) of the place (Ageeva & Foroudi, 2019 ). In other words, the starting point for developing the place brand is the place’s identity (Pedeliento & Kavaratzis, 2019). However, place identity is not a static or an externally imposed construct, but it is created through a complex system of interactions between the individual and the collective, the physical and the non-physical, the functional and the emotional, the internal and the external, and the organised and the random (Jacobs, 1961; Kavaratzis and Hatch, 2013).

#### ***From Image to Identity: Evolving Approaches to Place Branding***

The evolution of place branding has marked a shift from viewing cities as products to attract tourists and investors into a more holistic, multidimensional process that extends beyond mere visual representation (Kavaratzis & Hatch, 2013; Boisen et al., 2018). Traditional approaches focused on constructing appealing images, often inspired by commercial branding practices (Anholt, 2007). These strategies, frequently designed by top-down approaches, produce generic or even misleading portrayals of cities that overlook the lived experiences, cultural narratives, and values of the local community.

However, an effective place brand should be anchored in the identity and authenticity of the place it represents, due to the fact that place is a complex phenomenon that represents a large entity consisting of a variety of tangible and intangible components. This means acknowledging not only the visible and tangible elements of a place (including heritage sites, infrastructure, and architecture), but also its intangible components, which include culture, history, mythology, religion, people, environment, politics, food, and hospitality. Furthermore, authentic place branding emerges when it reflects the true character of a place—its distinctiveness, values, and narratives—and when local people are empowered to define and express what their place means to them (Cohen, 1988; Houghton & Stevens, 2010 ). In line with this view, if place brand is not deeply rooted in place identity, then it can have negative results, especially for the internal stakeholders (Houghton & Stevens, 2010; Kavaratzis & Hatch, 2013).

Thus, effective place branding requires inclusive and participatory processes. Marketing and branding models such as the “4Rs” (rights, roles, relationships, responsibilities) (Aitken & Campelo, 2011) refer to the social dimension of the branding process, which highlights the

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role of residents not as passive recipients but as active co-creators of the city’s narrative (Deffner et al., 2019). Through bottom-up processes and co-creation, place branding becomes a democratic and culturally embedded practice in which local identity and everyday life (with their distinctive characteristics) are represented (Kavaratzis & Hatch, 2013).

### ***The Rise of Participatory Place Branding and Community Engagement***

In response to the limitations of traditional branding approaches, scholars and practitioners have increasingly turned to participatory and more inclusive models that promote an active role of local communities in the creation of a place’s identity. Participatory place branding engages a broad range of local stakeholders—residents, cultural institutions, community organisations, businesses, and public authorities—in the co-creation of a place’s identity (Aitken & Campelo, 2011; Zenker & Braun, 2010). It is worth mentioning that participatory urban planning methods, such as co-creation workshops and citizen assemblies, have been increasingly used to engage residents in shaping urban spaces (Healey, 1997). These methods align with Lefebvre’s (1996) concept of the Right to the City, which argues for democratic participation in urban decision-making and especially in shaping urban space and identity. The integration of participatory practices in place branding allows for a more inclusive and representative narrative of urban identity (Kavaratzis & Kalandides, 2015).

As Kalandides (2011) notes, participatory methods foster a sense of ownership, authenticity, and community pride, ensuring that branding initiatives reflect the lived experiences and aspirations of local communities. Through focus groups, workshops, and collaborative storytelling, residents articulate what their place means to them, what narratives they wish to preserve or transform, and how they envision their city’s future (Kavaratzis & Kalandides, 2015; Zenker & Beckmann, 2013). The concept of place attachment, which refers to the emotional bond between individuals and their environment, has been identified as a crucial factor in shaping place identity (Scannell & Gifford, 2010).

The emphasis on inclusion also enables the representation of marginalised voices, ensuring that place branding does not reinforce existing inequalities or cultural hierarchies. In multicultural or historically layered cities such as Xanthi and Komotini, participatory branding allows for the negotiation of multiple narratives and the expression of complex identities that reflect lived diversity.

### ***Challenges and Benefits of Participatory Branding***

Despite its advantages, participatory branding is confronted with a range of challenges. One of the major concerns is the complexity of balancing the multiple stakeholder perspectives (Hankinson, 2015). Different groups—residents, businesses, cultural organisations, and municipal authorities—may have conflicting visions for the city’s identity, making difficult to create a unified branding strategy.

Another challenge lies in the lack of institutional support required for participatory processes. Effective community engagement demands time, resources, facilitation skills, and long-term commitment. In many cases, local authorities lack the capacity or political will to sustain inclusive branding strategies over time (Boisen et al., 2018).

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Nevertheless, when participatory place branding is properly implemented, brings significant benefits. It enhances social cohesion by strengthening community bonds, encouraging active citizenship, and cultivating a sense of belonging and pride. Moreover, co-created branding tends to resonate more strongly with local and regional audiences, offering an image of place that is both authentic and meaningful. Finally, a key outcome of participatory branding is the recognition that place identity is never complete. It is an ongoing, collective process that evolves with the community. Embracing this dynamic nature allows cities to remain adaptive, reflective, and responsive to social change while preserving their unique character and authenticity.

This literature review provides the basis for understanding the role of participatory methods in place branding. The following sections explore how these theoretical insights were applied in the case studies of Xanthi and Komotini.

### **Case study cities: Xanthi and Komotini**

Xanthi and Komotini are two medium-sized cities in Northern Greece, each distinguished by its unique yet interconnected cultural identity, shaped by historical influences and contemporary urban dynamics. These cities serve as significant cultural and administrative hubs within the region, reflecting the multicultural character of Thrace and the interplay between diverse ethnic and social groups.

Xanthi is a city built at the foothills of the Rhodope Mountains, combining both natural and architectural elements. Its rich history has left visible marks on the city's appearance. For this reason, it is often referred to as the "city of a thousand colors". Xanthi is renowned for its well-preserved old town, featuring traditional mansions and Ottoman-era, neoclassical, and eclectic buildings that stand as a testament to its rich architectural heritage. Historically, the city has been a melting pot of cultural influences, shaped by the coexistence of Greek Orthodox, Muslim, and Pomak communities, each contributing to its distinctive urban and social fabric. Today, Xanthi remains a cultural focal point, hosting major events such as the Xanthi Carnival, one of Greece's largest and most vibrant festivals, and the Old Town Festival, which celebrates local traditions, folklore, and artistic expression. These cultural events, alongside the city's dynamic creative sector, reinforce Xanthi's reputation as a center for cultural production, artistic innovation, and heritage preservation.

Komotini, the administrative capital of the Eastern Macedonia and Thrace region, embodies a different yet equally significant urban identity. Unlike Xanthi, Komotini has a political, academic, and multicultural character, serving as a key regional center for governance and education. The city is home to the Democritus University of Thrace, which attracts a large student population and fosters a lively intellectual and cultural environment. Komotini's demographic composition is notably diverse, with a Greek Orthodox majority, a significant Muslim minority, and Pomak communities, reflecting the region's complex historical legacy. The city's cultural identity is deeply tied to its historical evolution, shaped by Byzantine, Ottoman, and Greek influences, as well as its contemporary role as a hub for regional policy-making and cross-cultural interaction.

The selection of Xanthi and Komotini as case studies provides a comprehensive framework for analysing participatory place branding in cities that balance heritage

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preservation, cultural diversity, and economic development. Their shared and unique characteristics facilitate a comprehensive examination of how participatory branding strategies can effectively link historical narratives, engage local communities, and influence sustainable urban development policies. By examining how residents, stakeholders, and institutions perceive and contribute to place identity, this study sheds light on the potential of participatory branding as a tool for fostering social cohesion, reinforcing cultural authenticity, and enhancing the cities’ appeal on a regional and national scale.

### ***Xanthi vs. Komotini***

Xanthi and Komotini, as mentioned before, present both shared and distinct characteristics that influence their place branding potential. While both cities have rich cultural heritages and diverse populations, their urban identities and strategic branding challenges differ in meaningful ways.

**Table 1: Xanthi vs. Komotini**

| Aspect                                          | Xanthi                                                                                                                                                                                       | Komotini                                                                                                                                                                                                   |
|-------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Cultural Identity</b>                        | Strong focus on <b>festivals, traditions, and artistic expression</b> . A city known for its <b>vivid cultural scene</b> , deeply influenced by Greek, Muslim, Pomak and Jewish communities. | Defined by <b>administrative, academic, and cross-cultural interactions</b> . A city where cultural identity is shaped by a mix of <b>regional governance, education, and diverse ethnic communities</b> . |
| <b>Architectural &amp; Historical Landscape</b> | <b>Well-preserved Old Town</b> , Ottoman-era, eclecticism and neoclassical buildings, historical mansions, and former tobacco warehouses.                                                    | A city with <b>Byzantine, Ottoman, and Greek influences</b> , but with a more contemporary urban structure and less preserved historical architecture.                                                     |
| <b>Key Cultural Events</b>                      | <b>Xanthi Carnival</b> , one of Greece’s most well-known festivals, and the <b>Old Town Festival</b> , celebrating local traditions.                                                         | Fewer internationally recognized cultural events but a <b>strong emphasis on regional and minority cultural expressions</b> .                                                                              |
| <b>Demographic Composition</b>                  | Predominantly <b>Greek Orthodox</b> , with a strong presence of <b>Muslim and Pomak communities</b> , historically creating a multicultural atmosphere.                                      | One of Greece’s most <b>ethnically diverse cities</b> , with significant <b>Greek Orthodox, Muslim, and Pomak populations</b> , fostering <b>multicultural interactions and cohabitation</b> .             |
| <b>Economic &amp; Development Focus</b>         | Cultural tourism, creative industries, and small-scale entrepreneurship.                                                                                                                     | Administrative functions, academic sector, and regional policymaking.                                                                                                                                      |
| <b>Challenges in Place Branding</b>             | Managing <b>seasonal tourism demand</b> , maintaining <b>authenticity</b>                                                                                                                    | Balancing <b>multicultural representation in branding</b> while                                                                                                                                            |



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| Aspect                                            | Xanthi                                                                                                            | Komotini                                                                                                                        |
|---------------------------------------------------|-------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------|
|                                                   | while expanding cultural attractions.                                                                             | integrating the city's <b>academic and administrative identity</b> .                                                            |
| <b>Potential for Participatory Place Branding</b> | High potential due to <b>existing cultural engagement</b> , community-driven events, and strong local narratives. | Participatory branding could help <b>bridge cultural divides</b> , strengthen local identity, and enhance regional positioning. |

Xanthi and Komotini, despite their shared regional context, exhibit distinct urban identities that shape their place branding strategies. Xanthi is widely recognised as a cultural hub, celebrated for its vibrant artistic scene, historical architecture, and annual festivals that attract both locals and visitors. In contrast, Komotini functions primarily as an academic and administrative center, housing key regional institutions and serving as a melting pot of diverse communities. These differences create unique branding opportunities for each city. Xanthi can capitalise on its rich cultural heritage and dynamic creative sector, reinforcing its image as a destination for cultural tourism and artistic expression. Komotini, on the other hand, can highlight its multicultural character and academic presence, positioning itself as a center for knowledge exchange, regional governance, and cross-cultural dialogue. However, both cities face distinct challenges in implementing participatory place branding. Xanthi must navigate the fine line between cultural preservation and tourism-driven commercialisation, ensuring that branding efforts do not dilute its authentic identity. Meanwhile, Komotini’s challenge lies in fostering an inclusive representation of its diverse communities, balancing the different cultural narratives that coexist within the city.

Despite these differences, both cities share common ground in their deep-rooted traditions and historical significance, providing a strong foundation for participatory branding approaches. By actively involving local stakeholders in shaping their urban identity, both Xanthi and Komotini can develop branding strategies that enhance community engagement, strengthen cultural sustainability, and create long-term value for their residents and visitors alike. By examining these two cities side by side, the study reveals how participatory branding strategies need to be tailored to each city's unique socio-cultural and economic landscape. This comparison provides valuable insights into how cities with shared regional characteristics but different urban functions can adopt branding approaches that are both authentic and effective, aligning with local values and aspirations.

## Methodology

This chapter outlines the methodology employed in this study, which is divided into three main sections: first visit, online meetings, and participatory workshops. The combination of direct engagement through field visits and participatory workshops, along with virtual interactions, aims to provide a comprehensive and nuanced perspective on the cultural dynamics at play. Prior to these activities, a secondary literature review is conducted to identify both qualitative and quantitative elements—material and immaterial—of culture in the two cities.

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### ***Primary Research and Data Collection***

The initial phase of this study focused on a comprehensive search and categorization of all relevant cultural, social, and urban infrastructure data. This process was crucial for establishing a solid understanding of the cultural landscape in Xanthi and Komotini. The first step involved the compilation of existing data, including reports, archival records, and academic literature related to the cultural identity and infrastructure of both cities. Next, stakeholders and infrastructure were categorised, identifying cultural institutions, creative industries, municipal authorities, and grassroots organisations. This mapping helped to clarify the various entities contributing to the cultural scene in each city. Information was then organised into thematic databases, facilitating comparative analysis of available resources. This process also highlighted gaps in the cultural infrastructure that require further attention. Additionally, spatial mapping of cultural assets was undertaken to visualise areas of cultural density and identify underutilised spaces. This cartographic representation helps to visualise the data collected; the two maps can be compared in terms of the number and concentrations of points of interest.

Finally, a comprehensive list of key actors in the cultural sector was developed to ensure a thorough and representative approach to stakeholder engagement. The identification of these stakeholders is crucial for the next phases of the research. These steps provided an initial basis for understanding the existing context and laid the groundwork for more in-depth qualitative research through interviews and participatory workshops.

### **Phase 1: First Meeting and Interviews**

The initial phase of the research included a field visit and interviews to collect first-hand information on the cultural, social, and urban dynamics of Xanthi and Komotini. This phase was organised into two main activities: field observation and semi-structured interviews with key stakeholders.

#### ***A. Field observation:***

The research team conducted a structured tour of the city to document existing cultural infrastructure and public spaces. This was done to confirm the information collected in the secondary survey and data collection remotely. Beyond the most popular venues, and infrastructure with a distinct online presence, the team identified unused or underused cultural and public spaces, focusing on potential opportunities for regeneration and integration into a comprehensive place branding strategy. During the city tour stage, detailed notes and photographic documentation were collected to analyse spatial characteristics and urban dynamics. Particular attention was paid to historic districts, community hubs, and creative spaces, examining their roles in shaping the city's identity. In addition, the team identified neglected or abandoned public spaces that could be reused for cultural initiatives.

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**Images 1 & 2: Exploring and mapping cultural infrastructures**

### ***B. Semi-structured Interviews:***

Prior to the site visit, as mentioned above, a list of key individuals and organisations involved in cultural administration, urban planning, and community development was compiled. The study team was then contacted by phone or email to ensure a diverse range of stakeholders were involved. Participants included city officials, representatives of cultural institutions, members of the creative industries, and residents actively involved in community initiatives. The interview framework explored issues such as the current cultural landscape and the strengths and weaknesses of existing policies, and aspirations for the city's cultural future. Interviewees provided insights into community engagement practices and identified challenges they face in promoting participatory decision-making in cultural planning. The research team encouraged interviewees to highlight both tangible and intangible aspects of the city's identity, including traditions, historical narratives, and artistic expressions. The interviews were recorded, transcribed, and analysed to extract recurring themes and key perspectives to inform subsequent phases of the research.

Semi-structured interviews were conducted at the same time as the field observation. This allowed the interviewees to visit the sites and point out places not identified by the team, or other places whose current use is not cultural but could potentially be. By systematically integrating direct observations with stakeholder input, this phase established a fundamental understanding of the cultural and social ecosystem of each city. The insights gained will inform the design of the next stages, particularly the SWOT analysis and participatory workshops, ensuring that the final place branding proposals are rooted in local knowledge and perspectives.

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### **Phase 2: Discussion of Progress and SWOT Analysis**

After the initial data collection phase, a virtual stakeholder meeting was organised to engage participants in a discussion of the preliminary findings. This meeting was crucial to improve research knowledge and to ensure that various perspectives were taken into account before moving forward to participatory workshops. All stakeholders from the initial list were invited, but also other experts disclosed during the city visit. The online meeting enabled almost all invitees to participate, encouraging dialogue and discussion on everyone's suggestions.

#### ***1. Presentation of preliminary findings:***

Initially, the conference began with an introduction of the participants to the project and the purpose of the meeting. This was followed by a presentation by the research team. The basic knowledge gained from fieldwork, interviews, and initial observations was collected and presented. The data was organised into thematic categories, focusing on cultural identity, urban development, and place branding strategies. Visual aids, including maps and diagrams, were presented and used to demonstrate spatial patterns and stakeholder networks.

#### ***2. SWOT analysis and Collaborative Assessment:***

In the following, a structured SWOT analysis was presented divided into the main parts of the analysis (Strengths, Weaknesses, Opportunities, Threats) and the four main themes (actions and institutions, infrastructure and resources, creative economy and entrepreneurship, and identity and branding).

Strengths and opportunities related to existing cultural assets, cultural associations, community engagement, and historical narratives were identified. On the other hand, weaknesses and threats revealed challenges such as underutilization/abandonment of cultural sites, or sometimes the absence of major infrastructure. Perhaps the main challenge proved to be the lack of cooperation and coordination between stakeholders and policy constraints.

#### ***3. Integrating feedback and improving findings:***

Participants engaged in guided discussions to propose actionable solutions to address weaknesses and seize opportunities. But also, to comment on and confirm findings.

Participants offered direct feedback on the analysis, which helped clarify ambiguities and provided valuable contextual information. Some of the additional comments that emerged related to social inclusion, accessibility of cultural initiatives, and cross-sectoral cooperation. The final SWOT assessment laid the foundations for structuring the participatory.

By incorporating iterative feedback from stakeholders, this phase enhanced the credibility and relevance of the survey findings. The collective analysis ensured that subsequent workshops would focus on the real concerns and aspirations expressed by the community, thus improving the effectiveness of the place branding strategy.

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### Phase 3: Participatory Workshops

The third and most critical phase of the research centered on the implementation of participatory workshops, which served as the primary mechanism for co-creating the place branding strategy. These workshops were designed as interactive spaces where local stakeholders, including residents, business owners, cultural actors, and municipal representatives, could engage in meaningful dialogue and collective decision-making. The goal was to move beyond traditional top-down branding approaches and instead develop a strategy deeply rooted in local narratives, cultural heritage, and the aspirations of the community. Through a structured yet flexible methodology, participants were encouraged to reflect on their city's identity, articulate key branding elements, and collaborate in shaping a shared vision for the future. By integrating diverse perspectives and fostering a sense of ownership, the workshops aimed to ensure that the resulting branding proposals were authentic, inclusive, and sustainable.



**Images 3 & 4: The information posters for the participatory workshops**

#### *A. Structure and Process of the Workshops*

The participatory workshops followed a structured yet adaptable framework, ensuring that discussions were informed, inclusive, and conducive to meaningful collaboration. The process unfolded through a series of carefully designed steps, each aimed at fostering engagement, stimulating critical reflection, and guiding participants toward the co-creation of a shared place branding strategy.

#### *Presentation of Prior Research*

The workshops commenced with a comprehensive presentation of key findings derived from the preceding phases of the research, including insights from fieldwork, interviews, and the SWOT analysis. This step was essential in setting a common foundation for discussion, ensuring that all participants were familiar with the research outcomes, and providing an empirical basis for the branding process. By grounding the discussion in real data and lived



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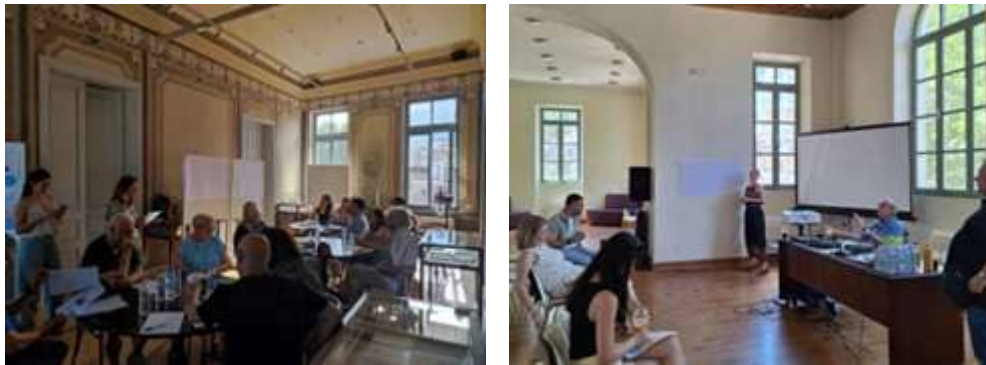
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experiences, the presentation aimed to bridge different perspectives and encourage participants to engage with the material critically.

### ***Introduction to the Workshop Goals***

Following the research presentation, the researchers introduced the core objectives of the workshop, emphasising the significance of collaborative place identity formation and the co-creation of branding strategies. This phase aimed to clarify the participatory nature of the process, highlighting the role of each stakeholder in shaping the branding approach. Participants were encouraged to reflect on their city’s identity, consider how it is currently perceived, and envision how they would like it to evolve. The emphasis was placed on authenticity, inclusivity, and sustainability, ensuring that the branding process aligned with local values and long-term aspirations.



**Images 5 & 6: Archive images from the participatory workshops in the two cities**

### ***Group Formation***

To facilitate dynamic discussions and encourage diverse contributions, participants were organised into small, multidisciplinary working groups. Each group was carefully composed to reflect a mix of backgrounds, expertise, and affiliations, incorporating local government officials, cultural stakeholders, community representatives, and youth groups. This structure ensured that a broad spectrum of voices and experiences was represented, fostering an environment where different perspectives could converge and complement one another. The group format encouraged collaborative problem-solving, creative brainstorming, and cross-sectoral dialogue, essential components of a participatory place branding approach.

### ***Interactive Group Activities and Proposal Development***

To guide discussions and encourage forward-thinking strategies, each group received a structured worksheet featuring the following central question:

*"What would constitute an improvement or success in your city's cultural landscape over the next decade—by 2034?"*

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This open-ended prompt allowed participants to reflect on long-term aspirations, identify key challenges, and propose actionable solutions. Working collectively, group members engaged in in-depth discussions, drawing from their lived experiences and expertise. Their responses captured a range of priorities, illustrating both common concerns and diverse perspectives. Notable responses included:

- ✓ "Showcasing historic buildings as pillars of activities that bring the city's history to life."
- ✓ Discarding outdated, centralized cultural production mindsets that exclude participation and interaction."
- ✓ "I consider the participation of the Muslim youth community essential."
- ✓ "Training of a volunteer network and potential cultural leaders."
- ✓ "Redefining direction and engaging new stakeholders."
- ✓ "Connection with the local community."

The structure of the workshop was designed to ensure that ideas evolved through collective deliberation. Following the brainstorming phase, each group selected one proposal to present in detail to the larger assembly. The presenting group elaborated on the rationale behind their proposal, its expected impact, and potential implementation strategies. Researchers recorded each proposal, ensuring that every idea was documented for further discussion.

### ***Iterative Refinement through Group Exchange***

After all groups completed their first round of presentations, a second round followed, during which each group formulated and presented a second proposal. This iterative approach encouraged participants to refine their ideas based on earlier discussions, integrate new insights, and consider complementary or alternative approaches.

Each proposal was carefully documented, allowing a comprehensive collection of ideas to emerge by the end of the workshop. This process ensured that a broad spectrum of cultural branding strategies was explored, incorporating different perspectives and stakeholder priorities.

### ***Collective Decision-Making and Strategic Prioritisation***

To transition from idea generation to strategic decision-making, the final phase of the workshop involved a structured voting process. Each group reviewed the full list of documented proposals and selected the two ideas they found most compelling and impactful. This voting mechanism served multiple purposes:

1. It facilitated consensus-building, ensuring that the most resonant ideas received broader support.
2. It highlighted priorities shared across different stakeholder groups, revealing areas of alignment between community needs and institutional perspectives.
3. It helped refine the direction of the branding strategy, guiding future efforts toward the most widely endorsed initiatives

Through this participatory and iterative methodology, the workshops not only generated concrete branding proposals but also fostered a collective sense of ownership over the city's

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cultural development. The emphasis on open dialogue, structured collaboration, and consensus-driven decision-making positioned participatory place branding as an inclusive and sustainable process, deeply rooted in the local community's aspirations.

### **Data Analysis and Results**

The primary research conducted in Xanthi and Komotini yielded substantial insights into the complex framework of place identity, cultural heritage, and urban development. Through a mixed-method approach that included semi-structured interviews, SWOT analysis, and participatory workshops, a series of interconnected insights and findings emerged.

#### ***Key Findings from Interviews and SWOT Analysis***

Semi-structured interviews with local stakeholders—including municipal authorities, cultural practitioners, business owners, and educators—revealed recurring concerns and aspirations regarding the cities' cultural and branding practices. A dominant aspect was the presence of strong cultural narratives: Xanthi is characterized by its vibrant festival culture and creative communities, while Komotini's identity is deeply shaped by its multicultural population and rich historical background. These narratives serve as vital assets for the creation of distinctive place identities.

However, interviewees consistently pointed to the absence of cohesive branding strategies, emphasizing the uncoordinated character of existing initiatives and the lack of a long-term vision. Many highlighted the challenges in stakeholder collaboration and particularly the limited interaction between local authorities, organizations, and residents. Despite these obstacles, highlighted the benefits of participatory processes, suggesting that community-led branding could bridge institutional gaps and reflect local values more authentically.

These observations were further reinforced by the SWOT analysis, which highlighted a series of internal and external factors affecting how place branding strategies can be developed in both cities. Among the identified strengths were the richness of cultural heritage, the presence of active artistic communities, and a strong sense of local pride. These assets provide a strong basis for the development of authentic branding strategies. On the other hand, several weaknesses were evident, including the absence of integrated marketing and branding efforts, limited collaboration across sectors, and a generally underdeveloped digital presence. Despite these challenges, notable opportunities emerged, such as the growing interest in sustainable tourism, the potential of digital storytelling to enhance visibility and engagement, and the increasing involvement of youth in cultural initiatives. Nonetheless, the analysis also pointed to significant threats that could undermine progress, including persistent bureaucratic inefficiencies, the danger of over-commercializing cultural assets, and the potential loss of distinct cultural identity as a result of diminishing local uniqueness.

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### ***Participatory Workshop Results***

The participatory workshops conducted in both Xanthi and Komotini enabled a bottom-up exploration of place branding strategies, encouraging collaboration among a diverse range of participants, including cultural professionals, urban planners, students, and community members. Through guided ideation sessions, participants collectively articulated key priorities and developed proposals focused on enhancing cultural visibility, revitalizing public spaces, and strengthening community involvement. One recurring theme was the importance of using digital platforms—such as interactive websites and targeted social media campaigns—to highlight local narratives and cultural heritage, and increase the visibility of creative initiatives. Another central idea revolved around the transformation of underused urban spaces into dynamic cultural venues. Participants envisioned initiatives such as open-air museums, artistic interventions, and community-led events as means to regenerate abandoned areas and foster public engagement. Additionally, the workshops brought attention to the necessity of inclusive governance models that promote participatory decision-making and ensure that a wide range of local actors are actively involved in shaping the identity and future of their city.

To transform ideas into actionable priorities, each workshop concluded with a voting session in which participants ranked the most impactful proposals. The top strategies that emerged included the creation of a cultural identity festival that would weave together elements of storytelling, visual and performing arts, and historical exhibitions. Another widely supported proposal was the development of heritage and cultural walking routes that would connect key architectural and historical landmarks while offering interpretative content to enrich the experience. Finally, participants strongly endorsed the establishment of a youth ambassador program, aimed at fostering intergenerational engagement by encouraging young people to take an active role in cultural promotion and the co-creation of place identity.

### ***Interpretation of Findings and Implications***

The research findings highlight the critical role of participatory approaches in fostering authentic and resilient place branding. Rather than relying on externally imposed narratives or top-down strategies, effective place branding must be grounded in the cultural narratives and lived experiences of the local community. When place identity initiatives resonate with local values and traditions, they not only gain legitimacy but also promote a deeper sense of belonging among residents. Co-creation emerges as a sustainable and inclusive model, that depends on continuous dialogue and collaboration between institutions and the residents. An approach like this could ensure adaptability, foster mutual trust, and strengthen community ownership over branding outcomes.

Moreover, the integration of branding strategies into broader urban development policies is essential for achieving long-term impact. Without alignment with existing governance frameworks and planning mechanisms, branding efforts risk remaining isolated or unsustainable. By embedding them within the wider context of urban transformation, cities can ensure coherence across cultural, economic, and spatial development agendas.

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Ultimately, this study demonstrates how participatory place branding can transform community-driven insights into actionable strategies. In doing so, it contributes to cultural sustainability, supports inclusive governance, and fosters a multidimensional urban identity that is both rooted in tradition and adaptable to future challenges.

### Discussion

The findings of this study highlight the significance of local narratives in shaping authentic and compelling place branding strategies. Both Xanthi and Komotini are strongly related to a deep historical background and multicultural traditions, which emerged as powerful tools for defining their identity. Rather than relying on externally imposed symbols or promotional campaigns, participants emphasized the importance of storytelling, emotional connection, and community-led initiatives. The participatory workshops revealed a strong desire to preserve and reimagine these local narratives through inclusive and creative strategies that reflect the lived experiences of residents.

In line with existing literature, this study confirms that place branding based on authentic local narratives is more likely to encourage a sense of belonging and local pride, enhance community engagement, and result in more sustainable outcomes (Kavaratzis & Kalandides, 2015). Furthermore, it supports the notion that identity is not static, but rather a dynamic construct shaped by continuous interaction between people, space, and culture (Kavaratzis & Hatch, 2013).

### *Insights from Community Responses*

The community feedback provided rich insights into residents' aspirations, particularly around youth participation and intercultural dialogue. Young participants expressed a strong desire to modernise the cultural landscape while respecting the historical context. Their suggestions - ranging from volunteer networks to cultural ambassador programmes - highlighted the role of youth as agents of change and cultural continuity.

The importance of cross-cultural cooperation was also consistently emphasised, especially in Komotini, where different ethnic groups coexist. Participants envisioned branding strategies that celebrate diversity, promote inclusion and foster mutual understanding. These insights are consistent with participatory branding models that value pluralism and diversity in identity construction (Zenker & Beckmann, 2013).

Notably, many participants proposed concrete actions, such as transforming unused public spaces into creative hubs, expanding local festivals, and establishing platforms for digital storytelling. These ideas demonstrate the community's capacity for strategic thinking and willingness to engage in co-creation processes.

### *Strategic Planning Considerations for Cultural and Economic Enhancement*

The study suggests that cultural identity and economic development are not mutually exclusive; rather, they can be strategically aligned. The participatory proposals emphasized



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the potential of cultural festivals, adaptive reuse of heritage buildings, and creative industries as drivers of both social and economic value.

For instance, in Xanthi, expanding the internationally recognized carnival and integrating it with year-round cultural programming could strengthen its reputation as a cultural destination. In Komotini, transforming underutilized spaces into intercultural centers or co-creation venues could attract new visitors while fostering internal cohesion.

To maximize impact, these initiatives should be embedded in broader urban and regional development frameworks. Aligning place branding with tourism strategies, education policies, and local entrepreneurship programs would ensure coherence and sustainability.

### ***Comparison with Existing Literature***

The findings strongly resonate with contemporary academic perspectives on participatory branding. Scholars such as Kavaratzis and Kalandides (2015) and Aitken and Campelo (2011) argue that effective place branding must be strongly connected with participatory processes and authentic local narratives, emphasizing that active community engagement is essential for creating identities that reflect the lived experiences and cultural values of residents. The findings reinforce these arguments by highlighting how co-creative practices can bridge the gap between top-down planning and community values, resulting in branding strategies that are inclusive, meaningful, and anchored to cultural identity.

Furthermore, a significant contribution of this study is how participatory methods not only gather feedback, but also shape strategic visions. The participatory process used in the workshops can be seen as a form of deliberative democracy in action—what Healey (1997) terms “collaborative planning.” It also reflects Lefebvre’s (1996) notion of the Right to the City, by asserting that the creation of a place’s identity is a civic right, not merely a branding practice.

### ***Challenges and Limitations***

Despite the success of the participatory process, the study encountered several limitations. Firstly, one of the most persistent issues identified was the inflexibility of institutional frameworks. While community members demonstrated a strong engagement, the integration of their proposals into formal policy frameworks remains uncertain. Without institutional commitment and structural support, even the most compelling ideas may struggle to materialize.

Second, balancing diverse stakeholder interests proved complex. Conflicting visions, particularly between administrative authorities and grassroots actors, underscored the need for facilitation skills and long-term dialogue mechanisms.

Third, the lack of follow-up mechanisms raised concerns about the sustainability of the process. Participants expressed interest in continued engagement, but without dedicated funding or formal structures, there is a risk of losing momentum.

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### ***Policy and Planning Implications***

To address these challenges and increase the impact of participatory branding, the study suggests the following policy recommendations. In terms of institutionalising participatory methods, local governments should establish permanent mechanisms - such as advisory boards or citizens' assemblies - to ensure ongoing community involvement in branding decisions. Branding strategies should be developed jointly by cultural institutions, urban planners, educational institutions and private actors to enhance both cultural relevance and economic sustainability. Continuous monitoring and evaluation should be used to consolidate strategies. Establishing metrics to assess the social and cultural impact of branding initiatives will allow for iterative improvement and long-term learning. In addition, the use of digital platforms can increase accessibility, especially for younger and more remote participants, and sustain interaction beyond physical workshops.

Finally, further research is needed to assess the long-term impact of participatory branding on urban development, particularly in medium-sized cities. Comparative studies in different geographical and cultural contexts could also help to improve best practice. In addition, exploring the role of emerging technologies - such as digital storytelling, gamification or augmented reality - may offer innovative ways to engage wider audiences in place identity processes.

### **Conclusions**

This research methodologically creates a toolkit for exploring the role of participatory methodologies in shaping authentic and sustainable place branding strategies. It focuses on the study of two cities and, by placing local voices at the center of the branding process, demonstrates how co-creation can enhance the cultural appeal, inclusion, and long-term impact of urban identity initiatives.

The participatory workshops revealed that residents possess deep knowledge and emotional attachment to their cities, which can serve as a foundation for strategic place branding. Local narratives, particularly those rooted in multicultural heritage and lived experiences, were consistently highlighted as essential elements of urban identity. Moreover, the workshops uncovered a strong desire for inclusive governance models, youth engagement, and the activation of underused public spaces for cultural purposes. Despite the enthusiasm and innovative proposals generated, several challenges were identified, including fragmented stakeholder collaboration, limited institutional support, and the lack of mechanisms for continuity.

In conclusion, this research reinforces the potential of participatory place branding to foster more inclusive, resilient, and culturally grounded cities. By empowering communities to shape their own urban narratives, place branding becomes not merely a promotional tool but a vehicle for democratic engagement and cultural sustainability.

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### **CULTURE AND SUSTAINABLE DEVELOPMENT OF CITIES: THE PHYSIOGNOMY OF THE CITY OF LAGKADAS**

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#### **Abstract**

Lagkadas, a city in Central Macedonia, exemplifies the synergy between cultural heritage and sustainable development. With a history dating back to antiquity, it boasts unique monuments such as the renowned thermal baths and vibrant traditions like Anastenaria, which solidify its regional identity.

Strategically located in a fertile basin, Lagkadas transitioned from an agricultural hub to a modern economy through industrial and artisanal growth. EU-funded projects have bolstered this transformation, focusing on sustainable natural resource management and enhancing residents' quality of life.

As a tourist destination, Lagkadas fosters a dynamic integration of culture, tradition, and development. Its innovative utilization of cultural and natural assets positions it as a leading example of sustainable urban and regional development, offering valuable insights for similar initiatives on a global scale.

**Key words:** Lagkadas, Cultural sustainability, Integrated development



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### **THE FORMATION OF THE PHYSIOGNOMY OF THE ISLAND OF ZAKYNTHOS - THE OPINION OF RESIDENTS AND VISITORS**

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#### **Abstract**

The present paper refers to the physiognomy of the places and is a study carried out by the Department of Economics and Sustainable Development of Harokopio University. The aim is to investigate the factors that contribute to the formation of this physiognomy and the opinion of residents and visitors on the issues in question. As a case study, the island of Zakynthos of the Region of the Ionian Islands is chosen.

In order to answer the main questions of the work and to investigate the main factors that shape the physiognomy of the island of Zakynthos a survey was carried out aimed at the residents of and visitors to the city. For the needs of the research, a questionnaire was created which included eight (8) closed-type structured response questions and two (2) open, was anonymous and distributed to Zakynthos people. The research was carried out in the months of October and November 2024. The questionnaire was addressed exclusively to adults, aged 18 to 70.

The paper concludes with interesting conclusions and proposals. An important conclusion is that in order to protect the special physiognomy of the island of Zakynthos strategies related to the more general protection of all issues related to its sustainable development should be implemented. It is proposed that both the local government, as well as the businesses of all service and production branches, work towards the protection and highlighting of the special character of the Zakynthos island.

**Key words:** Physiognomy of the places, sustainable development, the island of Zakynthos

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### **THE FORMATION OF THE PHYSIOGNOMY OF THE CITY OF TRIPOLI - THE OPINION OF RESIDENTS AND VISITORS**

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#### **Abstract**

The present paper refers to the physiognomy of the city of Tripoli and is a study carried out by the Department of Economics and Sustainable Development of Harokopio University. The aim is to investigate the factors that contribute to the formation of this physiognomy and the opinion of residents and visitors on the issues in question. As a case study, the city of Tripoli of the Region of Peloponnese is chosen.

In order to answer the main questions of the work and to investigate the main factors that shape the physiognomy of the city of Tripoli a survey was carried out aimed at the residents and visitors of the city. For the needs of the research, a questionnaire was created which included ten (10) closed-type structured response questions, was anonymous and distributed to 150 people. The research was carried out in the months of October and November 2024. The questionnaire was addressed exclusively to adults.

The paper concludes with interesting conclusions and proposals. An important conclusion is that in order to protect the special physiognomy of the city of Tripoli strategies related to the more general protection of all issues related to its sustainable development should be implemented. It is proposed that both the local government, as well as the businesses of all service and production branches, work towards the protection and highlighting of the special character of the city of Tripoli.

**Key words:** Physiognomy of the city, sustainable development, Tripoli

#### **Introduction**

The aim of this paper is to analyze the character of Tripoli, both from a historical and a cultural and social perspective. The study of the city's character seeks to highlight the unique identity of Tripoli by examining various parameters that shape its current image.

The paper includes several interrelated thematic sections that together construct a comprehensive portrait of Tripoli.

The first section focuses on the historical strategic importance and evolution of the city. It explores how Tripoli has developed through key historical periods, from antiquity and the Byzantine era to the Ottoman occupation and the Greek War of Independence. Each phase contributed to the city's identity and left distinct marks on its physical and cultural landscape.

The second section investigates architectural and cultural heritage. It delves into the city's buildings, monuments, and other architectural elements that reflect its cultural legacy.

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These structures serve as physical evidence of Tripoli's historical trajectory and symbolize its enduring connection to multiple time periods and influences.

The third section analyzes the social and economic structure of the city. It examines how the population has evolved socially and demographically over time and considers the city's economic transformations. This section provides insights into the interactions between social composition, labor patterns, and broader economic developments that have shaped Tripoli's growth.

Finally, the paper evaluates modern development and trends, offering an assessment of Tripoli's current character in the 21st century. It looks at contemporary cultural, economic, and social dynamics, highlighting the opportunities and challenges the city faces in an era of rapid change and regional integration.

In this way, the paper aims to examine Tripoli as a city with a rich history and tradition while also highlighting the modern dynamics that define it and establish its significance as a central hub in the Peloponnese.

### **Methodology**

The methodology of this paper includes two main stages: a literature review and quantitative research using questionnaires.

In the first stage, an extensive literature review was conducted on the character of Tripoli. This included the study of books, academic articles, and other research works that refer to the historical, cultural, social, and economic development of the city. The purpose of this review was to understand Tripoli's historical trajectory as well as the factors that shaped its identity.

In the second stage, a quantitative survey was carried out through questionnaires designed to explore the opinions of residents and visitors regarding the city's character. The questionnaires were distributed to a broad group of individuals to gather data on the general image of the city and people's perceptions of its key characteristics. A total of 148 responses were collected and subsequently analyzed.

### **Geographical Position and Natural Environment of Tripoli**

Tripoli is located in the heart of the Peloponnese, in the central and eastern part of Arcadia, at an altitude of 670 meters (Malikouti, 2005). This elevated geographical position gives the city a continental climate with cold winters, hot summers, and frequent snowfall in the winter months. These climatic conditions are more intense than in many other cities in the Peloponnese, shaping not only the natural environment but also the lifestyle of the inhabitants.

A dominant feature of the region is Mount Mainalo, which surrounds Tripoli and plays a decisive role in its natural and cultural landscape. The mountain is covered with dense forests of black pine and fir, making the area rich in biodiversity and ideal for outdoor activities such as hiking, skiing, and nature observation. It has been included in the Natura 2000 network, highlighting its ecological importance (Skintzis, 2013).

### **Historical Background of Tripoli**

Tripoli's history is rich and closely tied to the broader history of Arcadia and the Peloponnese. The city first appears in historical records during the 15th century under the name Drobolitsa,

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which possibly originated from the Slavic languages due to earlier settlements in the area. Over time, it developed into a significant urban and administrative center, especially during the period of Ottoman rule.

In the early 18th century, it was renamed Tripolitsa, a name derived from the unification of three older cities of Arcadia (Tegea, Mantinea, and Pallantion). Its central location and strategic importance led to its designation as the capital of the Peloponnese during the Ottoman period (Skintzis, 2013).

Tripoli played a key role during the Greek War of Independence. The Fall of Tripolitsa in 1821, under the leadership of Theodoros Kolokotronis, was one of the most decisive victories of the revolutionaries and marked the collapse of Ottoman control in the Peloponnese. However, in 1828, the city was destroyed by Ibrahim Pasha during the Egyptian campaign.

In more recent history, Tripoli suffered damages during the German occupation in World War II and during the civil war that followed, but it recovered after the restoration of democracy and became the administrative capital of the Peloponnese Region in the 20th century.

### **Culture of Tripoli**

Tripoli has a long tradition in the field of culture, which is expressed through the operation of cultural associations, museums, theaters, and local events. The city supports initiatives that promote the arts, literature, music, and tradition.

The Municipal Library of Tripoli, with thousands of titles, serves as a hub for education and research. The Malliaropouleio Municipal Theater, a neoclassical building in the city center, hosts theatrical performances, music concerts, and other cultural events. In recent years, Tripoli has developed artistic groups and workshops for painting, dance, and music, with the aim of encouraging the participation of young people and the promotion of local talent.

Cultural events of major importance include the Fall of Tripolitsa Celebrations in September, commemorating the city's liberation in 1821, the Easter celebrations, which attract visitors due to their deeply rooted traditions and the local festivals dedicated to Arcadian customs and gastronomy. These cultural activities reflect the city's effort to preserve its heritage while integrating modern creative expression (In Arcadia, n.d.).

### **Architectural Heritage of the City**

The city of Tripoli is adorned with numerous neoclassical and preserved buildings that either serve as museums or simply embellish the urban landscape.

The most important buildings include the Metropolitan Church of Saint Basil, the Malliaropouleio Theater, the Karyotakis Residence, the Courthouse, the Tourkovasilis Villa, the Archaeological Museum of Tripoli, the Megalo Kafeneio (Grand Café), the Zacharopoulos Residence, the Pedagogical Academy, the Petropouleio Bequest, the War Museum of Tripoli, the old Town Hall, and the Matzouneio Foundation.

The Metropolitan Church of Saint Basil, located in the heart of the city, is its emblematic symbol. It was designed by an unknown architect and its foundation was laid in 1884. The church is an elaborate structure built from Doliana marble, and its iconostasis (temple screen)

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was designed by Ernst Ziller. A unique feature of the monument is the existence of fourteen special spaces on the ground floor, which function as shops, offices, and exhibition halls. These occupy only the section beneath the church’s courtyard (Metropolitan Church of Saint Basil, 2014).

The Malliaropouleio Municipal Theater of Tripoli, a donation by Dr. Ioannis Malliaropoulos, was built in 1910 based on the plans of Anastasios Metaxas, with interior decoration by the French artist Joly. Today it is a designated monument and hosts various events.

The Karyotakis Residence was the family home of poet Kostas Karyotakis and is a state-protected monument.

Another house, representing a classic example of the aristocratic old Tripoli, is the Synadinos Residence, the birthplace of playwright Theodoros Synadinos (National Documentation Centre, n.d.).

The Courthouse of Tripoli stands out for its architecture, and on its ground floor, one can find engraved messages left by resistance fighters sentenced to death.

The Tourkovasilis Villa is an Art Nouveau building from the early 20th century, named after Theodoros Tourkovasilis, former Minister of Education and Justice. The villa was declared a preserved monument in 1994.

The Archaeological Museum of Tripoli is a neoclassical building designed by Ernst Ziller. It served as a hospital from 1913 to 1951 and was converted into a museum in 1986.

The Grand Café (Megalo Kafeneio) has been declared a preserved monument. It once served as a meeting point for the bourgeoisie of Tripoli. Its interior features wooden oval tables and red velvet sofas.

The Zacharopoulos Residence is also a significant neoclassical building, notable for its distinctive architectural elements.

The Pedagogical Academy operated from 1880 and has been designated as a preserved building.

The Petropouleio Bequest is a preserved neoclassical building that now functions as a digital museum.

The War Museum of Tripoli is housed in what was once the residence of Dr. Malliaropoulos. Today, it exhibits weapons and artifacts from the Greek War of Independence in 1821, as well as from other significant historical events.

The Old Town Hall of Tripoli formerly belonged to the pharmacist Grigoris Dareiotis. It holds considerable architectural and morphological significance.

The Matzouneio Foundation was built on the ruins of a Catholic church dedicated to the Virgin Mary. The building has been declared preserved and has hosted the Public Library and the municipal philharmonic orchestra (Sini, 2019).

### Notable Figures of the City

Theodoros Kolokotronis, known as the “Old Man of the Morea,” is the most prominent historical figure associated with the city. He was renowned for his strategic genius and played a leading role in key battles, such as the Battle of Valtetsi, the Fall of Tripolitsa, and the Battle of Dervenakia.



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Nikitas Stamatelopoulos, known as Nikitaras, fought in the Battles of Valtetsi and Doliana, which boosted Greek morale and paved the way for the capture of Tripolitsa.

The Sekkeris brothers made significant contributions to the Filiki Eteria, played an active role in the Greek War of Independence, and devoted their entire fortune to the cause (Notable Figures of the Revolution – Arcadian Fighters, n.d.).

The Spetseropoulos brothers are also important personalities. They oversaw the iconography of the Metropolitan Church of Saint Basil and donated 100,000 Swiss francs for the purchase and installation of the church’s clock, which is still in operation today (Matoula Tomara-Sideri, 2024).

In modern times, Kostas Karyotakis, poet and prose writer, stands out as the leading voice of modern lyrical poetry in Greece.

In the field of visual arts, Dimitris Kouros left his mark in painting and sculpture, with dozens of exhibitions in Greece and abroad. He also created the Monument of Asia Minor Hellenism, located in the Refugees of Asia Minor Square in the Filikon neighborhood (Wikipedia, n.d.).

Another prominent figure from Tripoli is architect and artist Dimitrios Talaganis, who created many notable works, including the pastoral staff of Ecumenical Patriarch Bartholomew, the commemorative items for the Athens 2004 Olympic Bid Committee, and the Olympic Truce Disc.

In sports, Nikolaos Georgantas distinguished himself as an Olympian in discus throw, winning medals at the 1904 Olympic Games in St. Louis, USA, and at the 1906 Intercalated Games in Athens.

In politics, Ioannis Malliaropoulos, a physician and politician who lived in Tripoli, is noteworthy for donating the Malliaropouleio Theater and the War Museum to the Municipality of Tripoli.

### Identity Catalysts of the City

The identity catalysts of Tripoli have shaped—and continue to shape—the city’s character.

The local cuisine and traditional recipes always win over visitors. Regional specialties include rooster with *hilopites* (traditional pasta), salted pork with eggs (*kagianas*), wild boar, traditional pies, pork with celery, and *trahanas* (fermented grain soup) (*Kratimenou, 2019*).

Tripoli is also renowned for its PDO feta cheese, known for its unique combination of sweet flavor with spicy undertones—features that make it stand out and render it a true identity catalyst for the city.

Another PDO product of the region is the “Delicious Pilafa” apples of Tripoli, cultivated exclusively on the fertile plateaus surrounding the city and widely recognized for their quality.

The climate of the region plays a significant role in the production of these local products. It is itself considered an identity catalyst, as Tripoli ranks among the cities with the lowest temperatures in Greece during the winter months.

The statue of Kolokotronis, standing prominently in Areos Square, is deeply associated with Tripoli and is the city’s most iconic symbol. Kolokotronis’ recognizable figure, depicted in a heroic stance, remains etched in the memory of visitors.

One of the most characteristic associations with Tripoli is Asteras Tripolis, the city’s most prominent football club, with a rich history and numerous distinctions and titles.

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### Surrounding Area of the City

The city of Tripoli is the hub of commercial, economic, and administrative activities in the Arcadia region and plays a key role in both local and regional development.

A modern road network connects Tripoli with Athens as well as with the urban centers of neighboring municipalities and regional units (*Tzerefos, 2021*).

The Municipality of Tripoli consists of 8 Municipal Units, divided into 1 Municipal Community, 79 Local Communities, and 110 Settlements (*Municipality of Tripoli, 2010*).

Tripoli is located to the east of Mount Mainalo at an elevation of 665 meters above sea level.

A major contributor to the city's development is the Industrial Area of Tripoli (Β.Π.Ε.), situated northeast and very close to the urban center. It is considered the closest industrial area to Athens and hosts industries and small manufacturing units from various and diverse sectors (*Arcadia Regional Development Fund, n.d.*).

Tripoli contains several peri-urban forests within its limits. The most important include the Epano Chrepa Forest, the Saint George Grove on the northern outskirts of the city, the Mai-Thanasis Hill woods, the Kartsova Grove, the area surrounding the chapel of Saint Elias, and the Panarkadian Hospital Forest.

The mountainous terrain and green spaces blend harmoniously with the Arcadian or Mantinian Plateau—a fertile, alluvial plain. The plateau is largely occupied by cultivated fields, pastures, vineyards, and more.

A short distance from Tripoli lies the Natura 2000 protected area of Lake Taka, one of the most significant inland wetlands in the Peloponnese.

### Institutional Framework for the Protection of the City

Although Tripoli is not classified as a traditional or historical settlement and does not include any UNESCO monuments, it has a significant number of listed buildings protected by the Ministry of Environment and Energy.

According to Article 24 of the Greek Constitution, the cultural environment and the monuments of architectural heritage—such as listed buildings—are under special state protection. This means that the state is obligated to adopt specific legislative measures to ensure their ongoing preservation.

Additionally, the city's surrounding area includes several NATURA 2000 zones.

The European Ecological Network NATURA 2000 is a network of protected natural areas across the European Union. Its aim is to ensure the long-term conservation of Europe's most valuable and threatened species and habitats at a satisfactory level.

Within the Municipality of Tripoli, there are four NATURA 2000 protected areas, Mount Mainalo, Lake Taka, the Artemisio and Lyrkeio mountains and Mount Oligyrtos.

### The City's Economy

Tripoli serves as the core of all commercial, economic, and administrative activities in the entire Peloponnese Region.

Within the Municipality of Tripoli, the tertiary sector dominates with a share of 67%, followed by the secondary sector at 20%, and the primary sector at 13%.

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Tripoli's role and its corresponding functions make it a hub for various tertiary sector activities, such as services, commerce, education, and public administration.

In the secondary sector, key contributions come from investments, energy-related activities, and the construction industry.

A special mention should be made of the Tripoli Industrial Zone (VI.PE.), which is evolving into a pharmaceutical production hub. Two major pharmaceutical companies are investing in the area, with DEMO leading the way through an ambitious investment plan worth €356 million.

The new pharmaceutical units are expected to create more than 600 direct jobs and are projected to cover 30% of the EU's demand for penicillin-based drugs and 37% of the EU's demand for oncology medicines. (Sustainable Urban Development Strategy of Tripoli Municipality, 2024)

Despite Arcadia's regional orientation towards agriculture, the primary sector remains highly limited, due to critical issues such as water scarcity, lack of training for farmers, absence of modern cultivation methods, and more.

Finally, tourism plays an important role in the economic life of the Municipality of Tripoli. The region's main forms of tourism include religious, archaeological, nature-based/ecotourism, winter tourism, wine tourism, and conference tourism.

### **EU-Funded Projects in the City**

In October 2024, the Municipality of Tripoli submitted its Sustainable Urban Development Strategy (SUDS) proposal, structured around three strategic pillars: the transition to improved, sustainable, and resilient infrastructure, the support of the local economic environment, and the promotion of social inclusion and protection. (Tripoli SUDS, 2024)

This proposal is part of the “Peloponnese 2021–2027” Operational Programme, which aims at sustainable, endogenous, and outward-looking development, based on innovation and ensuring spatial and social cohesion.

The “Peloponnese 2021–2027” programme is co-financed by the European Union and the NSRF (ESPA) 2021–2027.

The Municipality of Tripoli has included several projects in the programme, such as the establishment and operation of a supported living facility, aiming to enhance the provision of social and educational support services for vulnerable social groups, particularly persons with disabilities. Continuation of the operation of the Community Center and Mobile Unit in Tripoli. This mechanism combines human resource support to offer a wide range of integrated services promoting social inclusion and employment for vulnerable population groups. A key urban project is the redevelopment of Agios Vasileios Square, with the inclusion of Phase B, which contributes to sustainable mobility by improving pedestrian and disability access, while ensuring mild and safe vehicle transit. Another major initiative is the Open Commercial Center, co-financed by the European Regional Development Fund (ERDF), ESPA 2014–2020, the EPAnEK programme, and the Ministry of Development and Investments. The project includes urban redevelopment actions aimed at creating an aesthetically pleasing network of streets and walkways that connect significant cultural assets and simultaneously promote commercial growth. A social welfare project included in ESPA 2021–2027 is the continuation of the Women's Shelter for victims of violence, offering psychological support and assistance

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with integration into the labor market. In terms of sustainable mobility, an integrated electric bicycle rental system was installed in the city, aiming to reduce car traffic, support public transportation, decrease congestion, and lower environmental and noise pollution. This project was funded by the European Union’s Cohesion Fund. In the health sector, a natural gas network was installed at the Panarkadian Hospital, a project funded by ESPA 2014–2020 (Municipality of Tripoli, 2024).

### Questionnaire

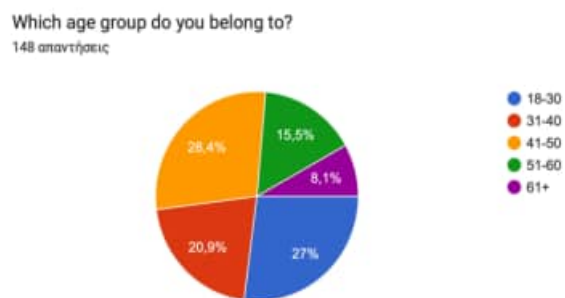


**Chart 1. Age Group of Respondents**

28.4% of the respondents belonged to the 41–50 age group.

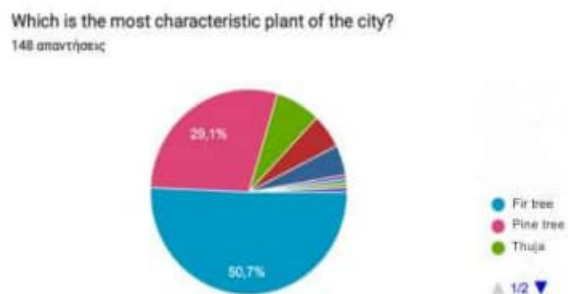


**Chart 2. The Most Characteristic Plant of the City**

50.7% of respondents answered that the fir tree is the most characteristic plant of the city.

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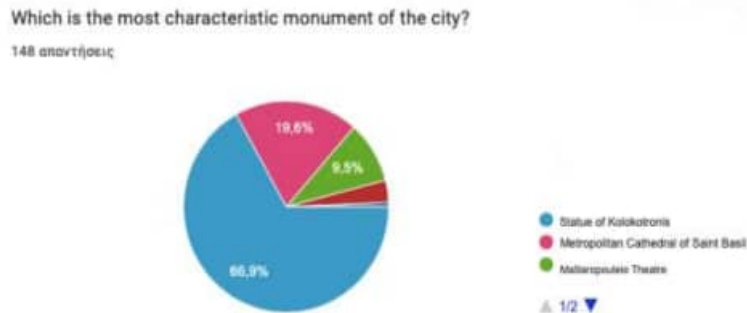


**Chart 3. The Most Characteristic Monument of the City**

66.9% of respondents answered that the most characteristic monument of the city is the Statue of Kolokotronis.

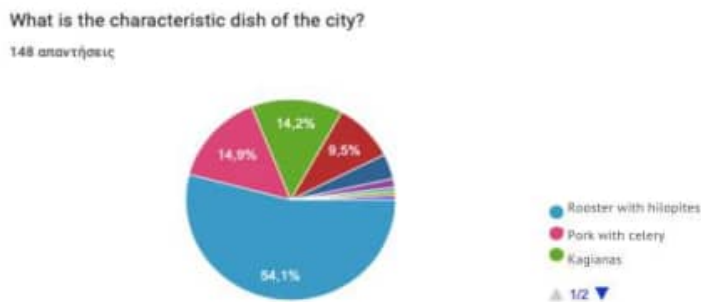


**Chart 4. The Most Characteristic Dish of the City**

54.1% of respondents answered that the most characteristic dish of the city is rooster with hilopites (traditional Greek pasta).

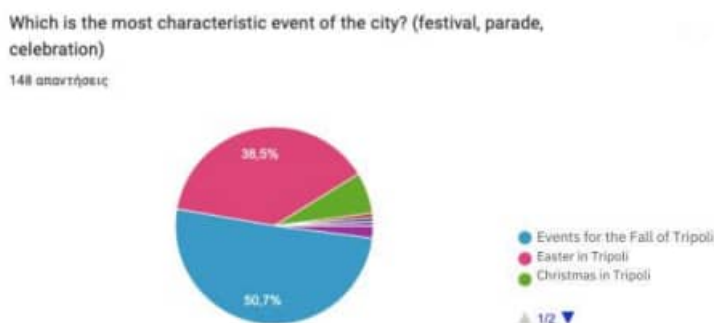


**Chart 5. The Most Characteristic Event of the City**

50.7% of respondents answered that the most characteristic event of the city is the celebrations of the Fall of Tripolitsa.



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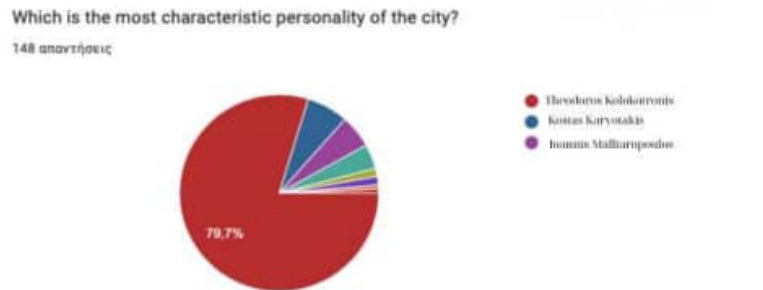


**Chart 6. The most characteristic personality of the city.**

79.7% of respondents answered that the most characteristic personality of the city is Theodoros Kolokotronis.

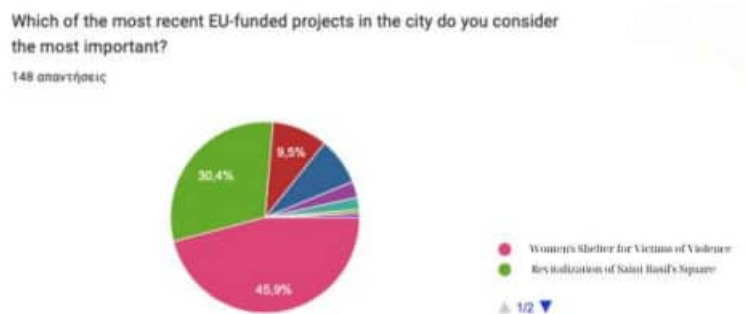


**Chart 7. The most important EU-funded project in the city.**

45.9% of respondents answered that the most important EU-funded project in the city is the shelter for women victims of violence.

## Conclusions

According to the literature review, Tripoli is known for its strategic position during the Greek War of Independence in 1821 and the importance of its historical monuments. The results of the questionnaire indicate that residents and visitors perceive the city in a similar way—that is, they recognize its significance in the history of the Revolution and its strategic location.

The literature review highlights the importance of the city's cultural heritage and traditions. The results of the questionnaire confirm that respondents are aware of and appreciate the cultural heritage, such as traditional foods, local products, and cultural events.

The findings also show that both residents and visitors value the city's architecture and historical monuments, aligning with the literature review. They consider the statue of Kolokotronis as the most iconic landmark.

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Overall, the results of the questionnaire appear to be broadly consistent with the assessments presented in the literature review, particularly regarding the historical and cultural significance of the city.

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### **THE FORMATION OF THE PHYSIOGNOMY OF THE CITY OF KALLITHEA - THE OPINION OF RESIDENTS AND VISITORS**

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#### **Abstract**

The present paper refers to the physiognomy of the city of Kallithea and is a study carried out by the Department of Economics and Sustainable Development of Harokopio University. The aim is to investigate the factors that contribute to the formation of this physiognomy and the opinion of residents and visitors on the issues in question. As a case study, the city of Kallithea of the Region of Attica is chosen.

In order to answer the main questions of the work and to investigate the main factors that shape the physiognomy of the city of Kallithea a survey was carried out aimed at the residents and visitors of the city. For the needs of the research, a questionnaire was created which included ten (10) closed-type structured response questions, was anonymous and distributed to 140 people. The research was carried out in the months of October and November 2024. The questionnaire was addressed exclusively to adults.

The paper concludes with interesting conclusions and proposals. An important conclusion is that in order to protect the special physiognomy of the city of Kallithea strategies related to the more general protection of all issues related to its sustainable development should be implemented. It is proposed that both the local government, as well as the businesses of all service and production branches, work towards the protection and highlighting of the special character of the city of Kallithea.

**Key words:** Physiognomy of the city, sustainable development, Kallithea

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# AN ONLINE PLATFORM FOR ENABLING OPEN DATA COLLECTION, STORAGE, ANALYSIS AND CLASSIFICATION OF WATER MANAGEMENT DATA FOR THE ATTICA REGION IN GREECE

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## **Abstract**

Water resource management is considered critical in an era where the specific resource is becoming increasingly scarce due to population growth, over-usage, changing weather patterns and climate conditions. The existence of detailed and concentrated data regarding its usage is predominantly needed in order to perform research, guide relevant policies and necessary management and planning.

The present paper aims at designing and implementing a backbone platform that may be used to gather, store, analyze, categorize and display relevant data to be used in understanding water consumption and availability patterns. The data refer to water availability in reservoirs, water production statistics, temperature and precipitation as well as supply network failures in the Attica region of Greece. To this end, it makes use of open data sources (eydap.gr, the main authority responsible for water supply in the Greek capital and surrounding areas, open-meteo.com for weather and precipitation conditions, as well as 3 services for geocoding and mapping- namely geodata.gov.gr, openstreetmap and geoapify).

The developed platform is able to retrieve historical data, as well as implement complex automated workflows for the daily update of these data from their sources. It is also able to parameterize the views and display of data based on user-needed configurations, in order to support a more fine grained and tailored analysis. Clustering is performed in order to create relevant categories in data ranges as well as classify observed values. Data acquisition is performed both in a typical web-based user friendly interface as well as through offering the

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same functionalities through a backend REST API that may be used to programmatically interact with it and submit filtering queries. Therefore it can support researchers in finding concentrated data for their studies through a single access point, as well as export that data for further analysis.

**Key words:** Water management, digital platform, open data, policy making, REST API, data analysis, clustering

### 1. Introduction

Water resources are becoming scarce around the world, either due to overutilization or change in climate patterns and conditions. The drive to invest further in relevant infrastructures and/or suitable water management schemes needs to be complemented by the appropriate baseline data that can inform decision-makers to prioritize actions and policies. One of the benefits of the modern era is the abundance of sensing devices, monitoring systems as well as data sources that can provide such a baseline. However in most cases these systems are fragmented and diverse, thus making it difficult to aggregate, analyze and distribute them to all relevant stakeholders.

Different data models, different interfaces, as well as different levels of information, create challenges to the data collection process, or the mapping of similar information based on different granularities and features of the data. For example, geographic location may be given in one case as GPS coordinates, in another as street names and in another at municipality level. Furthermore, filtering and exposure of that data from remote locations, based on researcher or policy maker needs is required in order to exploit their full potential. Thus exposing them through a set of RESTful services i.e., a web-based way to filter and retrieve data subsets, is necessary.

The aim of this research is to present the development of such a platform that collects, analyzes and stores all relevant data for the city of Athens. To this end it collects open data from the main water authority of Athens (EYDAP), regarding consumption of water and status of reservoirs, weather data from an extended area around these locations, as well as information on water distribution disruptions due to technical reasons (e.g. broken water pipes). The latter is needed in an effort to understand and prioritize areas with frequent such disruptions, in order to save water waste. Further analysis is conducted at reservoir levels, applying a classification scheme based on the available historical data, in order to understand the comparative status of them. The implementation of the platform is an open source project available through its github repository<sup>130</sup>. It has also been deployed and is accessible for end users<sup>131</sup>.

The paper proceeds as follows. In Chapter 2, related work is presented, while in Chapter 3 the methodology of data collection and transformation is given. Chapter 4 describes the

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<sup>130</sup> <https://github.com/giannisclipper/water-reserves>

<sup>131</sup> <https://water.ditapps.hua.gr/>



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inner system architecture as well as the data serving mechanisms, while Chapter 5 presents the front-end (data presentation) as well as the analysis mechanisms for the classification of water levels and municipality disruptions. Finally Chapter 6 gives the final conclusions.

## 2. Related Work

Existing research highlights the critical role of digital platforms in advancing water resource management through open data collection, storage, and analysis (Horsburgh et al 2025). Cosgrove and Loucks (2015) discuss the pressing challenges in water management, particularly issues related to data accessibility, integration, and the need for robust decision-support systems. They emphasize the necessity of technological advancements to enhance data-sharing mechanisms and support evidence-based decision-making. Complementing this perspective, Delipetrev et al. (2014) present the development of a web-based application utilizing open-source software for water resource management, demonstrating the feasibility of real-time data access, modeling, and decision support in hydrological systems. Drost et al. (2022) present an automated event driven monitoring system exploiting satellite data, based on open source software. Only recently, Horsburgh et al (2025) recognizing the significance of such an infrastructure for decision-makers, made an attempt to develop an application for data acquisition and curation in a US application, highlighting the potential of such applications to minimize technological challenges decision-makers might face, given that several of the data repositories require data management expertise.

Several web-based platforms highlight the role of digital technologies in water management. WaterApp<sup>132</sup> enables real-time monitoring through IoT, while Utilios<sup>133</sup> provides insights into top water management software. WebbyLab<sup>134</sup> explores IoT applications for smart water monitoring, and FREEWAT<sup>135</sup>, based on AkvaGIS from Criollo et al. (2019), offers an open-source GIS-based tool for groundwater management and classification in Belgium, while HydroShare (Horsburgh et al 2025) develops a similar application for the US. These platforms demonstrate the importance of digital innovation and data-driven decision-making, aligning with the need for an advanced online system for water data collection, storage, and analysis.

## 3. Methodology

The designed platform collects, stores and analyzes data concerning the water reserves and the water supply of Athens. As Figure 3.1 shows, the data of interest are about the remaining quantities in the water reservoirs, the quantities of the drinking water production, precipitation and temperature measurements, the water supply interruptions as well as their distribution

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<sup>132</sup> <https://waterapp.in/>

<sup>133</sup> <https://utilios.io/best-water-management-software/>

<sup>134</sup> <https://webbylab.com/blog/iot-in-water-management/>

<sup>135</sup> <http://www.freewat.eu/>

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over the municipalities. Moreover, the platform provides the collected data to other systems through a REST API or to end-users through a graphical UI.

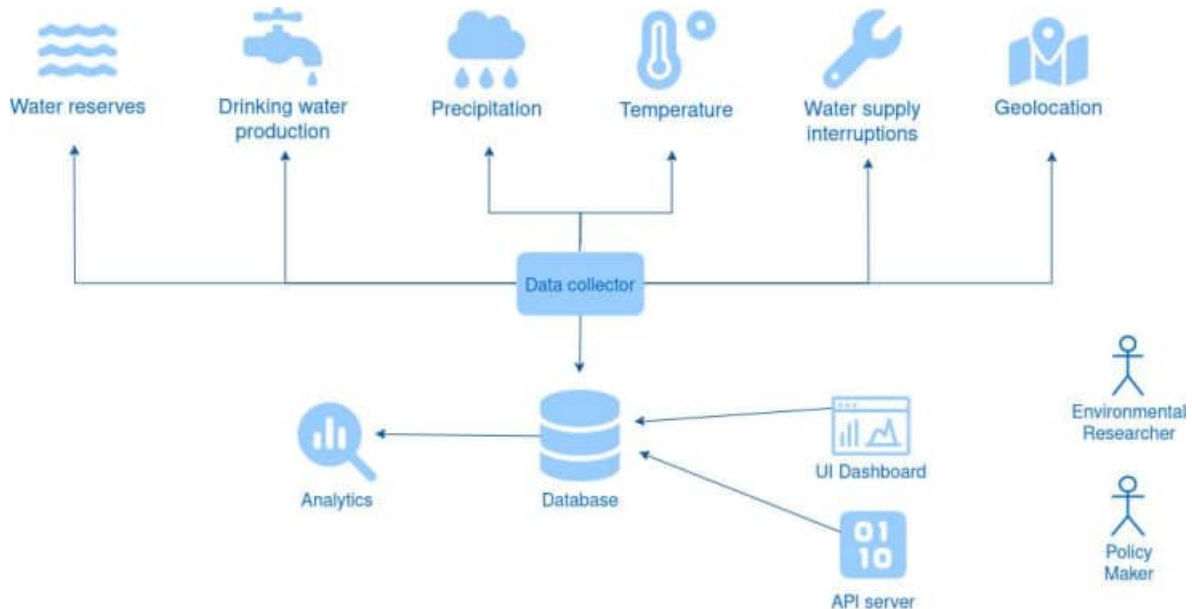


*Figure 3.1. An overview of the platform functionality*

### Data sources

Different datasets are created and maintained by the platform facilitating various data views and a better insight of the water reserves and the water supply of Athens. While the data is acquired from external data sources, transformation processes are required to make them coherent and usable. A DB schema has been designed ensuring data integrity and processing efficiency. The collected data is checked for missing, inconsistent or inaccurate values, and they are cleaned and transformed to follow the DB schema, the table relations and the data types. The transformed data is finally stored in the DB and becomes available for analysis, filtering and illustrations.

### Water data acquisition

EYDAP<sup>136</sup> is the main authority responsible for water supply in the Greek capital and surrounding areas. The company uses raw water mainly from four surface water resources, the lakes of Marathonas, Yliki, Mornos and Evinos, while some more underground water resources are used for backup purposes (EYDAP, 2024a). Furthermore, the company operates four water treatment plants located in Galatsi, Acharnes, Polydendri and Aspropyrgos (EYDAP, 2024b) in order to make the raw water drinkable.

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<sup>136</sup> <https://www.eydap.gr>

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On an almost daily basis, the water quantities remaining in the four main reservoirs as well as the drinking water quantities produced from the four water treatment plants, are reported through the official website of EYDAP. All the daily values for the water reserves since 1985 and for the drinking water production since 1996, are available on this website. The users can reach them as HTML outputs by specifying a time range of interest (a single day, a week, a month or a year). The outputs are shaped as tables of values, containing the date, the apart quantities (per reservoir or per treatment plant accordingly) and the sum of the quantities.

After a calendar month is completed, EYDAP makes the data available through its open data hub<sup>137</sup> as well. The users can specify a time range of interest (a sequence of months). The result is an HTML output shaped as a list of values but can also be downloaded as a CSV file. However there is no offering of a programmatic way (e.g. REST API) to download these files on demand based on an easy programmable interface.

Additionally the company reports the water supply interruption events through this open data hub, within a few months delay since they were encountered. There are available interruption events from 2021. In a way similar to the water reserves or drinking water production, the users can specify a time range of interest (a sequence of months) and get the result as an HTML output shaped as a list of interruption events. An interruption event is described by the date when it was encountered and the address (a crossroad and a neighborhood) where the water supply network was disrupted and repaired. The output can also be downloaded as a CSV file.

The website and the open data hub of EYDAP, constitute the most essential data source for the platform, which utilizes all the historical data and automatically incorporates the new updates concerning the water reserves, the drinking water production and the water supply interruptions.

### ***Weather data acquisition***

A second important data source is the open-meteo.com, an open-source weather API offering free access for non-commercial use. It provides weather measurements for almost any place around the world and for a long time in the past. It follows the style of a typical REST API, it receives requests in the form of URLs with differentiated endpoints and query parameters, and it responds in JSON format.

The created platform utilizes open-meteo to collect daily precipitation and temperature measurements for eight cities located in Central Greece (Athens, Amfissa, Chalkida, Karpenisi, Lamia, Livadeia, Thiva, Agrinio), the wider area where the water reservoirs of EYDAP are located too. The platform has collected all the daily precipitation and temperature measurements for these cities since 1985 and goes on checking and getting new updates daily.

### **Data Extract-Transform-Load Approach**

One of the most critical processes in the envisioned system is the Extract-Transform-Load (ETL) process responsible for acquiring and ingesting the diverse data in the unified data

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<sup>137</sup> <https://opendata.eydap.gr/>

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model of our system. The variables already mentioned (water reserves, drinking water production, precipitation and temperature measurements, water supply interruptions) are tracked on a daily basis. The datasets are updated in time order without duplicated or missing dates. The values are incorporated respecting the DB schema, the table relations and the data types. Although it is very infrequent, some values may be missing or invalid regarding the water reserves and the drinking water production. In such cases, the values are considered the same as the ones of the previous date, due to the slight daily change of these variables. As an example, Figure 3.2 illustrates the transformation of the water reserves data, originating from HTML documents, stored in SQL DB tables and provided in JSON format.

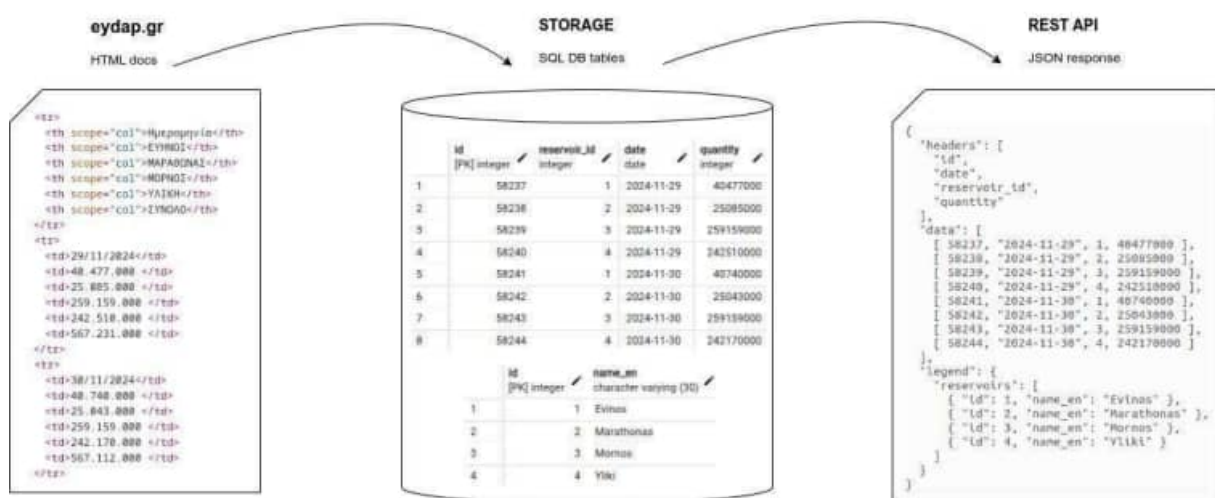


*Figure 3.2. The transformation of the water reserves data, originating from HTML documents, stored in SQL DB tables and provided in JSON format.*

Additional services and resources are used for the geospatial analysis of the water supply interruptions, which are very common in the region of Attica and for which any kind of organized information service would significantly improve local and regional management. At first, the platform utilizes [openstreetmap.com](https://openstreetmap.com), the well known online map, which is free to use under an open license. It is used for map representations of the municipalities of greater Athens. Then, [geodata.gov.gr](https://geodata.gov.gr) which hosts open geospatial datasets from public sector organizations. It has provided the boundaries of the municipalities as bounding boxes of geographical coordinates.

Moreover, two geolocation services, [nominatim.org](https://nominatim.org) and [geoapify.com](https://geoapify.com), are used for the classification of raw text addresses describing crossroads and neighborhoods into different municipalities. Nominatim is an open source project using OpenStreetMap data to search and find locations on earth and for the same purpose Geoapify is a commercial API providing a free tier. In most cases the use of Nominatim is enough to identify the municipality from a given address, but due to no strict format or notation of the addresses, the use of the second geolocation service was adopted to maximize the accuracy of matching the addresses to the municipalities. This process is needed since we considered that an analysis at the level of municipalities would be a desired level for policy makers to understand the status of the

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supply network and target investments. However, other means of grouping are not excluded by the organization of the data.



*Figure 3.3. The steps of converting between crossroads and municipalities.*

Figure 3.3 illustrates the steps of converting between crossroads and municipalities. It follows a detailed description of this process:

- Each one of the water supply interruptions given by EYDAP, is described including the address that it took place. e.g. "Bulgari and Tsamadou" KASTELLA
- The program needs to find a pair of geographical coordinates (latitude, longitude) representing the address of the water supply interruption. The two geolocation APIs (Nominatim, Geoapify) that the platform is powered by, do not respond well to queries describing crossroads. So the crossroads have to be split.
- A typical form ("road A & road B" AREA) is followed in the very most of the cases, but it is not a strict pattern. Sometimes the program is obliged to deal with differences in syntax or the presence of explanatory remarks. Nevertheless, the program tries to recognize and distinguish two roads and an area. e.g. road A: Bulgari, road B: Tsamadou, area: KASTELLA
- The program composes up to 3 alternative queries trying to identify the corresponding municipality:
  - a) based on road A and area, e.g. Bulgari, KASTELLA, ATTICA, GREECE
  - b) based on road B and area, e.g. Tsamadou, KASTELLA, ATTICA, GREECE
  - c) based on area only, e.g. KASTELLA, ATTICA, GREECE

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- Up to 6 requests (2 APIs x 3 queries) can be performed until some response fulfills all the query address terms. The response also includes the geographical coordinates of interest, e.g.: lat:37.9406, lon:23.6558
- That pair of the geographical coordinates is matched with the geographical polygon that encloses it, identifying consequently the corresponding municipality. For this purpose, a number of geographical polygons defining the boundaries of the municipalities are used. These polygons originate from geodata.gov.gr and they are stored locally in a geojson file for the needs of the platform. For example, the previous pair of coordinates is enclosed in the geographical polygon of Piraeus municipality identified by id: 9205

### Data Analysis

A data analysis is performed to evaluate the new measurements of the water reserves, the drinking water production and the weather variables (precipitation, temperatures). It is a temporal analysis comparing the recent measurements with the historical ones. All the measurements over time are grouped into different clusters through a K-means clustering (Likas et al., 2003). K-means is a widely used clustering method, appropriate to distinguish a number of instances into different sets. This approach was chosen in order to summarize the data in meaningful and easy to interpret information. The clusters are ordered indicating lower to higher measurements. Thus the current value of each metric is classified in one of the available levels (e.g. low, medium, high etc) that are discovered from the historical data in a non-supervised manner.

A geospatial analysis is performed to classify the municipalities regarding how much they are disrupted from interruption events in a similar fashion. The events encountered within municipality areas are taken into account either over sq. kilometers or over thousands of inhabitants. Based on one of these two alternative indexes, the municipalities are grouped into clusters through a K-means clustering. The clusters are ordered indicating lower to higher levels of disruption.

Moreover, a correlation hypothesis was investigated between the precipitation measurements and the water reserves. For this purpose the Pearson and the Spearman correlation coefficients were used to check that hypothesis. The results of all the above appear in Chapter 5.

## 4. System architecture

### Overview

The platform is a distributed system, based on a Three-Tier Client-Server Architecture. As Figure 4.1 represents, the platform consists of three distinct subsystems: a database, a backend application and a frontend application. A multi-tiered architecture encourages the separation of concerns and the modularity of the systems, and offers advantages regarding the



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maintainability of the implementation, the security of the database, the scalability of the deployment, as well as the performance of the applications (Nyabuto et al., 2024).

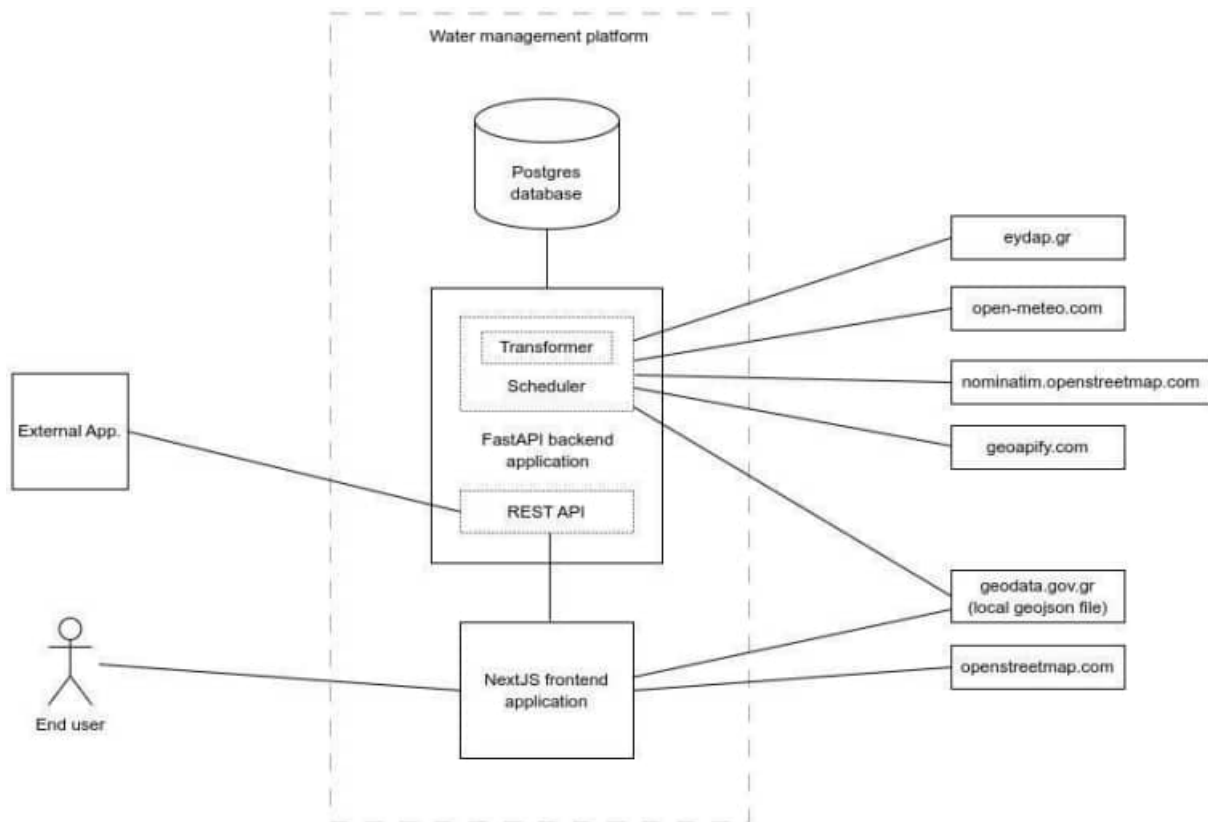


Figure 4.1. The platform as a Three-Tier Client-Server system

The first tier is an SQL database, based on the open source Postgres system. The DB schema is designed to incorporate and organize the data originated from the external sources, in such a way that ensures the integrity as well as the effective and efficient processing of them. A number of main tables are used to store the instances of the different datasets (water reserves, drinking water production, weather measurements, interruption events), while some auxiliary tables are used to codify different entities (water reservoirs, water treatment plants, locations of weather measurements, municipalities) which are included in the data and are useful for filtering and classification purposes.

The second tier of the system is a backend application written in FastAPI, a Python framework. It is designed to collect data from different data sources, as well as to store and analyze them. Additionally to provide them to other applications through a REST API service. The data is collected in various formats (HTML, JSON or CSV) and is transformed while it is incorporated in the platform. This tier implements the various transformation mechanisms that were described in the Methodology section and represented in Figures 3.2 and 3.3.

The third tier of the system, is a frontend application that carries out the interaction with the end users through a graphical interface. It is written in NextJS (a ReactJS framework). Typescript was also adopted in application development, to ensure the cohesion and the

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integrity of the code while it was being extended. Tailwind CSS (a CSS framework) was used for styling purposes, including responsive design to adjust layouts into different screen sizes. The Recharts library was used to create graphical charts and the Leaflet library to create map representations over OpenStreetMap.

### **Acquisition, Transformation and Data Serving Processes**

At the very first time of its execution, the backend application initializes the database with the main body of the historical data (water reserves since 1985, drinking water production since 1996, water supply interruptions since 1985, precipitation and temperatures since 1985, water supply interruptions since 2021). This content has already been collected from the external data sources and stored in local HTML, JSON or CSV files. By retrieving these bulk updates from local files, the backend avoids overloading the data sources with massive requests. Additionally, the installation process is performed much faster.

Since the historical data has been loaded, the backend undertakes to communicate with the data sources on a daily basis, to check for possible new updates and to retrieve the new data whenever it exists. This operation is performed by five different schedulers running periodically. The four of them are used to check and retrieve updates, each one concerning a different dataset (water reserves, drinking water production, weather measurements, water supply interruptions). Figure 4.2 represents the typical flowchart of these procedures. The fifth one is used for geolocation purposes, to match the new water supply interruption events with the municipalities. Figure 4.3 represents the flowchart of that procedure. From a technical aspect, the schedulers have been developed to run in different threads, for not disturbing other backend operations with excessive delays during the updating processes.

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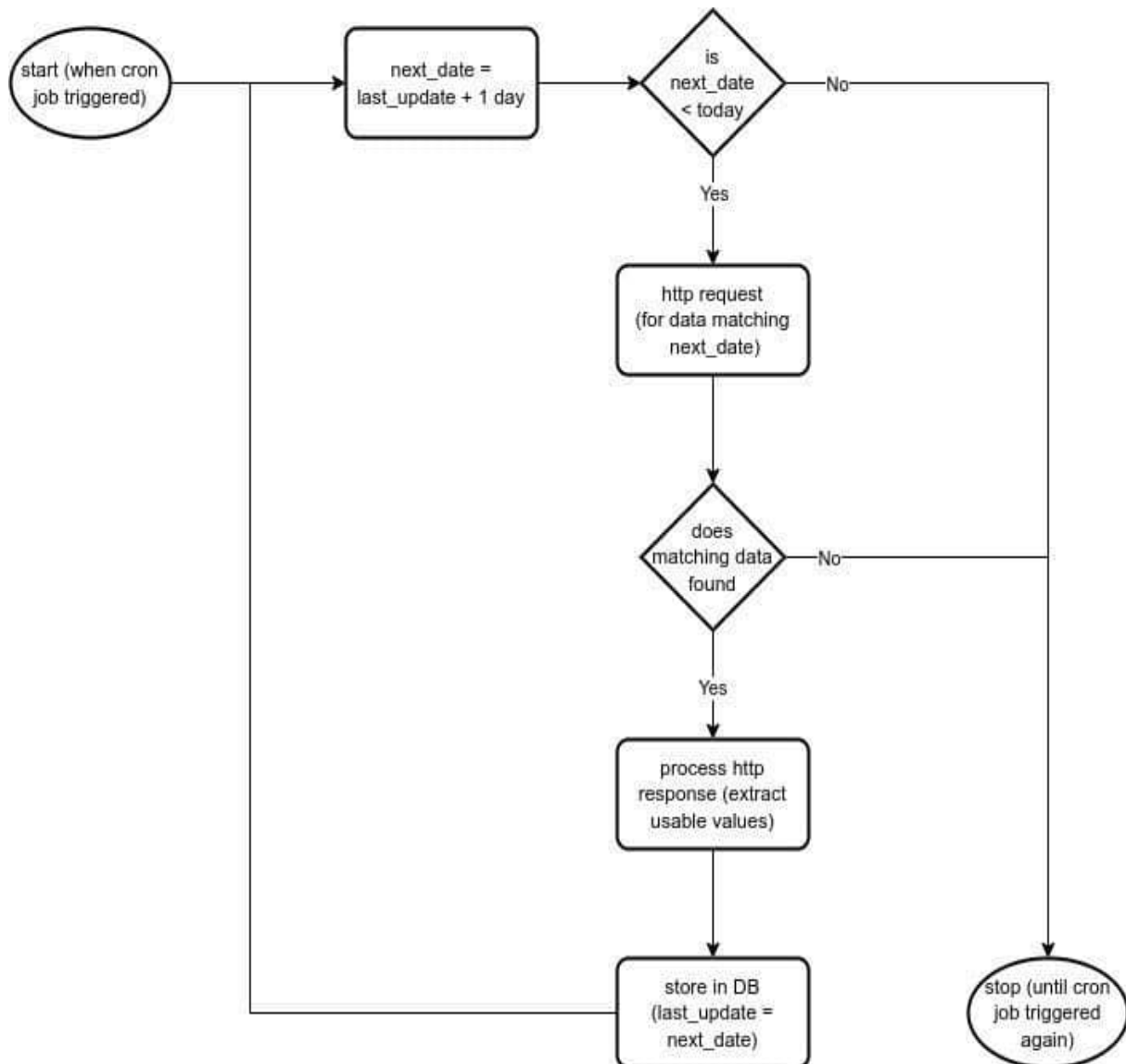


*Figure 4.2. Retrieving new updates from the data sources*

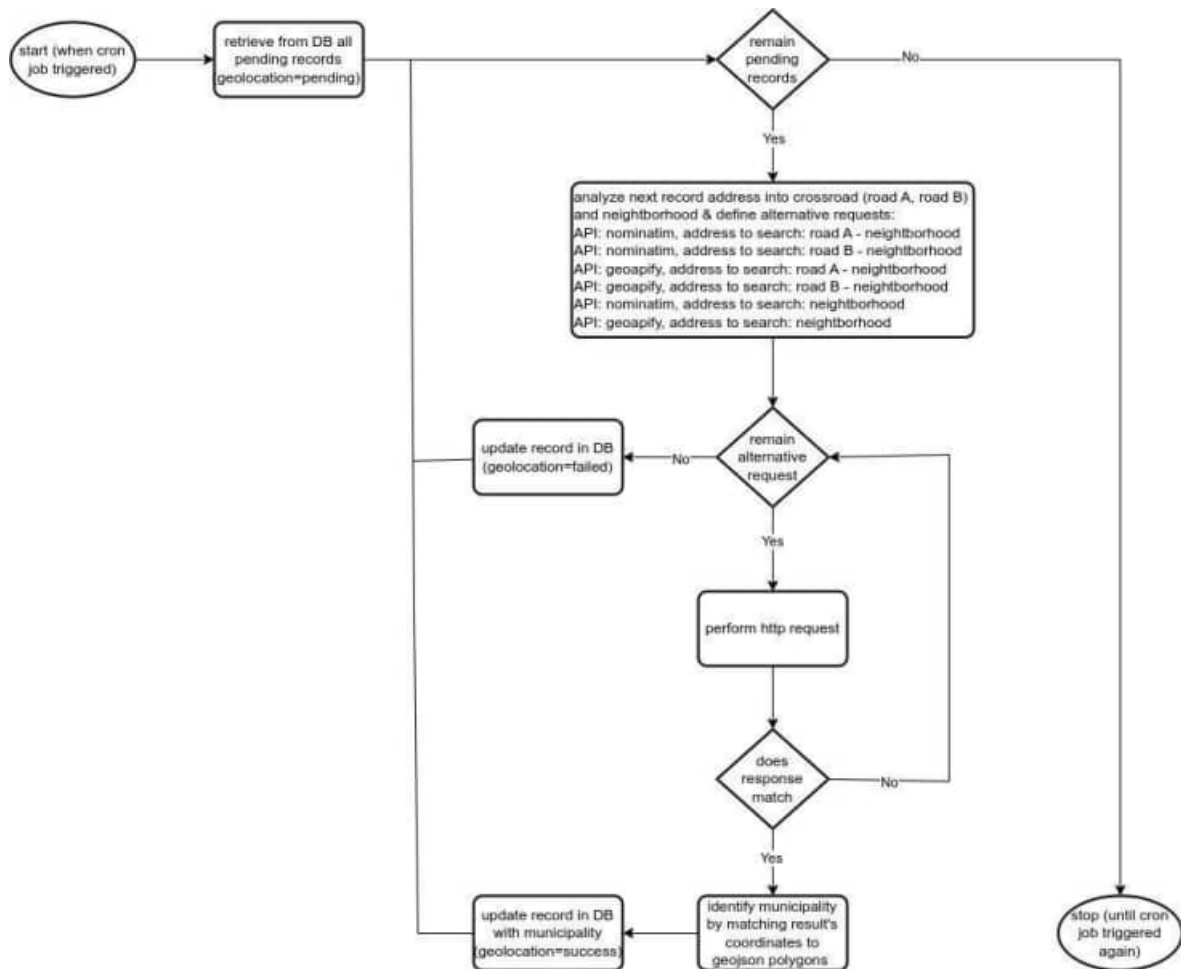


Figure 4.3. Matching water supply interruptions to municipalities

Furthermore, the backend operates as an HTTP server responding to client requests and providing them with data and analysis results. The communication with the clients is based on the principles and the architectural style of the REST API, which is qualified for network-based systems emphasizing in generality of interfaces, in independent deployment of components, in scalability, caching and reduced interaction latency (Fielding, 2000).

Different URL endpoints are used to serve different data categories and a number of query parameters are used to filter the data and specify the result. Validation checks are also used to ensure the integrity of the requests and the parameter values. The processing of the requests is carried out in asynchronous mode due not to disturb simultaneous requests or other backend operations with excessive delays. The responses are provided in JSON format. Table 4.1 illustrates all the available API endpoints.

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### 5. Results

#### Dashboard presentation

The frontend application that carries out the interaction with the end-users, makes use of the data and the analysis that are available through the backend’s REST API. It is also equipped with more features to address the needs of the end users, such as the graphical interface making the interaction between the users and the system easier, the charts illustrations and the map representations making the outputs more comprehensible, the options of downloading the outputs as PNG or CSV files for further processing, the options of getting unique URLs to reproduce or share specific data views.

*Table 4.1. The available API endpoints*

| Method | Endpoint                                                        | Description                               | Response |
|--------|-----------------------------------------------------------------|-------------------------------------------|----------|
| GET    | /api/v1/docs                                                    | API documentation (swagger-ui)            | HTML     |
| GET    | /api/v1/status                                                  | Gets the current values of the values     | JSON     |
| GET    | /api/v1/reservoirs?id=...                                       | Gets the water reservoirs                 | JSON     |
| GET    | /api/v1/savings?time_range=2000,2023&time_aggregation=...       | Selects water reserves data               | JSON     |
| GET    | /api/v1/factories?id=...                                        | Gets the water treatment plants           | JSON     |
| GET    | /api/v1/production?time_range=2000,2023&time_aggregation=...    | Selects drinking water production data    | JSON     |
| GET    | /api/v1/locations?id=...                                        | Gets the weather measurement locations    | JSON     |
| GET    | /api/v1/weather?time_range=2000,2023&time_aggregation=...       | Selects precipitation & temperature data  | JSON     |
| GET    | /api/v1/municipalities?id=...                                   | Gets the municipalities of greater Athens | JSON     |
| GET    | /api/v1/interruptions?time_range=2000,2023&time_aggregation=... | Selects water supply interruptions data   | JSON     |

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For this reason of reproducing and sharing specific views, the frontend application does not follow the single-page-application logic. Page URLs are composed of diverse endpoints and query parameters leading to different pages with content specified by the parameter values.

One of the pages is designed to illustrate the current status of the system, informing about the most recent updates of the variables and the evaluation of them compared to the historical data (Figure 5.1). It is actually a dashboard illustrating four variables -the water reserves, the drinking water production, the sum of the precipitation measurements and the temperature measurements (min, mean, max) in Athens. All these four layouts have the same structure, at top the users are informed when was the last update of the variables and what was the exact value. In the middle is shown the trend of the 30 most recent values. And at the bottom is indicated the evaluation score of the recent values compared to the historical data.

The other pages correspond to the different datasets (water reserves, drinking water production, precipitation, temperatures, water supply interruptions). In these pages the users can set parameters in order to filter the data and specify the exact output. Through these parameters, various preferences can be specified, such as time periods (years, months, dates), entities (water reservoirs, water treatment plants, locations, municipalities), aggregations (time, entity), computations (mean, sum).

The requested data are represented both as graphical charts (Figure 5.2) and as tables of raw values (Figure 5.3). A number of icon tools accompany these representations and users can change the type of chart output (line, area or bar charts are available), can download the outputs as image file (PNG) or as text file (CSV) or can get URLs to reproduce and share the whole page output or just a single chart or the table of values.

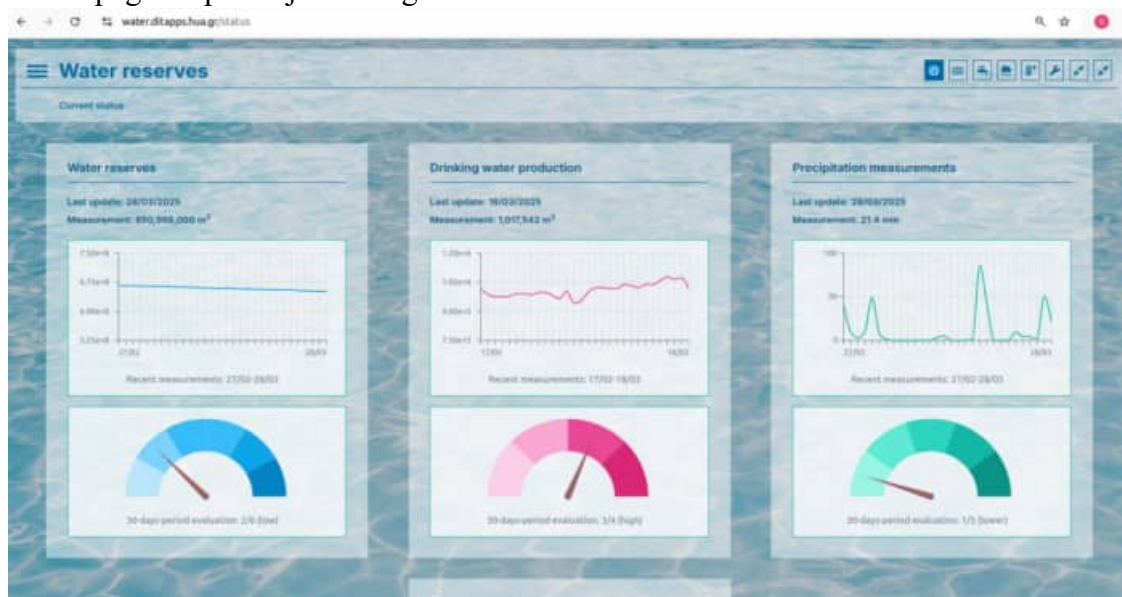


*Figure 5.1. The dashboard with the most recent values of the variables and their evaluation.*



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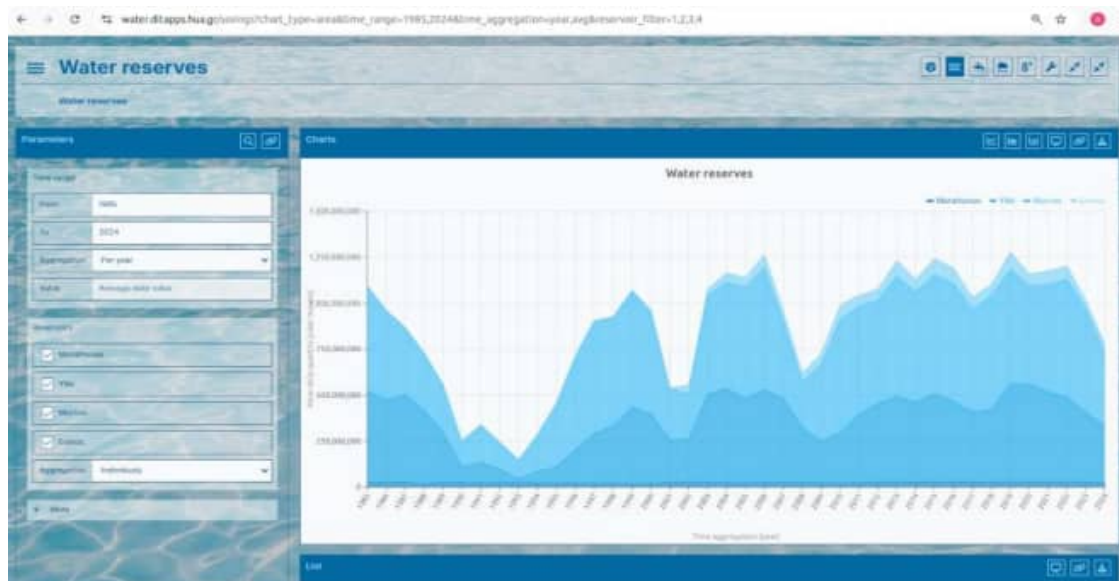


Figure 5.2. The water reserves per year are illustrated as an area chart.

Furthermore the page of the water supply interruptions includes the geospatial analysis of the interruption events. It is illustrated as an interactive map of the greater Athens where the municipalities are drawn from cold to warm colors regarding how much they were disrupted from the interruptions, based on the output of the k-means clustering classification. There are available two analysis alternatives. The one is based on the municipality area taking into account how many events are encountered per sq. km (Figure 5.4). The other is based on the municipality population taking into account how many events are encountered per 1000 inhabitants (Figure 5.5).

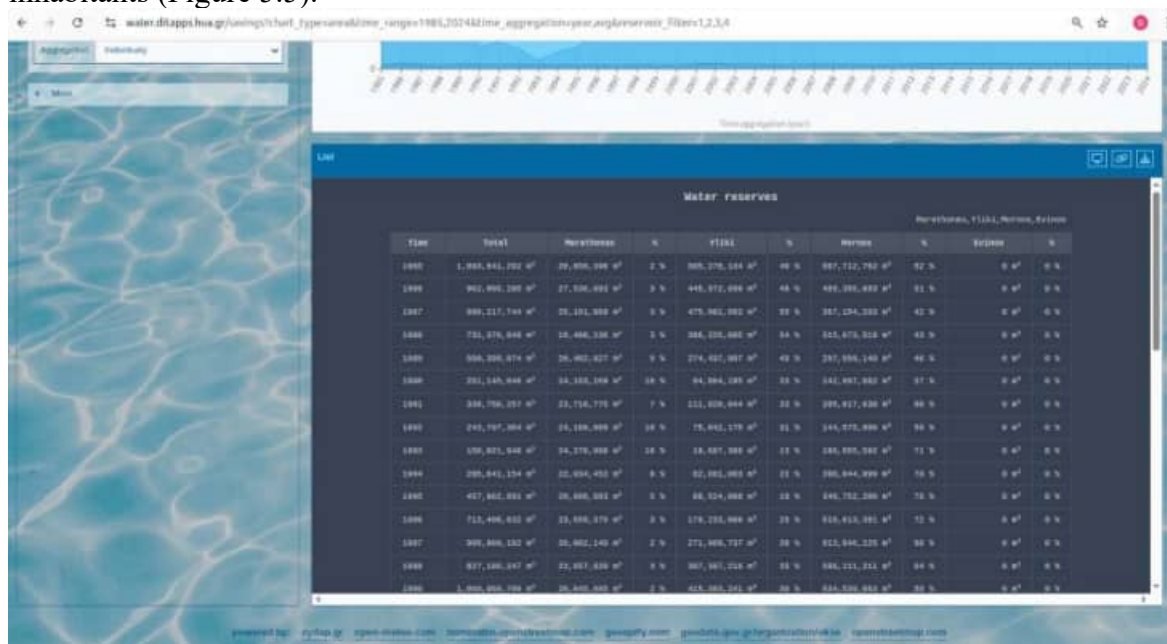


Figure 5.3. The water reserves per year are provided as a table of values .

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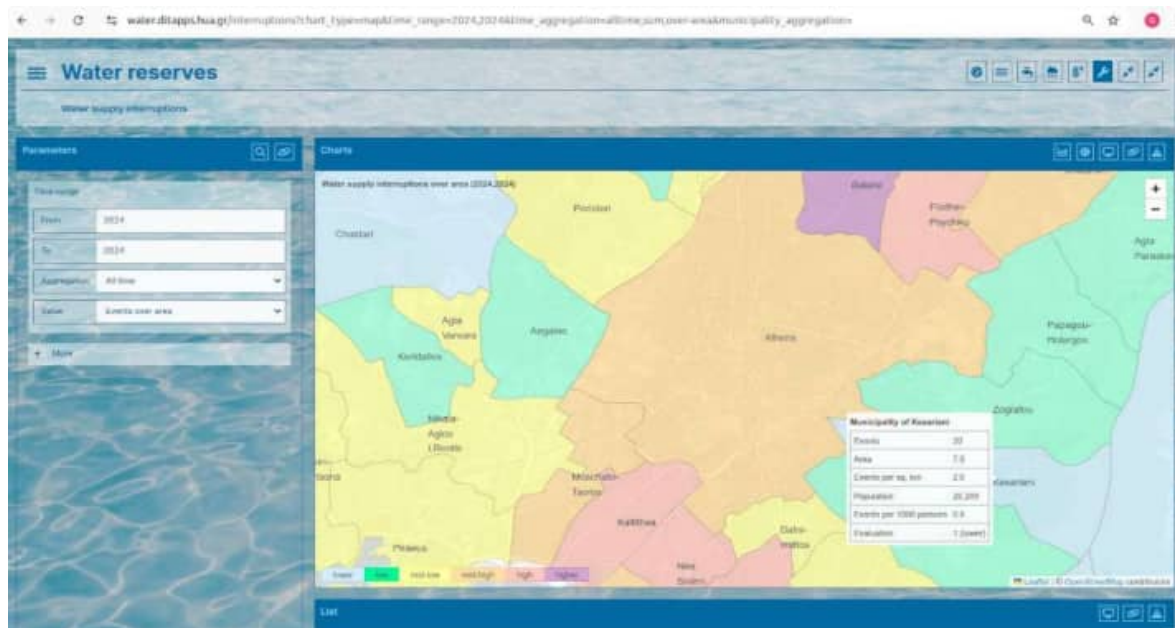


*Figure 5.4. The distribution of the water supply interruptions among the municipalities (events per sq. km)*

### Data analysis on the acquired data

#### Clustering water reserve levels, water production and weather indexes

The recent values of the variables are evaluated compared to the historical data. Actually it is about 30-days-period comparisons in order to avoid possible single-day outliers. So, the average of the 30 most recent values of each variable is compared with the averages of the same 30-days-periods of the previous years. The K-means clustering algorithm is used, in order for these comparisons to be carried out.

Every single cluster is defined by a centroid value automatically estimated by the algorithm in an unsupervised learning manner. The instances are assigned to the set with the nearest centroid to them (Oti et al., 2021). For our purposes here, a K-means clustering is applied to group and classify all those averages across the years. The sets, or so-called clusters, correspond to different levels of values. Afterwards they are represented as a rating scale from lower to higher points.

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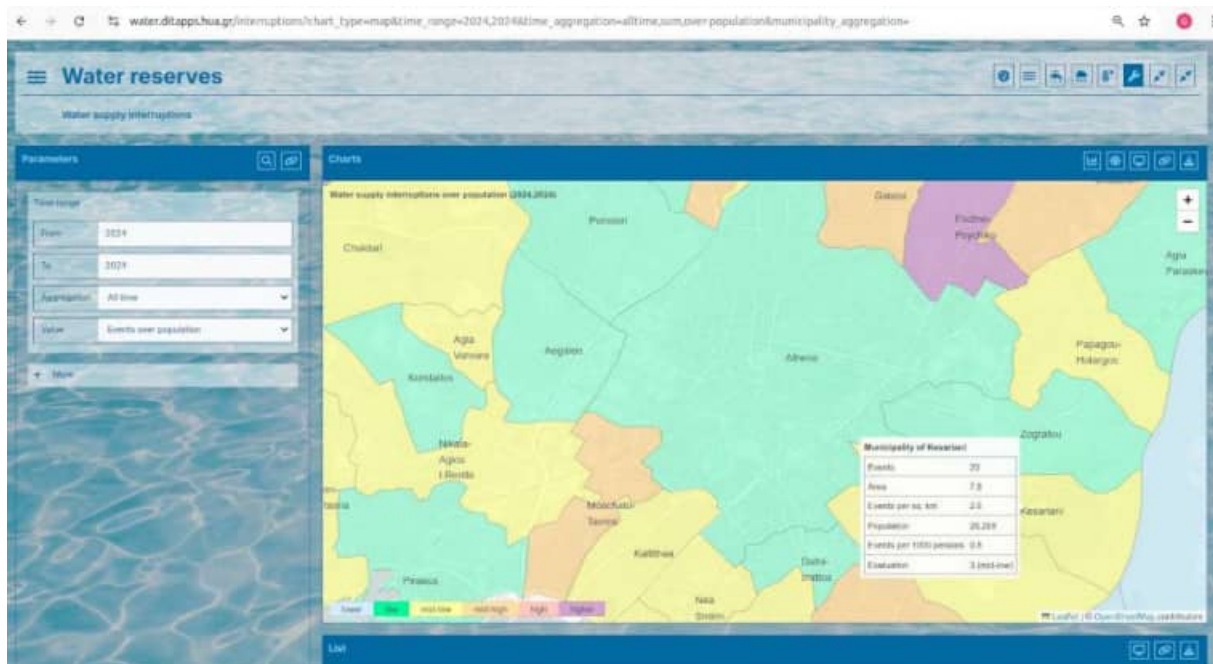


*Figure 5.5. The distribution of the water supply interruptions among the municipalities (events per 1000 inhabitants)*

The number of the clusters and consequently the length of the rating scale was a question. The representation of a very short scale could be naive and meaningless, on the other hand a quite long scale could seem too confusing. Intuitively, a five-point rating scale seemed to be appropriate.

Additionally, the Elbow and Silhouette methods were applied to check how well different numbers of clusters fit to the different datasets. The Elbow method measures the cluster cohesion, how closely related are the instances within their cluster, while the Silhouette takes into account not only the cluster cohesion but also how separated the clusters are between each other (Saputra et al., 2020). Finally, a four, a five or a six-point rating scale was adopted considering each specific dataset of the four.

For example, Figure 5.6 shows the scores of Elbow and Silhouette methods applied to the water reserves data. A number of six clusters was adopted for that dataset, although a number of two or three clusters gets an even better score regarding the Silhouette method. However the number of six clusters hits a good score regarding both methods, as well as it is closer to that intuitively supposed as more appropriate. Moreover, Table 5.1 shows the centroid values of these six clusters and Table 5.2 lists the averages of the daily water reserves per year and the evaluation score of them.

In a similar way, a four-point rating scale was adopted for the drinking water production evaluation, a five-point rating scale for the precipitation evaluation, and a six-point rating scale for the temperature evaluation.

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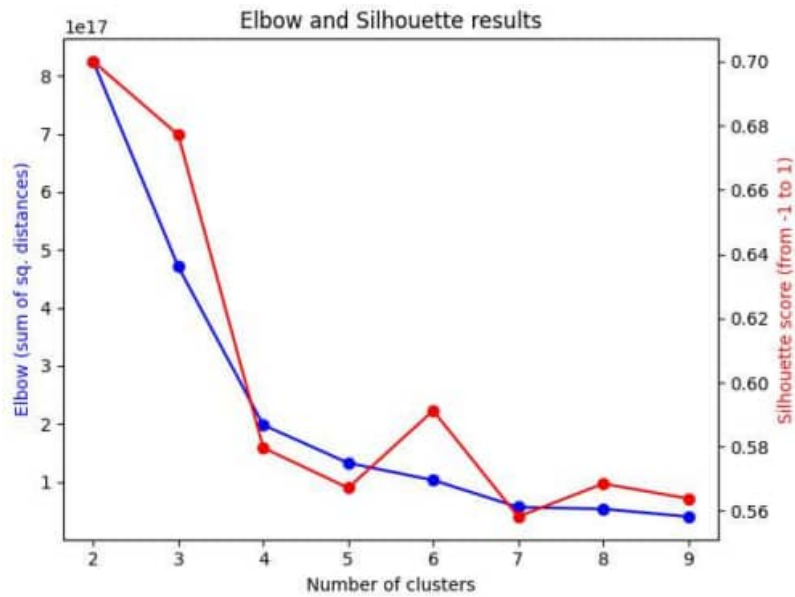


Figure 5.6. The results of Elbow and Silhouette methods applied to water reserves data

Table 5.1. The centroids and the labels regarding the water reserves evaluation

|                             |             |             |             |               |               |               |
|-----------------------------|-------------|-------------|-------------|---------------|---------------|---------------|
| Centroids (m <sup>3</sup> ) | 254,072,753 | 612,945,583 | 908,215,661 | 1,055,842,615 | 1,166,232,292 | 1,255,070,428 |
| Labels                      | 1 lower     | 2 low       | 3 mid-low   | 4 mid-high    | 5 high        | 6 higher      |

Table 5.2. The averages of the daily water reserves per year and the evaluation scores of them

| Year | Daily average (m <sup>3</sup> ) | Difference (m <sup>3</sup> ) | Growth (%) | Evaluation score |
|------|---------------------------------|------------------------------|------------|------------------|
| 1985 | 1,093,841,292                   | 0                            | 0          | 4 mid-high       |
| 1986 | 962,905,285                     | -130,936,007                 | -12        | 3 mid-low        |
| 1987 | 868,217,744                     | -94,687,541                  | -9.8       | 3 mid-low        |
| 1988 | 731,378,840                     | -136,838,904                 | -15.8      | 2 low            |
| 1989 | 558,399,873                     | -172,978,967                 | -23.7      | 2 low            |
| 1990 | 251,145,046                     | -307,254,827                 | -55        | 1 lower          |

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|      |               |              |       |            |
|------|---------------|--------------|-------|------------|
| 1991 | 339,758,258   | 88,613,212   | 35.3  | 1 lower    |
| 1992 | 243,797,364   | -95,960,894  | -28.2 | 1 lower    |
| 1993 | 150,021,946   | -93,775,418  | -38.5 | 1 lower    |
| 1994 | 285,641,153   | 135,619,207  | 90.4  | 1 lower    |
| 1995 | 457,962,890   | 172,321,737  | 60.3  | 2 low      |
| 1996 | 713,406,632   | 255,443,742  | 55.8  | 2 low      |
| 1997 | 905,809,101   | 192,402,469  | 27    | 3 mid-low  |
| 1998 | 927,166,247   | 21,357,146   | 2.4   | 3 mid-low  |
| 1999 | 1,069,968,709 | 142,802,462  | 15.4  | 4 mid-high |
| 2000 | 959,013,397   | -110,955,312 | -10.4 | 3 mid-low  |
| 2001 | 540,976,936   | -418,036,461 | -43.6 | 2 low      |
| 2002 | 555,437,096   | 14,460,160   | 2.7   | 2 low      |
| 2003 | 1,078,911,761 | 523,474,665  | 94.2  | 4 mid-high |
| 2004 | 1,165,431,448 | 86,519,687   | 8     | 5 high     |
| 2005 | 1,140,740,940 | -24,690,508  | -2.1  | 5 high     |
| 2006 | 1,265,312,537 | 124,571,597  | 10.9  | 6 higher   |
| 2007 | 958,084,141   | -307,228,396 | -24.3 | 3 mid-low  |
| 2008 | 620,835,709   | -337,248,432 | -35.2 | 2 low      |
| 2009 | 725,166,695   | 104,330,986  | 16.8  | 2 low      |
| 2010 | 989,674,997   | 264,508,302  | 36.5  | 4 mid-high |
| 2011 | 1,044,216,071 | 54,541,074   | 5.5   | 4 mid-high |
| 2012 | 1,076,791,238 | 32,575,167   | 3.1   | 4 mid-high |
| 2013 | 1,232,389,148 | 155,597,910  | 14.5  | 6 higher   |
| 2014 | 1,129,315,303 | -103,073,845 | -8.4  | 5 high     |
| 2015 | 1,243,746,000 | 114,430,697  | 10.1  | 6 higher   |
| 2016 | 1,190,968,396 | -52,777,604  | -4.2  | 5 high     |
| 2017 | 1,033,002,684 | -157,965,712 | -13.3 | 4 mid-high |
| 2018 | 1,102,115,255 | 69,112,571   | 6.7   | 4 mid-high |



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|      |               |              |       |            |
|------|---------------|--------------|-------|------------|
| 2019 | 1,278,834,027 | 176,718,772  | 16    | 6 higher   |
| 2020 | 1,158,609,413 | -120,224,614 | -9.4  | 5 high     |
| 2021 | 1,175,615,283 | 17,005,870   | 1.5   | 5 high     |
| 2022 | 1,202,945,266 | 27,329,983   | 2.3   | 5 high     |
| 2023 | 1,014,061,532 | -188,883,734 | -15.7 | 4 mid-high |
| 2024 | 776,313,716   | -237,747,816 | -23.4 | 3 mid-low  |

### Classification of municipalities regarding the water supply interruptions

The municipalities are classified regarding how many water supply interruptions were encountered inside their boundaries. That classification can be carried out based on two alternative indexes, either the interruption events per sq. kilometer or the interruption events per one thousand inhabitants.

Regardless of the selected index, the municipalities are grouped into different clusters through a K-means clustering. Afterwards the clusters are represented as a six-point rating scale from lower to higher points. The number of the clusters and consequently the length of the scale was selected in the same way as it was discussed in the preceding section about the evaluation of the recent values compared to the historical data. Table 5.3 shows some municipality examples, with the results of both alternatives: classification based on area and classification based on population.

*Table 5.3. Examples of municipalities classifications*

| Municipality | Events | Area (km <sup>2</sup> ) | Events /km <sup>2</sup> | Classification based on area | Population | Events /1000 pers. | Classification based on population |
|--------------|--------|-------------------------|-------------------------|------------------------------|------------|--------------------|------------------------------------|
| Athens       | 2608   | 39.0                    | 66.9                    | 5 high                       | 643.452    | 4.1                | 2 low                              |
| Kallithea    | 340    | 4.8                     | 70.8                    | 5 high                       | 97.616     | 3.5                | 2 low                              |
| Elefsina     | 381    | 36.6                    | 10.4                    | 2 low                        | 30.147     | 14.2               | 4 mid-high                         |
| Galatsi      | 392    | 4.0                     | 98.0                    | 6 higher                     | 57.909     | 6.8                | 3 mid-low                          |
| Peristeri    | 314    | 10.1                    | 31.1                    | 3 mid-Low                    | 133.630    | 2.4                | 1 lower                            |
| Piraeus      | 688    | 10.9                    | 63.1                    | 5 high                       | 168.151    | 4.1                | 2 low                              |
| Vrilissia    | 11     | 3.9                     | 2.8                     | 1 lower                      | 32.417     | 0.3                | 1 lower                            |



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### Correlation hypothesis

A correlation hypothesis has been checked between the water reserves and the precipitation. It is more discussed as an indicative example of the possible relations between the different variables. Platform's precipitation measurements originate from eight cities located in Central Greece, in the wider area where the fourth water reservoirs of EYDAP are located too. Potentially other areas could be included based on a more complete hydrological justification.

At first, a similarity was visually detected in line charts between the growth of a single year precipitation and the trend of the following year water reserves (Figure 5.7). In order to check if an association exists between the two variables, Pearson and Spearman correlation coefficients were applied on the data. Such coefficients explore if a change in the one variable is associated with a change in the other, but no causation can be inferred from the correlation results (Schober et al., 2018).

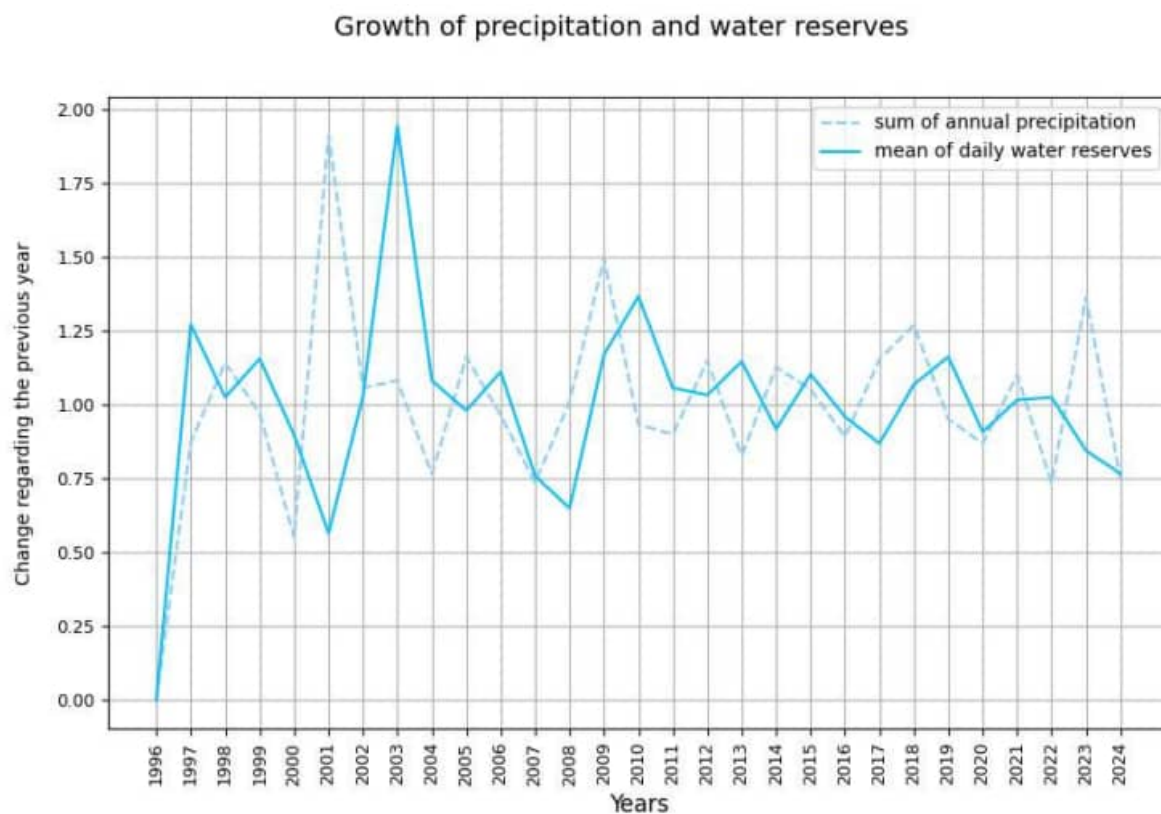


*Figure 5.7. The change of the precipitation fall and the water reserves regarding the previous year quantities*

Table 5.4 shows the water reserves and the precipitation measurements that the correlation coefficients were applied on. The precipitation of a single year was compared to the next year's water reserves. The time period that was taken into consideration was from 1996 assuming similar conditions regarding the water reserves infrastructure. In 1996 the

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construction of Evinos-Mornos tunnel was already completed and the water from the Evinos river was transported to boost the Mornos reservoir quantities (EYDAP, 2024a).

A first computation was carried out from 1996 to 2023 and both coefficients indicated a good correlation, the Pearson's value was 0.68 and the Spearman's 0.62. A second computation was carried out extending the time period by one year, from 1996 to 2024. The coefficients still indicated the existence of correlation but their values decreased, the Pearson's value became 0.58 and the Spearman's 0.53.

*Table 5.4. The sum of the precipitation measurements and the mean of the daily water reserves per year*

| Year | Precipitation (mm) | Water reserves (m <sup>3</sup> ) | Year | Precipitation (mm) | Water reserves (m <sup>3</sup> ) |
|------|--------------------|----------------------------------|------|--------------------|----------------------------------|
| 1996 | 5,647              | 713,406,632                      | 2011 | 5,139              | 1,044,216,071                    |
| 1997 | 4,923              | 905,809,101                      | 2012 | 5,897              | 1,076,791,237                    |
| 1998 | 5,615              | 927,166,247                      | 2013 | 4,869              | 1,232,389,147                    |
| 1999 | 5,440              | 1,069,968,708                    | 2014 | 5,484              | 1,129,315,303                    |
| 2000 | 2,991              | 959,013,397                      | 2015 | 5,760              | 1,243,746,000                    |
| 2001 | 5,711              | 540,976,936                      | 2016 | 5,126              | 1,190,968,396                    |
| 2002 | 6,025              | 555,437,095                      | 2017 | 5,905              | 1,033,002,684                    |
| 2003 | 6,511              | 1,078,911,760                    | 2018 | 7,486              | 1,102,115,254                    |
| 2004 | 4,969              | 1,165,431,447                    | 2019 | 7,113              | 1,278,834,027                    |
| 2005 | 5,763              | 1,140,740,940                    | 2020 | 6,166              | 1,158,609,412                    |
| 2006 | 5,552              | 1,265,312,537                    | 2021 | 6,777              | 1,175,615,282                    |
| 2007 | 4,080              | 958,084,140                      | 2022 | 4,968              | 1,202,945,265                    |
| 2008 | 4,116              | 620,835,709                      | 2023 | 6,766              | 1,014,061,531                    |
| 2009 | 6,144              | 725,166,694                      | 2024 | 5,067              | 776,313,715                      |
| 2010 | 5,723              | 989,674,997                      |      |                    |                                  |

## 6. Conclusion

The 6 data sources (water reserves, drinking water production, precipitation, temperatures, water supply interruptions, municipalities' geographical boundaries) and the 3 web services (the two geolocation services and the openstreetmap) we have already seen, are effectively

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combined with software development technologies. The proposed system is featured by automated data acquisition through the REST API and by flexible data filtering through the UI. The created system managed to address efficiently the data collection and curation challenges, presenting diverse means of exploiting the available data, from a visual representation to a programmatically oriented usage through the provided API.

The researchers and practitioners might benefit from a rather convenient way to search and get data relevant to their investigation or management questions. The policy makers might prioritize the monitoring and the upgrading of the more disruptive areas of the water supply network according to the results of the geospatial analysis. Indicative data analysis has been performed in order to indicate the usefulness of the acquired data as well as their comparative classification in time.

Finally, due to the correlation results, more research may be appropriate to explore possible relations between the water reserves and more specific precipitation measurements or even other weather variables.

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# **TOWARDS A SUSTAINABLE DIGITAL TRANSFORMATION: THE ROLE OF HUMAN RESOURCES IN PUBLIC ADMINISTRATION AND CITIZEN SATISFACTION. THE CASE OF THE MUNICIPALITY OF KILLELER.**

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## **Abstract**

Digital transformation has highlighted its importance as a catalyst for the modernization of public sector structures and functions, offering opportunities for improving efficiency, transparency and the citizen experience. This paper, entitled: "Towards a Sustainable Digital Transformation: The Role of Human Resources in Public Administration and Citizen Satisfaction. The Case of the Municipality of Kileler", explores the critical role of human resources as agents of change in a sustainable digital reform. At the same time, the impact of human dynamics on citizen satisfaction is examined, with an emphasis on the Municipal Authority of Kileler as a case study.

A total of 186 questionnaires were collected from residents of the Municipality of Kileler and statistical analysis using SPSS 29.0 showed that the reliability of the analysis is excellent, with a Cronbach's alpha coefficient ( $\alpha=0.897$ ). Through the quantitative and statistical analysis of the questionnaires, four (4) research questions were examined, which gave us useful results such as: (a) Digital transformation is the key to improving the efficiency of human resources and the quality of services in the Municipality of Kileler, while contributing to the creation of a sustainable administration system. (b) Digital applications, such as electronic protocols and automated application management, have significantly reduced bureaucratic procedures, the response time to citizens' requests and the environmental footprint of the administration. (c) Human resources have satisfactorily faced the challenges of adapting to new technologies, but, through appropriate education and training, can respond even more to the new requirements, implementing a more effective, transparent and sustainable administration model, which will meet the needs and expectations of citizens.

**Key words:** Digital transformation, Public administration, Sustainability, Human resources, Municipality of Kileler.

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### Introduction

Digital transformation has emerged as a key factor in modernizing public sector structures and operations. According to the Organization for Economic Cooperation and Development (OECD, 2014), the integration of digital technologies not only improves efficiency and transparency, but also enhances the citizen experience, creating a more participatory public sector.

#### *Definition and Elements of Digital Transformation*

Digital transformation has emerged as a key factor in the modernization of public sector structures and functions and has been the subject of numerous formulations and interpretations, both in the broader social and business field, and in the public sector in particular. Digital transformation is a complex process that involves the integration of digital technologies into the business processes and structure of organizations. It refers to the strategic integration of digital technologies into all aspects of an organization or business. It includes the adoption of technologies such as cloud computing, big data, artificial intelligence (AI) and the Internet of Things (IoT), with the aim of improving efficiency, flexibility and the experience of citizens or customers (Westerman, Bonnet, & McAfee, 2014). In the context of public administration, digital transformation involves the use of digital technologies to improve transparency, efficiency and interaction with citizens. The aim is to upgrade traditional processes and create new, more flexible and efficient approaches to the provision of public services (OECD, 2014).

The European Commission's Directorate-General for Research and Technological Development (DG RDT, 2013) also emphasizes that digital transformation involves new methods of dealing with citizens, the creation of innovative service delivery frameworks, and new relationships between citizens and public organizations. This process requires changes in infrastructure, culture and skills, which contribute to efficiency and participation. The success of digital transformation in the public sector depends on the understanding and adoption of innovations, which are not limited to technology alone, but include the overall reorganization of organizational structures and strategies.

Recent studies, such as that of Mergel et al. (2019), highlight digital transformation as a complete reorganization of public sector processes and services, going beyond the simple digitization of existing functions. In other words, it incorporates the need to cultivate skills that facilitate the understanding and application of new technologies (Karanatsios&Bouga, 2021). Innovation in this context acts as a catalyst for improving daily life and solving complex social issues.

#### *Key Drivers and Technological Trends*

The success of digital transformation depends on enhancing communication and collaboration between public organizations. The use of unified information systems and data interconnection allow for more efficient information management and informed decision-making (Janssen & van der Voort, 2016). In addition, digital platforms and social networks provide new tools for citizen participation in decision-making processes, thereby enhancing transparency and democratic governance.



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Rapid progress in digital technologies, combined with the growing need for efficient and transparent governance, necessitate the adoption of modern strategies. These strategies focus on the use of cutting-edge technologies to improve the delivery of public services and solve everyday problems for citizens (Sandhu, 2021).

### *The Role of Human Resources*

The success of digital transformation in the public sector depends largely on the contribution of human resources. Human resources are a determining factor for the success of digital transformation. Employees are the agents of change, as the effective integration of technologies requires knowledge, skills and adaptability in technological and managerial operations, which are key to the transition to sustainable digital operation. According to Kane et al. (2015), the development of technological and leadership skills in employees is a basic prerequisite for the transition to sustainable digital governance.

Targeted education and continuous training of human resources is crucial. Creating an environment that promotes innovation and encourages inclusion enhances the acceptance and success of new technologies (Tzamaloukas, 2021). At the same time, leadership plays a crucial role, as the commitment and vision of management executives are catalysts for the adoption of digital transformation strategies. The human dynamic in this context, the participation of human resources in the decision-making process offers trust and increases inclusiveness. Leadership commitment and the creation of a favorable environment that encourages innovation and collaboration are vital. By adopting good practices from other government models, the public sector can and must adapt to the rapid changes of technological developments.

### *Citizens and Satisfaction*

Citizen satisfaction is a key indicator for assessing the success of digital transformation. Citizens expect services that are fast, efficient, easily accessible and, of course, meet their expectations, while at the same time fulfilling to a high degree the feeling of transparency and immediacy. According to Janssen and van der Voort (2016), the use of integrated information systems and digital platforms can improve the citizen experience, strengthening their trust in public administration. Citizen participation in decision-making processes is equally important. Initiatives that incorporate citizens' views and needs enhance transparency and democratic governance (Sandhu, 2021). Furthermore, the use of tools, such as e-government applications, allows citizens to have direct access to information and services, promoting their active participation.

### *Holistic Approach and Need for Cultural Change*

Digital transformation requires a comprehensive review of organizational structures, corporate culture and business models. Leadership commitment, adaptability and innovation are critical factors for its success (Kane et al., 2015). Beyond technological change, digital transformation entails the reorganization of relations between citizens and public services, encouraging the active participation of human resources in the exploitation of new technologies, as a result of the acquisition of important skills and competencies, on the part of human resources (Tzamaloukas, 2021).

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### *Digital Innovation in Greek Public Administration*

In Greek public administration, digital innovation is a key driver for the modernization and reform of public services. Digital transformation initiatives have intensified, especially through the adoption of advanced technologies and the exploitation of the potential of the digital age. These efforts offer significant opportunities, both for improving efficiency and transparency, and for citizen participation in public affairs (Deloitte & SEV, 2022).

### *The case of the Municipality of Killeler*

This research focuses on the importance of digital transformation and the role of human resources for a sustainable and effective public administration. With an emphasis on citizen satisfaction, the paper examines the implementation framework in the Municipal Authority of Killeler, highlighting the challenges and opportunities for harnessing the potential of digital transformation.

Digital transformation allows for the simplification of procedures and the faster provision of services, such as the ability to serve online and direct information. Digital services become more accessible and flexible, allowing citizens to interact with local authorities, without restrictions in time and place (Gil-Garcia et al., 2020; Tsiavos et al., 2023).

The Municipal Authority of Killeler is a typical example of the implementation of sustainable digital transformation strategies. The study of this case reveals the importance of the commitment of local leadership and the adaptability of human resources to technological changes (Bousios et al., 2021). The adoption of innovative solutions by the Municipal Authority aims to reduce bureaucracy, improve efficiency and enhance citizen satisfaction. The strategic approach of the Municipal Authority includes the integration of digital tools for service management, promoting transparency and strengthening collaboration with citizens. These initiatives highlight the potential of local authorities to act as pioneers of digital transformation, in a sustainable public sector.

Digital transformation in local government does not depend only on technology and infrastructure, but also on human resources, which is recorded as the most important form of intangible capital (Giannouklidis, 2015). The human factor is the one who, through the production of innovative ideas and the utilization of knowledge and capabilities in finding solutions, provides added value and multiplies productivity.

Human resources have a crucial role in the successful implementation and management of digital initiatives, since as mentioned, the successful implementation of ICT depends mainly on the availability of potential to possess the relevant ICT knowledge and skills (IOBE, 2014).

In conclusion, we state that digital transformation constitutes a multidimensional strategy that extends beyond the adoption of new technologies. It requires changes in organizational structures, business processes and culture, while focusing on improving the citizen experience, efficiency and transparency. Despite the challenges, the opportunities it offers are crucial for the evolution of public services and the creation of a more efficient and participatory governance (Gil-Garcia & Pardo, 2005; Nam&Pardo, 2011; Fung, 2015). Undoubtedly, the success of digital transformation in practice depends on leadership commitment, as well as the ability to adapt and innovate (Kane et al., 2015).

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### 1. Aim of the Research

The main purpose of this study is to investigate the digital transformation in public administration, with an emphasis on the role of human resources in citizen satisfaction, through the case study of the Municipality of Killeler. The study will focus on the efforts to digitize the Municipality's services and examine how these efforts affect citizen satisfaction with the services provided, with the contribution of well-trained human resources and the improvement of electronic and building infrastructure. The analysis of the results will confirm the relationship between digital technology and the quality of the services provided. The study also aims to provide valuable conclusions and directions for the future improvement of public services, promoting a more efficient and transparent sustainable administration model, which will meet the needs and expectations of citizens.

### 2. Methodology of the Research

In this paper, the quantitative research method was used, as it is considered the most appropriate for our research objectives. By incorporating modern tools and adapting to current trends, quantitative research can provide accurate and valid results for the investigation of social phenomena (Sukamolson, 2007), as well as allowing the examination of correlations between variables and is suitable for the investigation of opinions and perceptions (Robson, 2010; Marinopoulos, 2021).

The research part includes statistical analysis with questionnaires, that is, a quantitative analysis carried out with the main aim of recording the participants' agreement or disagreement with a number of statements related to each research question.

A total of 186 questionnaires without incomplete responses were collected through the google forms application, as well as in person, which constitute the research sample. The participants in the survey answered the questions included in the questionnaire, after observing the ethical principles, that is, the voluntary nature of participation and also the respect of their anonymity were made known. The participants expressed their opinions by completing the questionnaire, during the period from August 10 to September 10, 2024. The questionnaire included questions on a five-point scale (Likert), which examines the degree of agreement or disagreement on certain issues related to the survey.

The research questions that the participants in the survey were asked to answer are the following:

1. How does digital transformation affect public administration?
2. What is the role of human resources in Digital Transformation?
3. How can digital transformation improve citizen satisfaction?
4. What is the current state of digital infrastructure and services provided in the Municipality of Killeler?

Descriptive statistics and correlation analysis were applied to conduct the statistical analysis of the data. The data analysis was implemented using the SPSS 29.0 statistical package and resulted in the production of diagrams and results derived from the participants' responses to the questionnaire questions.

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### 3. Results

#### 3.1 Quantitative analysis

No missing measurements were observed in either the demographic data or the main part of the quantitative analysis. The demographic data analyzed consisted of gender, age, educational level, professional status, and marital status.

##### 3.1.1 Cronbach's $\alpha$ coefficient

One of the main indicators for assessing the reliability of a questionnaire is the Cronbach's alpha coefficient (Cronbach, 1984).

The reliability of the analysis was considered excellent, because the Cronbach's coefficient approaches unity to a very high degree ( $\alpha=0.897$ ). Also, the highest reliability appeared in the questions "digital transformation contributes to the reduction of bureaucracy in public administration" of the 1st research question and "the human resources of the Municipality of Killeler respond adequately and directly to the requests of its citizens", of the 4th research question ( $\alpha=0.899$ ).

Regarding the analysis of the reliability of the research questions, the 2nd research question presented the highest, where it proved to be excellent, since the Cronbach's coefficient approaches unity to a very high degree ( $\alpha=0.893$ ).

- Then, the highest reliability was presented by the 3rd research question ( $\alpha=0.885$ ).
- Then the 4th research question ( $\alpha=0.817$ ) and finally,
- the 1st research question with ( $\alpha=0.812$ ).

#### 3.2 The profile of the citizens (Municipality of Kileler)

A total of 186 residents of the Municipality of Kileler participated in the survey, distributed as follows: 54.8% men and 45.2% women (Figure 1).

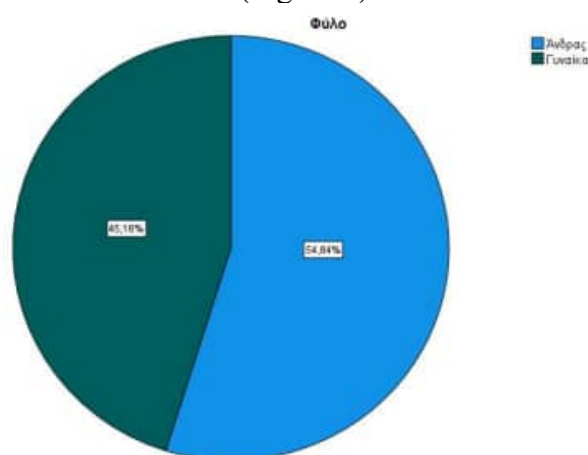


Figure 2: Distribution of participants by gender.

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### 3.3 Age of the participants (Municipality of Kileler)

Regarding the age of the participants, the dominant group consisted of individuals aged 31-40 years, constituting 31.7% of the total cohort, followed by the 51-60 year old group with a percentage of 20.4%, the 41-50 group with a percentage of 16.7%, the over 60 group with a percentage of 14.5%, followed by the 21-30 group with a percentage of 13.4%, while participants under 20 years of age represented only 3.2% of the total sample of participants (Table 1).

Table 1: Demographic Data – Age  
Age of participants

|       |       | Frequency | Percent | ValidPercent | CumulativePercent |
|-------|-------|-----------|---------|--------------|-------------------|
| Valid | <20   | 6         | 3,2     | 3,2          | 3,2               |
|       | 21-30 | 25        | 13,4    | 13,4         | 16,7              |
|       | 31-40 | 59        | 31,7    | 31,7         | 48,4              |
|       | 41-50 | 31        | 16,7    | 16,7         | 65,1              |
|       | 51-60 | 38        | 20,4    | 20,4         | 85,5              |
|       | >60   | 27        | 14,5    | 14,5         | 100,0             |
|       | Total | 186       | 100,0   | 100,0        |                   |

### 3.4 Level of education

Regarding educational level, the majority of the study participants were high school graduates, constituting 39.2% of the total sample. In addition, 33.9% of the participants were university graduates, 15.6% had postgraduate studies, 7% had completed high school and finally 4.3% had completed primary school (Table 2).

Table 2: Demographic Data – Level of education  
Level of education

|       |                | Frequency | Percent | ValidPercent | CumulativePercent |
|-------|----------------|-----------|---------|--------------|-------------------|
| Valid | Primaryschool  | 8         | 4,3     | 4,3          | 4,3               |
|       | Middle School  | 13        | 7,0     | 7,0          | 11,3              |
|       | High school    | 73        | 39,2    | 39,2         | 50,5              |
|       | University     | 63        | 33,9    | 33,9         | 84,4              |
|       | Master'sdegree | 29        | 15,6    | 15,6         | 100,0             |
|       | Total          | 186       | 100,0   | 100,0        |                   |

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### 3.5 Professional status of participants

Regarding professional status, most participants in the survey declared themselves farmers/livestock breeders, at a rate of 30.1%, followed by private and public employees at rates of 20.4% and 19.9%, respectively (Table 3).

Table 3: Demographic Data – Professional status

Professional status

|       |                          | Frequency | Percent | ValidPercent | CumulativePercent |
|-------|--------------------------|-----------|---------|--------------|-------------------|
| Valid | Civil servant            | 37        | 19,9    | 19,9         | 19,9              |
|       | PrivateEmployee          | 38        | 20,4    | 20,4         | 40,3              |
|       | Freelancer               | 35        | 18,8    | 18,8         | 59,1              |
|       | Farmer / LivestockFarmer | 56        | 30,1    | 30,1         | 89,2              |
|       | Worker                   | 20        | 10,8    | 10,8         | 100,0             |
|       | Total                    | 186       | 100,0   | 100,0        |                   |

### 3.6 Maritalstatusofparticipants

Regarding marital status, the majority of participants were married at 62.9%, while as single, a percentage of 33.3% was reported and another percentage, referred to as "Other", was reported at a percentage of 3.8% (Table 4).

Table 4: Demographic Data – Marital status

Marital status

|       |           | Frequency | Percent | ValidPercent | CumulativePercent |
|-------|-----------|-----------|---------|--------------|-------------------|
| Valid | Married   | 117       | 62,9    | 62,9         | 62,9              |
|       | Unmarried | 62        | 33,3    | 33,3         | 96,2              |
|       | Other     | 7         | 3,8     | 3,8          | 100,0             |
|       | Total     | 186       | 100,0   | 100,0        |                   |

### 3.7. Correlations of variables

#### 3.7.1 The ‘Pearson’ criterion

Regarding the correlations of the variables, the ‘Pearson’ criterion was applied, where it was shown that the questions under study are independent of both gender and educational level. More specifically:

- “The improvement of the efficiency of both the procedures due to the application of digital transformation technologies in public administration”, and the



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- “Services provided to citizens, due to the adoption of new technologies by the potential in public administration”, proved to be independent of gender and age, because the condition  $p > 0.05$  applies.

Accordingly:

- “The successful implementation of digital transformation, through teamwork and the active participation of employees with appropriate leadership”, as well as
- “The requirement of investments for the digital transformation of the services of the Municipality of Kileler”, proved to be independent of gender and age, as long as the condition  $p > 0.05$  applies.

Essentially, the responses of men or women or participants belonging to the same category of educational level are not identical, therefore they express *different opinions*.

### 3.8. Effect of demographic/individual characteristics on the questionnaire variable.

#### 3.8.1. ANOVA analysis

ANOVA analysis is applied to test if there is a significant difference between the variables, at a significance level of 5%.

In particular, it was demonstrated through the analysis of variance (ANOVA) regarding the research questions that:

- **age** is a significant factor only for the variable:
  - “Digital transformation contributes to citizens’ satisfaction and trust in public services” of the 3<sup>rd</sup> research question ( $F = 2.540$ ,  $p = 0.03$ ).
- Correspondingly, the **educational level** was a significant factor for the variables:
  - “Online access to public administration services improves the response to citizens’ needs” ( $F = 3.546$ ,  $p = 0.008$ ) and
  - “Digital transformation in public administration accelerates the progress and development of society” of the 3<sup>rd</sup> research question ( $F = 2.465$ ,  $p = 0.047$ ).
- Furthermore, with regard to **family status**, it was shown to be a significant factor for the variable:
  - “The development of digital services aimed at satisfying the needs of citizens-users, makes it possible to reduce costs in the long term” of the 3<sup>rd</sup> research question ( $F = 4.403$ ,  $p = 0.014$ ).
- On the other hand, **professional status** was not characterized as a significant influencing factor for any variable of all research questions.

#### 3.8.2. T-test analysis

Through the application of the T-test method, it was shown that:

- gender was not a significant factor of influence for any of the variables of the 1<sup>st</sup> and 2<sup>nd</sup> research questions.
- On the contrary, gender was a significant factor for the variables:

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- “Online access to public administration services improves the response to citizens’ needs” ( $t = -1.862$ ,  $df=184$ ,  $p = .031$ ), and
  - “Digital transformation in public administration accelerates the progress and development of society” ( $t = -1.962$ ,  $df=184$ ,  $p = .012$ ), of the 3rd research question.
- In particular, women had a higher level of perception regarding:
- “The improvement in responding to citizens’ needs, through online access to public administration services” (M.O.= 3.98, SD = 0.821), compared to men (M.O.= 3.74, SD = 0.922). Similarly, for
  - “The acceleration of progress and development of society, due to the implementation of digital transformation in public administration” (M.O.= 3.45, SD = 0.870), compared to men (M.O.= 3.16, SD = 1.132).
- Furthermore, gender was characterized as a significant factor for the variable:
- “Online access to the services of the Municipality of Kileler is easy and efficient” ( $t = -1.758$ ,  $df=184$ ,  $p = .008$ ) of the 4th research question.
- In particular, women had a higher level of perception regarding the ease and efficiency of online access to the services of the Municipality of Kileler (M.O.= 2.96, SD = 0.811), compared to men (M.O.= 2.76, SD = 0.719).

## 4. Conclusions - Proposals

The research focuses on the digital transformation of local government with an emphasis on the Municipality of Killeler. The research questions focused on:

1. The influence of digital transformation (D.T.) on public administration(1<sup>st</sup>),
2. The role of human resources in D.T. (2<sup>nd</sup>),
3. The ability of D.T. to improve citizen satisfaction (3<sup>rd</sup>),
4. The current state of digital infrastructure and services provided in the Municipality of Killeler (4<sup>th</sup>).

As for the majority of the participants in the research, they agreed:

- with most of the questions in the 1st research question and
- with all of the 2<sup>nd</sup> and 3<sup>rd</sup>.
- On the contrary, in the 4<sup>th</sup> research question, most participants expressed their neutrality with most of the questions.

Specifically, in the 1st research question, the majority of the survey participants answered that they agree with certain questions that compose it, such as:

- “by imposing the restructuring of administrative services” (48.4%), due to the implementation of digital transformation. This specific finding is identical to the corresponding one (Janssen, Charalabidis, & Zuiderwijk, 2012), which states that the

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simplification and automation of bureaucratic procedures through the use of digital tools is able to reduce the time and cost of administrative management.

Accordingly, most agreed:

- “with the improvement of the efficiency of procedures, by the application of technologies” (53.2%), as well as
- “of providing solutions to citizens’ problems” (45.7%), which is in line with research (West, 2004), which states that the adoption of technologies such as electronic signature and identification through biometric data can improve the security and usability of digital services.

➤ At the same time, regarding the 2<sup>nd</sup> research question “the role of human resources in digital transformation”, the majority of participants have agreed on all questions, such as:

- With the degree of success of digital transformation, due to the training in digital skills of the workforce and citizens (50%), or

On the contrary, with the lack of digital skills (32.8%), as an obstacle to digital transformation.

The above finding is identical to the study (Brynjolfsson & McAfee, 2014), which states that the continuous training and development of the digital skills of human resources is crucial for the successful implementation of digital transformation.

➤ Additionally, regarding the 3<sup>rd</sup> research question “ability of digital transformation to improve citizen satisfaction”, most of the participants answered that they agree with all the questions, such as:

- Trust in the security and protection of personal data by public services (33.9%).

The above finding is identical to the study (Bertot, Jaeger, & Grimes, 2010), where the adoption of digital tools that promote transparency, such as online platforms for data publication and decision-making control systems, can enhance citizens’ trust in public administration.

➤ Accordingly, the majority agreed that:

Digital transformation can be achieved through teamwork with the active participation of employees with appropriate leadership (41.4%).

This specific finding is identical to the research (Kane et al., 2015), which states that the leadership of the public administration must understand the situation and promote in every way the values of transparency, cooperation and continuous improvement.

➤ Finally, regarding the 4<sup>th</sup> research question “the current state of digital infrastructure and services provided in the Municipality of Killeler”,

the majority declared its neutrality regarding:

- The support of digital transformation, from its infrastructure (37.6%), but also
- The improvement of the quality of services provided to citizens, due to its implementation (40.3%).

➤ However, they declared that they strongly agree regarding:

- The requirement of investments for the digital transformation of its services (45.2%).

This finding stems from the requirement to ensure adequate funding and resources for the implementation of digital initiatives (Davenport & Harris, 2005).

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➤ On the other hand, the majority disagreed:

- With the numerical adequacy of the potential of the Municipality of Kileler, for the immediate and effective satisfaction of its citizens (37.1%). The finding is consistent with the limited financial resources and the insufficient funding of digital actions (Tsikrika, 2022).

Regarding reliability, it is worth emphasizing that the reliability of the analysis was considered excellent, because the Cronbach's  $\alpha$  coefficient approaches unity to a very high degree ( $\alpha=0.897$ ).

➤ *Some indicative proposals* that will be focused on the Municipality of Killeler are summarized below:

1. *Strengthening digital infrastructure*

- Large-scale investments, aimed at upgrading IT networks and servers, in order to ensure the smooth operation of digital services.
- Development and implementation of cloud computing systems, to improve data storage and management.

2. *Development of digital services for citizens*

- Creation of a single digital portal to expand the electronic services offered to citizens, such as issuing certificates, paying fees and submitting applications.
- Promotion of transparency, by providing access to open data on the activities of the municipality and its expenditures.

3. *Education and training of staff*

- Organization of regular training programs and seminars to develop the digital skills of all employees.
- Providing incentives for continuous training and professional development of staff.

4. *Promoting participation and collaboration*

- Encouraging the active participation of employees in decision-making and the development of new digital initiatives.
- Promoting collaboration between the various departments of the municipality, for the implementation of digital projects.

5. *Utilizing Information and Communication Technologies (ICT)*

- Developing mobile applications that facilitate citizens' communication with the municipality and reporting problems.
- Using geographic information systems (GIS) to improve the management of municipal infrastructure and services.

6. *Change management and communication*

- Developing a change management strategy that includes clear communication of the objectives and benefits arising from the digital transformation.
- Providing support and ongoing guidance to employees during the transition to new technologies and practices.

At the same time, there are some limitations in the research, such as the non-uniformity of the questions in the research questions.

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Furthermore, another limitation is that the research concerns exclusively one Municipality (Kileler), so it is not possible to conduct a comparative study in relation to other Municipalities of the local government and / or abroad. Therefore, a future study would be good to include a larger sample of participants from various Municipalities in Greece, in order to be more reliable. In addition, future research may include a sample of participants from abroad, in order to determine differences or similarities, among the research questions under study.

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# THE ROLE OF NEW TECHNOLOGY INTO FIGHTING AGAINST POVERTY AND SOCIAL ALIENATION. STUDYING THE INNOVATIVE DIGITAL PLATFORM USE WITHIN THE REGION OF CRETE

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## Abstract

Social cohesion along with the social integration of any individual plays a determining role in the decision making of any local and regional authority worldwide. The poverty-stricken and vulnerable individuals and groups are related to the socio-political context of any society. At the same time, these liabilities are associated with the way they are dealt with by the authorities in charge. All the developed and developing countries shape skills strategies. These strategies affect the structure and the content of systems which aspire after establishing a more financially prosperous society.

Within this context the Hellenic Mediterranean University and in particular the Social Work Department under the auspices of the Act “Social Partnership of Crete’s Regional Authority – Decentralized Food and Essential Material Provisions, Administration Costs and Accessory Measures Provision 2018-2019” in collaboration with the Regional Authority of Crete, they are developing an innovative platform which caters for work orientation. This project aims at providing the beneficiaries of this attempt with education, training along with counseling support. This project aims to facilitate the beneficiaries’ personal and professional development along with their integration into the labour market.

The current research inquires into the platform’s efficiency in promoting and socially integrating the participants into the job market. Within this context questionnaire based researches have been conducted. The research collects data the time period from October 2022 to May 2024. The data under investigation are a priori and a posteriori the intervention has occurred. The evidence of this research is indicative of the ensuing phenomenon: the

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participants have the opportunity to adopt an introspective attitude, reach deductions about their personality and interests while ameliorating them. Additionally, this evidence proves that e-mentoring activation contributes to the establishment of the participants professional opportunities.

**Key words:** Poverty, social alienation, counseling support, digital platform, development

### Introduction

We are currently undergoing a profound restructuring of the role, functions, and structure of the welfare state. In this context, there is a transition to new organizational models aimed at improving the effectiveness and increasing the efficiency of social administration mechanisms (Sharma, 2019). Consequently, the expansion of social exclusion phenomena and the widening of population groups affected or threatened by poverty have contributed to the focus of social administration on the timely provision of social support services for the most vulnerable groups of the population (Mikelson, 2016). Especially in the European Union the need for restructuring the welfare state is deemed necessary (Apistoulas & Nikou, 2021).

Vulnerability, often linked to poverty and social exclusion, tends to deepen over time. It can be broadly defined as a state of uncertainty and emotional distress, which Fineman (2019) describes as an individual rather than a purely social issue. (Fineman, 2019), In this context, individuals or groups with limited access to resources and opportunities, or those exposed to multiple risks, are considered vulnerable (Morese et al., 2019). Other approaches about the vulnerability definition refers to the susceptibility of individuals or groups to harm due to exposure to social, economic, environmental, or health-related risks. It encompasses both the inherent characteristics that make certain populations more prone to adverse outcomes and the external factors that exacerbate their risk. Vulnerability is often assessed through indices that aggregate various social determinants, such as socioeconomic status, education, age, and health conditions (Brown et al., 2017; Mah et al., 2023) These indices help in identifying and categorizing vulnerable populations to tailor interventions and support mechanisms effectively

According to the European Court of Human Rights (ECHR), all people are generally vulnerable. The gradation of vulnerability is partly constructed according to economic, political, and social inclusion processes and policies to combat social exclusion (Council of Europe, 2021). Therefore, indicators of vulnerability include prejudice, stigmatization, social educational disadvantage, and material deprivation. For the ECHR, people are generally vulnerable, and vulnerability is determined by the prevailing economic, political, educational, and social conditions in each society.

Additionally, according to Brown (2017), synonyms for the word vulnerability include "transparency, receptivity, and sensitivity." Article 2 of Law 4430/2016 characterizes as vulnerable the population groups "whose integration into social and economic life is hindered by physical and mental causes or due to delinquent behavior" and as special, "those groups of the population who are at a disadvantage in terms of smooth integration into the labor market due to economic, social, and cultural causes." In the same law, "social inclusion" is defined as "the creation of conditions for the equal participation in social and economic life of

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individuals belonging to vulnerable and special groups." Additionally, socially vulnerable are recognized, based on the criterion of "high risk of discrimination or social exclusion," the unemployed, long-term unemployed, working poor, uninsured, individuals with cultural peculiarities such as the Pomaks and religious minorities, prisoners/ex-prisoners, disease carriers, single-parent households, and individuals with low educational levels (Apistoulas & Nikou, 2021; Brown et al., 2017).

Vulnerability can serve as a reference point for human experiences from which courage can emerge, especially in conjunction with unstable situations, leading to change. This approach underscores that individuals are constantly subject to changes influenced by social factors, as humans, being social beings, are part of a social structure system. In this context, these groups of individuals require special support for their (re)integration into both the labor market and the broader economic and social environment. Therefore, socially vulnerable or vulnerable groups, often abbreviated as VPG, are related to the term vulnerability and necessitate active developmental policies to recover (Brown et al., 2017).

The European social model emphasizes the importance of social protection and inclusion, aiming to ensure that all citizens have access to essential services and opportunities, regardless of their socio-economic status. Social inclusion is the process of improving the terms on which individuals and groups participate in society, enhancing their ability, opportunity, and dignity (Brik & Brown, 2024). The European Union's social protection systems aim to stabilize the economy and promote socio-economic equality and stability (Munoz et al., 2019). Vulnerability, as defined by the United Nations Office for Disaster Risk Reduction, involves conditions determined by physical, social, economic, and environmental factors that increase susceptibility to the impacts of hazards (UNDRR, 2007). The European Court of Human Rights has increasingly relied on vulnerability reasoning to prioritize claims and extend positive obligations (Al Tamimi, 2016).

Recent research indicates that the European Union collaborates closely with local partners, including the Directorate for Labour and Social Affairs, to enhance employment services for job seekers (European Commission, 2025). New employment service centres are being established and integrated with a digital employment platform, offering services such as skills development, career guidance, job search assistance, and job placement (ETF, 2022).

The European Union is also tasked with supporting the development of digital connectivity, capitalizing on the trend towards increased automation in employment services to better manage the integration of vulnerable population groups. Enhanced digital connections can facilitate data sharing between Public Employment Services (PES) and their stakeholders, allowing for more effective use of labour market information (LMI) and PES client data, which in turn leads to efficient labour market absorption strategies (Digital Skills and Jobs Platform, 2025). This is particularly crucial for employment service providers addressing skills shortages and demographic pressures from an aging workforce across Europe (European Parliament, 2024).

Over the past decade, e-mentoring, a form of distance mentoring has shown significant success due to the use of ICT and effective virtual communication between mentors and mentees. This method ensures flexibility and interaction between participants (European School Education Platform, 2023). Implementing such e-mentoring programs helps e-mentees achieve their professional goals, meet the expectations of both mentors and mentees, and

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fosters career development, constructive feedback, enthusiasm for learning, motivation, learning techniques, and professional growth when e-mentees receive guidance from e-mentors (European Commission, 2024).

Aim of the study is to describe the first results of the usage of a platform developed from a university department with the aim of local authorities. Those results were focused on mentees characteristics, such as demographics, vulnerabilities, job aims and specialties. Additionally, the acceptance of this process using an active / inactive status is presented.

## Materials and Methods

### *Sample and Population*

The following two groups were implemented in the sample. The first group includes the mentors and employers that participated voluntarily in the program. The second group includes the beneficiaries (mentees), in other words, all people that wanted to participate for guidance from the mentors / employers.

### *Platform description*

The present platform has been designed and developed in the framework of the implementation of the Act "Social Partnership of the Region of Crete – Decentralized procurement of food and basic material assistance, administrative costs and provision of accompanying measures 2018-2019" in partnership between the Region of Crete and the Hellenic Mediterranean University (HMU).

The platform named as "Mentoring" is a part of the aforementioned program and it can be found in the website (<https://mentoring.sw.hmu.gr/>). The aim of this platform is to perform career guidance (mentoring) and succeed personal and work development. In more detail, mentees receive a counseling support and training from specialized personnel. All actions were in cooperation with the competent social services and associated partners. Platform is divided into two parts: one from the mentors / employees and one for the beneficiaries.

### *Mentors and employers platform*

Mentors and employers were recruited through a public invitation from the Department of Social Work through website posting, news portal, newspapers and social media in general. The selection of mentors and employees was based on specific criteria (degree, work and counseling experience, knowledge of new technologies) and a personal online interview. Quantitative data analysis was used as a methodological tool to investigate the extent to which mentors contributed to the integration of population groups into the labor market.

Till now (March 2025) the mentors/employees sample consisted of 130 volunteer mentors and 75 employers. Each of them have answered a list of specific questions about its interests and qualifications. n.

### *Mentees platform*

Mentees were asked to participate through invitation in social media and platforms. The "Mentoring" platform provides a user-friendly registration process for mentees. After entering their data, the platform automatically matches them with suitable employers or mentors. This matching is based on the applicants' personality, skills, work type, values, and desired

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employment sector. The goal is to offer effective guidance and training to help beneficiaries find a job.

### ***Procedure***

At the start of the call of mentor / employees a public invitation through social networks and public announcements. The Mentor/employee signs up on the platform and provides a brief curriculum vitae, with an optional inclusion of a self-introduction video. Afterward, they complete the required fields in their registration form. Data selected in this process were diplomas, work experience (more than 3 years), trainings, knowledge of computer used and knowledge of foreign languages, entrepreneurship education competences, application of basic skills, knowledge of technological modernisation methods, alternative forms of educational activity.

At the same time mentees were signed in account in the appropriate area of the program “Mentoring”. Mentee was completed a form for personal data such as: belonging to a VPG group, type of VPG group, language and informatic knowledge, working area of interest.

The platform “Mentoring” using an algorithm will automatically match the mentee with an available mentor/employer that matches their needs. After matching mentee-mentor/employer, the mentee can see the curriculum vitae and the self-presentation video of their Mentor/Employer before their online meeting. Additionally, the Mentor/Employer in turn sees the mentees and accepts them by sending them in the chat his/her availability for the upcoming online meetings.

### ***Statistical Methods***

Statistical analysis includes Pearson’s  $\chi^2$  test for contingency Tables for examining the association or proportion differences between discrete variables. Simple or clustered bar charts were used to represent discrete data. All analyses were performed in IBM SPSS Statistics 24.0 statistical platform. A level of significance  $\alpha=0.05$  was set.

### ***Results***

During the study period (Oct 2002- a total of 389 participants (mentees) have been recorded. Most of the participants were females (274, 70.4%), aged less than 36 years old (260, 66.9%), living mainly in Heraklion (316, 81.2%). Marital status was single for 233 participants (59.9%) while only 106 (27.2%) were married. Finally, 80 persons (20.6%) can be categorized as a VPG (VPG: Vulnerable Population Groups)

Distribution between VPG and non VPG population showed that age distribution is significantly different ( $p<0.001$ ) with a higher percentage in non-VPG participants <36 years old (223, 72.2%) vs VPG participants of the same age (37, 46.3%). Single were 197 (63.8%) in non VPG group while 36 (45.0%) were in the VPG group ( $p<0.001$ ). Similarly, educational level is lower in VPG and non VPG groups ( $p=0.001$ ) (**Table 1**).

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**Table 1.** Mentees’ demographic characteristics

|                      |                       | VPG (Vulnerable Population Groups) |      |             |      |                |      | p      |
|----------------------|-----------------------|------------------------------------|------|-------------|------|----------------|------|--------|
|                      |                       | No<br>(309)                        |      | Yes<br>(80) |      | Total<br>(389) |      |        |
|                      |                       | n                                  | %    | n           | %    | n              | %    |        |
| Prefecture           | Chania                | 19                                 | 6.1  | 10          | 12.5 | 29             | 7.5  | 0.057  |
|                      | Rethimno              | 21                                 | 6.8  | 4           | 5.0  | 25             | 6.4  |        |
|                      | Heraklion             | 257                                | 83.2 | 59          | 73.8 | 316            | 81.2 |        |
|                      | Lasithi               | 12                                 | 3.9  | 7           | 8.8  | 19             | 4.9  |        |
| Sex                  | Man                   | 87                                 | 28.2 | 28          | 35.0 | 115            | 29.6 | 0.232  |
|                      | Woman                 | 222                                | 71.8 | 52          | 65.0 | 274            | 70.4 |        |
| Age groups           | 17-25                 | 152                                | 49.2 | 12          | 15.0 | 164            | 42.2 | <0.001 |
|                      | 26-36                 | 71                                 | 23.0 | 25          | 31.3 | 96             | 24.7 |        |
|                      | 37-47                 | 59                                 | 19.1 | 22          | 27.5 | 81             | 20.8 |        |
|                      | 48+                   | 27                                 | 8.7  | 21          | 26.3 | 48             | 12.3 |        |
| Marital status       | Single                | 197                                | 63.8 | 36          | 45.0 | 233            | 59.9 | <0.001 |
|                      | In relation           | 18                                 | 5.8  | 5           | 6.3  | 23             | 5.9  |        |
|                      | Married               | 85                                 | 27.5 | 21          | 26.3 | 106            | 27.2 |        |
|                      | Divorced /<br>Widowed | 9                                  | 2.9  | 18          | 22.5 | 27             | 6.9  |        |
| Educational<br>level | 2nd (Gymnasium)       | 7                                  | 2.3  | 16          | 20.0 | 23             | 5.9  | <0.001 |
|                      | 2nd (Lyceum)          | 156                                | 50.5 | 40          | 50.0 | 196            | 50.4 |        |
|                      | College               | 121                                | 39.2 | 20          | 25.0 | 141            | 36.2 |        |
|                      | University            | 25                                 | 8.1  | 4           | 5.0  | 29             | 7.5  |        |

VPG: Vulnerable Population Groups

Distribution of the Vulnerability of mentees can be shown in **Figure 1**. Long-term unemployment (34, 42.5%) and long-term unemployment with low qualifications (6, 7.5%) results to a 50% of the driven with an unemployment issue. Single parent family was the second most selected option (23, 28.8%), while the rest 17 showed motor disabilities (6, 7.5%), ADHD (5, 6.3%), autism spectrum disorders -ASD (2, 2.5%), psychiatric diseases (2, 2.5%) and one (1.3%) showed speech and language disorders or ex-drug users.



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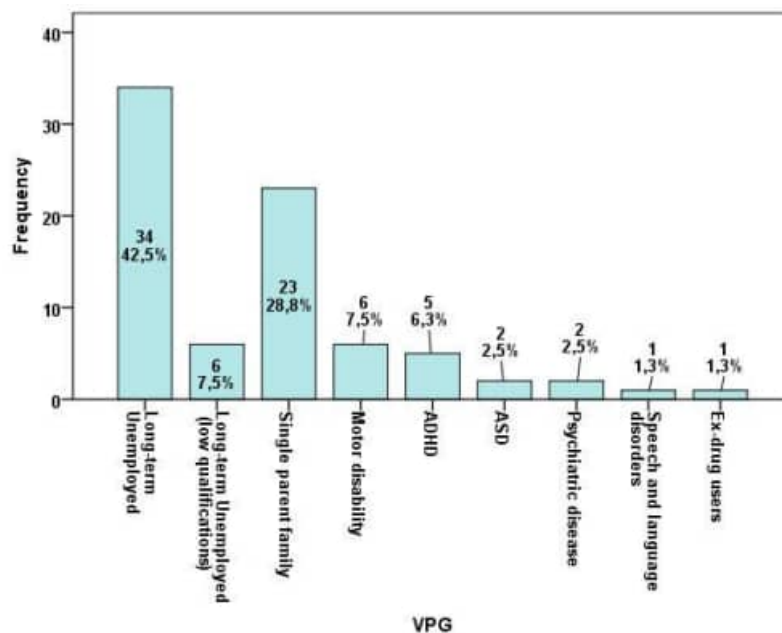


**Figure 1.** Vulnerable Population groups distribution

In **Figure 2** the level of spoken foreign language is presented. Values from 4 to 6 (1-neither, 2-very little, 3-little, 4-adequate, 5-very good, 6-excellent) were recoded and presented. English language was at least adequate for 77.6%, while for other languages (French, German, Italian and other) were adequate for less than 7% of the participants.

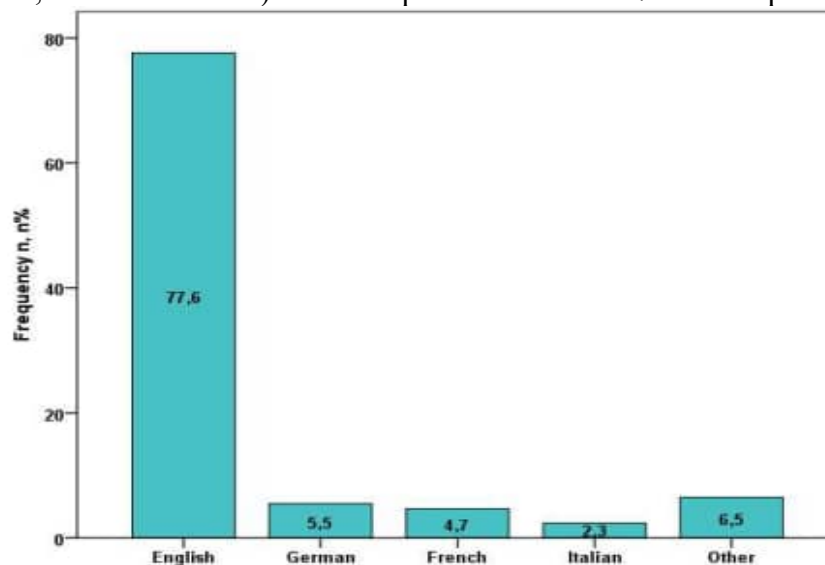


**Figure 2.** Levels of adequate knowledge of foreign languages

As expected, FEAD was more common in venerable group (24. 30.0%) that the non VPG group (13, 4.2%) and the total percentage was 37 persons (9.5%) ( $p < 0.001$ ). Use of e-portfolio was reported from 34 (8.7%) persons in total, while 14 (17.5%) of the persons were

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in the VPG group significantly higher than the 20 (6.5%) persons in the non-VPG group ( $p=0.002$ ) (Table 2).

**Table 2.** Participants characteristics in total and per group of vulnerability

|                         |      | VPG (Vulnerable Population Groups) |       |     |       |       |       | p      |
|-------------------------|------|------------------------------------|-------|-----|-------|-------|-------|--------|
|                         |      | No                                 |       | Yes |       | Total |       |        |
|                         |      | n                                  | %     | n   | %     | n     | %     |        |
| FEAD*                   | No   | 296                                | 95,8% | 56  | 70,0% | 352   | 90,5% | <0,001 |
|                         | Yes  | 13                                 | 4,2%  | 24  | 30,0% | 37    | 9,5%  |        |
| Work related to studies | No   | 151                                | 48,9% | 46  | 57,5% | 197   | 50,6% | 0,169  |
|                         | Yes  | 158                                | 51,1% | 34  | 42,5% | 192   | 49,4% |        |
| e-Portfolio             | No   | 289                                | 93,5% | 66  | 82,5% | 355   | 91,3% | 0,002  |
|                         | Yes  | 20                                 | 6,5%  | 14  | 17,5% | 34    | 8,7%  |        |
| Past mentoring          | No   | 272                                | 88,0% | 61  | 76,3% | 333   | 85,6% | 0,007  |
|                         | Yes  | 37                                 | 12,0% | 19  | 23,8% | 56    | 14,4% |        |
| Infomatics              | No   | 25                                 | 8,1%  | 6   | 7,5%  | 31    | 8,0%  | 0,073  |
|                         | Some | 126                                | 40,8% | 22  | 27,5% | 148   | 38,0% |        |
|                         | Yes  | 158                                | 51,1% | 52  | 65,0% | 210   | 54,0% |        |

\*Fund for European Aid to the most Deprived (TEBA program)

A good working environment was the most common answer (68.4%) in all the respondents, followed by the social relationships (56.6%) money/benefits (48.1%), creativity (46.5%), free time (30.8%) and fame/recognition (13.1%)

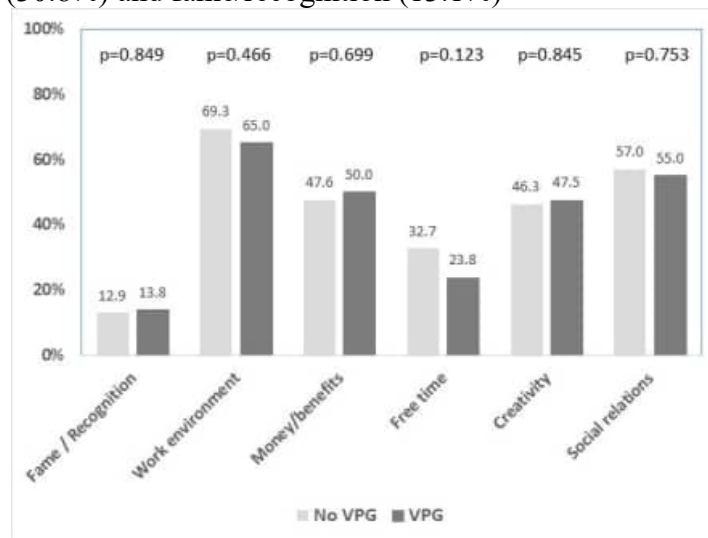


Figure 3. What the mentees expectation from a future work.

From the total of 389 persons only 12 (3.1%) have a status of inactive users. The distribution of active and non-active users per VPG groups is significantly different ( $p=0.001$ ).

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Distribution of active / inactive users in Mentoring platform vs past mentoring ( $p=0.288$ ), work experience ( $p=0.269$ ) and seeking for work related to studies ( $p=0.588$ ) do not differ significantly (**Table 3**).

**Table 3.** Active and non-active members of “Mentoring” platform

|                         |           | Status in Mentoring platform |     |        |       |       |
|-------------------------|-----------|------------------------------|-----|--------|-------|-------|
|                         |           | Inactive                     |     | Active |       |       |
|                         |           | n                            | %   | n      | %     | p     |
| VPG                     | No        | 5                            | 1.6 | 304    | 98.4  | 0.001 |
|                         | Yes       | 7                            | 8.8 | 73     | 91.3  |       |
| Work related to studies | No        | 7                            | 3.6 | 190    | 96.4  | 0.588 |
|                         | Yes       | 5                            | 2.6 | 187    | 97.4  |       |
| Past mentoring          | No        | 9                            | 2.7 | 324    | 97.3  | 0.288 |
|                         | Yes       | 3                            | 5.4 | 53     | 94.6  |       |
| Work experience         | No        | 9                            | 3.8 | 231    | 96.3  | 0.269 |
|                         | 1-3 years | 3                            | 3.7 | 78     | 96.3  |       |
|                         | >3 years  | 0                            | 0.0 | 68     | 100.0 |       |

VPG: Vulnerable Population Group

The top 5 areas of job interest between mentees were in the Health, Welfare and Wellness (87, 22.4%), Social and behavioural sciences (52, 13.4%), Management and Economics (45, 11.6%) and Economics and business Administration (29, 7.5%). The 5 corresponding proportions in VPG group in decreasing order were: informatics (15, 18.8%), management and economic (15, 18.8%), health, welfare and wellness (8, 10.0%), social and behavioural sciences (8, 10.0%) and 5.0% was referred for economic and business administration, agriculture, food and environment area, Culinary Arts technician

**Table 4.** Distribution of area of interest from mentees

| Area of interest                          | VPG |      |     |      |       |      |
|-------------------------------------------|-----|------|-----|------|-------|------|
|                                           | No  |      | Yes |      | Total |      |
|                                           | n   | %    | n   | %    | n     | %    |
| Health, Welfare, and Wellness             | 79  | 25.6 | 8   | 10.0 | 87    | 22.4 |
| Social and Behavioral Sciences            | 44  | 14.2 | 8   | 10.0 | 52    | 13.4 |
| Management and Economics                  | 30  | 9.7  | 15  | 18.8 | 45    | 11.6 |
| Economics and Business Administration     | 25  | 8.1  | 4   | 5.0  | 29    | 7.5  |
| Informatics                               | 12  | 3.9  | 15  | 18.8 | 27    | 6.9  |
| Health Sciences                           | 16  | 5.2  | 3   | 3.8  | 19    | 4.9  |
| Education Sciences, Languages, and Sports | 14  | 4.5  | 3   | 3.8  | 17    | 4.4  |
| Agriculture, Food, and Environment        | 8   | 2.6  | 4   | 5.0  | 12    | 3.1  |

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|                                                                      |    |     |   |     |    |     |
|----------------------------------------------------------------------|----|-----|---|-----|----|-----|
| <b>Culinary Arts Technician - Chef</b>                               | 8  | 2.6 | 4 | 5.0 | 12 | 3.1 |
| <b>Commerce, Unskilled General Duties</b>                            | 8  | 2.6 | 3 | 3.8 | 11 | 2.8 |
| <b>Electrical Engineering, Computer Science, and Informatics</b>     | 10 | 3.2 | 0 | 0.0 | 10 | 2.6 |
| <b>Music Studies and Fine Arts</b>                                   | 8  | 2.6 | 2 | 2.5 | 10 | 2.6 |
| <b>Applied Arts</b>                                                  | 5  | 1.6 | 2 | 2.5 | 7  | 1.8 |
| <b>Natural Sciences</b>                                              | 6  | 1.9 | 1 | 1.3 | 7  | 1.8 |
| <b>Mechanical Engineering</b>                                        | 5  | 1.6 | 1 | 1.3 | 6  | 1.5 |
| <b>Security and Infrastructure Officer</b>                           | 4  | 1.3 | 2 | 2.5 | 6  | 1.5 |
| <b>Bakery and Pastry Technician</b>                                  | 5  | 1.6 | 1 | 1.3 | 6  | 1.5 |
| <b>Structural Works, Built Environment, and Architectural Design</b> | 4  | 1.3 | 0 | 0.0 | 4  | 1.0 |
| <b>Professional Drivers</b>                                          | 3  | 1.0 | 1 | 1.3 | 4  | 1.0 |
| <b>Engineering Sciences</b>                                          | 3  | 1.0 | 1 | 1.3 | 4  | 1.0 |
| <b>Military and Merchant Navy School</b>                             | 3  | 1.0 | 1 | 1.3 | 4  | 1.0 |
| <b>Law and Political Sciences</b>                                    | 3  | 1.0 | 0 | 0.0 | 3  | 0.8 |
| <b>Electrical Engineering, Electronics, and Automation</b>           | 2  | 0.6 | 1 | 1.3 | 3  | 0.8 |
| <b>Acting Arts</b>                                                   | 3  | 1.0 | 0 | 0.0 | 3  | 0.8 |
| <b>Fashion Designer</b>                                              | 1  | 0.3 | 0 | 0.0 | 1  | 0.3 |

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VPG: Vulnerable Population Group

## Conclusion

This manuscript describes in brief the first findings of a web-based platform which connects volunteers' employees or mentors with mentees who are looking for improvement of their qualifications and for finding a work position related to their interest. The profile of the mentees who have been participated in the platform, showed that mentees were mainly women, young aged (<36 years old), lyceum as educational class, speaking English at an adequate level, referring a good level in informatics, not having an e-portfolio, never had mentoring before. A good working environment, and social relations with their co-workers was the most prominent expectation. More than one to five of the mentees wanted to work in the health, welfare and wellness section. Vulnerable (VPG) mentees' profiles showed to be different in proportions than non VPGs in age (higher age), marital status (not single), educational level (lower), help from FEAD, not having a e-portfolio (higher), and do not experiencing any past mentoring. The main groups of VPG were long-term unemployment and leaders of single parents' families. Also, a small but significant proportion of VPG individuals were inactive in the platform more than the non-VPG group.

The “Mentoring” platform is a web-based approach which trying to gap the needs of people for work with the proper mentoring. The primary goal of the platform is to enhance self-awareness, self-confidence, and internal motivation of mentees. This includes understanding new opportunities for personal and professional development, such as interests, values, skills, and personality traits. The program also offers suggestions for improving

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employment-related skills, supports and encourages individuals to actively manage their careers, and facilitates their integration into the labour market and society through the dissemination of best practices. The professional counselling model includes assessing personality traits, career research and selection, professional training, placement, and monitoring (Spyridaki, 2022, 2023).

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# THE DESIGN AND DEVELOPMENT OF A MOBILE APPLICATION FOR SUSTAINABLE INTERACTION WITH CULTURAL HERITAGE: THE ‘THESSALONIKI REIMAGINED’ PROJECT

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## Abstract

Thessaloniki, a city with a rich historical legacy and a dynamic cultural landscape, offers a unique opportunity to integrate digital innovation and sustainability in the management of cultural heritage. This proposal outlines the development of a mobile application, "Thessaloniki Reimagined," designed to facilitate the preservation, exploration, and sustainable promotion of the city's cultural assets through advanced digital technologies and environmentally conscious strategies.

The application leverages augmented reality (AR) and virtual reality (VR) to provide immersive reconstructions of iconic landmarks, such as the Rotunda and the White Tower, enabling users to interact with historical contexts dynamically. Personalized itineraries, powered by artificial intelligence, are tailored to user preferences and encourage eco-friendly transportation modes, such as walking, cycling, and public transit, in alignment with sustainable urban mobility goals.

"Thessaloniki Reimagined" also incorporates participatory and gamified elements to foster community engagement. Features such as cultural heritage quests and interactive challenges incentivize users to explore the city while contributing to a deeper understanding of its diverse history. A crowdsourcing functionality allows users to contribute stories, multimedia content, and localized knowledge, enriching the app's database and fostering a sense of collective ownership over the city's heritage.

The app is designed to align with the European Union's twin transition priorities, integrating digital transformation and green innovation. Sustainability is embedded through features such as real-time eco-impact tracking, partnerships with environmentally responsible businesses, and promotion of low-carbon tourism practices.

This initiative positions Thessaloniki as a case study for combining cultural heritage preservation with digital and ecological advancements, reflecting the principles of the New European Bauhaus and the EU's Agenda for Culture 2030. The proposed application demonstrates how cities can harness technology to enhance cultural accessibility, promote sustainable development, and support a resilient and inclusive urban identity.

**Key words:** Cultural heritage management, Digital transformation, Sustainability, Augmented reality (AR), Eco-friendly tourism

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### RECONNECTING MYSTRAS: LINKING ARTIFACTS TO HISTORY THROUGH DIGITAL NARRATIVES

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#### Abstract

The archaeological site of Mystras, located in western Laconia, is the best-preserved Byzantine site in Greece also known as the "Castle City of Mystras" (Ministry of Culture and Sports, 2012). Mystras, a UNESCO world cultural heritage monument since 1989, was founded in 1249 by the Frank commander William II of Villehardouin, and was initially built as a castle fortress on top of Myzithra hill, overseeing the Valley of Evrota 6km southwest of Sparta creating a control point for his regime. The city passed to Byzantine rule in 1259 and expanded outside the Acropolis eventually developing into the powerhouse of the Peloponnese, capital of the Despotate of Morea. The city flourished through a significant number of phases, different rulers and population changes, from the initial Frankish regime to Byzantine, Venetian and Ottoman rulers. The city was destroyed during the raid of Ibrahim troops in 1824 (Sinos, 2009).

Following the establishment of the Modern Greek state a significant number of people returned and lived in the ruins, salvaging all they could until 1954 when Mystras was declared a national archaeological site. Excavations and restoration work began as early as 1860, uncovering artifacts that offer valuable insights into late Byzantine life in the Peloponnese. Located within the Agios Dimitrios church complex, the Museum of Mystras showcases these findings, including unique garments, books, and more (Martiniani-Reber, 2000). This study aims to connect the museum collection with the site itself through digital storylines linking artifacts to their discovery locations, historical figures, and events. By intertwining these artifacts with their original contexts within the site, visitors gain a deeper understanding of their historical significance and the daily life they represent. A web-based experience allows visitors to explore the pebbled streets of Mystras while accessing virtual storylines that bring its Byzantine history to life. This innovative application not only enhances cultural heritage preservation but also fosters global accessibility and engagement with the site's rich history (Panagiotidis, 2023).

**Key words:** Cultural Routes, Mystras, Museum Collections

## CREATION OF A DEVELOPMENT RIGHTS MANAGEMENT MECHANISM USING BLOCKCHAIN TECHNOLOGY

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### Abstract

The Transfer of Development Rights (TDR) is an urban planning tool that allows the transfer of building rights from one property (where construction is restricted due to regulations, e.g., historical monuments, protected areas) to another property where increased construction is permitted. The legal framework governing TDR in Greece is Law 4759/2020 (Government Gazette A' 245/09.12.2020) for the modernization of spatial and urban planning legislation, which provides for the establishment and operation of the Digital Land Bank (DLB).

The Digital Land Bank serves as a mechanism for:

- Recording all transferable development rights available.
- Exchanging and transferring development rights between property owners.
- Transparency, by providing access to accurate information on the availability of building rights.

In this research paper, we propose a theoretical framework for the operation of the Digital Land Bank, based on Blockchain technology and the use of smart contracts, including various mechanisms that can further enhance the effectiveness of such an application. The use of Blockchain technology in urban planning tools like TDR through the Digital Land Bank could revolutionize the management of such development rights, generating the following benefits:

- **Transaction security:** Each transfer of building rights can be recorded with an encrypted signature on the Blockchain, preventing fraud through verifiable transactions.
- **Transparency:** The Digital Land Bank allows all participants (e.g., property owners, authorities) to track the path of every building right through a tamper-proof system.
- **Elimination of bureaucracy:** Transfer processes become immediate and automated, reducing delays caused by traditional registration systems.
- **Interoperability:** Blockchain allows the integration of the Digital Land Bank with other systems (e.g., land registry, taxation systems).

Nevertheless, investments in technology, legal adjustments, and education are required to overcome challenges and achieve full implementation.

**Keywords:** Transfer of Development Rights, Blockchain, Smart Contracts, Digital Land Bank, Urban Planning, Transparency, Interoperability.

### 1. Introduction

Managing urbanization and land usage has long been a challenge for developers, policymakers, and property owners. Because it permits the flexible redistribution of

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development rights while preserving places that are significant to the environment or culture, the Transfer of Development Rights (TDR) is a crucial tool in urban planning. Development rights are the ability to alter or improve a property, such as by constructing new structures, expanding existing ones, or altering the land's original use. Development Rights are commonly transferable (TDRs), allowing owners to sell or assign them to a third party. Even if owners do not intend to develop their land directly, transferability allows them to capitalize on its development potential. This is especially useful in areas where development is limited due to legal or environmental constraints.

The legal characterization of a TDR title generally recognizes the right it embodies as a real right, a form of property right. This aligns with the view of Hou, Chan, and Li (2018), who explore TDR as an institutional innovation addressing property rights issues. Their research highlights how TDR programs can effectively balance public and private interests in development by enabling property owners to transfer their development rights to designated receiving areas.

Furthermore, Boettke and Candela (2014) underscore the importance of development rights as an integral component of the broader institutional framework of property rights, a framework crucial for economic development. They posit that clearly defined and enforceable property rights, including development rights, are essential for stimulating investment and driving economic growth.

Development rights, as a fundamental aspect of property ownership, are frequently subject to land use policies, planning regulations, and local zoning ordinances. While referred to by various names internationally, including Building Rights and Air Rights, in Greece, the concept is synonymous with "transferable building coefficient."

The law n.4759/2020 establishes the current legislative framework for TDRs in Greece, with the primary goal of creating a mechanism for the Digital Land Bank (DLB). The DLB is primarily an electronic marketplace for the trading of building rights. It can also serve as a funding source for green projects and a compensation mechanism for property owners.

For sellers and buyers of development rights (DR) who use the DLB platform to disclose their real estate assets, the DR transfer procedure will take place electronically, with no mediation or state interference.

The creation of Local Spatial Plans (LSP) by municipalities and the designation of at least a few locations for the distribution of building rights—known as Building Rights Reception Zones (BRRZ)—are prerequisites for the functioning of the DR transfer system. In essence, property owners whose construction rights have been "removed" (either whole or partially) are the potential sellers of building rights on the DLB. The Ministry of Environment will electronically issue a DR transfer title for any property that is planned for sale. The title will then be assessed using a mix of the property's square footage, chronological order, and the zone price of the area. The final stage in the procedure is to register the property with the DLB. The buyer, in turn, submits an electronic application stating their intention to purchase DR and indicating the property in a BRRZ to which the DR will be affixed. The DLB platform speeds up the process by automatically and anonymously matching DR between sellers and purchasers, prioritizing DR transactions within the same municipality.

When the DR transfer is complete, the matching DR is withdrawn from the donor property, and the cadastral office is notified of the changes. DR transfers made through the

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DLB are subject to a statutory payment to the Green Fund (a public-law body reporting to the Ministry of Environment and Energy) of 5% of the transferred DR's objective value. This cash will be used to fund environmental and urban planning balancing efforts in the municipality where the BRRZ is located.

The Technical Chamber of Greece is tasked with developing and operating the Digital Land Bank (DLB) under a decision issued by the Deputy Minister of Environment and published in the Government Gazette 4605 B/2022. The DLB will consist of a set of separate functions, including at least the following:

**a. The establishment of a digital database** for donor and recipient properties of building rights and associated transfer titles, along with the management of the records' content, comprises the following:

- Database design (including requirements analysis, entity-relationship diagrams (ERD), conceptual and logical designs, physical and functional designs, and entity/relationship models).
- The deployment and setup of G-Cloud-compatible apps and security measures that make use of cloud computing services (IaaS, PaaS, and SaaS) and facilitate the functioning of the created databases and apps.

**b. Development of an application for graded user access** to the services of the information system based on their designated roles.

**c. Creation of a workflow management and monitoring application** to support all required processes.

**d. Provision of user training services** for the system.

**e. Ensuring the smooth operation** of databases and applications.

**f. Provision of maintenance and technical support services** for the systems (applications and data).

The information system will be developed in accordance with common interoperability guidelines, leveraging open interfaces, protocols, and formats (together known as open standards).

The above indicates that the project primarily pertains to a cloud-based application that will centrally handle data. Cloud technology excels at scalability, ease of use, and integration, making it suited for managing enormous transaction volumes and frequently changing requirements.

On the other hand, there is a disruptive technology called Blockchain, which is said to change numerous industries. Blockchain is a decentralized, distributed ledger technology first introduced with Bitcoin in 2008 by Satoshi Nakamoto, an unidentified entity. Unlike traditional databases, blockchain provides transparency, security, and immutability by storing transactions in a chain of blocks that are protected by cryptographic hashing and consensus procedures (Swan, 2015).

Unlike cloud computing, which is based on centralized servers, blockchain eliminates the need for middlemen, lowering costs and the risk of single points of failure (Zyskind, Nathan, & Pentland, 2015). It improves security by making data tamper-resistant and provides greater transparency because records are immutable and verifiable by all network members (Pilkington, 2016).

Blockchain's openness, immutability, and security make it ideal for registering property rights. It eliminates fraud, streamlines transactions, and minimizes bureaucratic bottlenecks.

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Smart contracts can automate property transactions, and tokenization allows for fractional ownership, increasing liquidity and access to real estate markets (Zohar, 2015). Blockchain provides a more secure and efficient framework for managing property rights since it ensures verifiable ownership records.

This paper explores how Blockchain technology can help turn the DLB into a strong, transparent, and efficient system for controlling development rights. Blockchain-based methods can increase stakeholder confidence and involvement by solving critical concerns including fraud, inefficiencies, and bureaucracy.

## 2. Methodology

To construct a theoretical framework for a Blockchain-powered Digital Land Bank, the following methodologies were employed:

1. **Literature Review:** An extensive review of existing research on Blockchain applications in land management and urban planning was conducted. Key focus areas included transaction security, interoperability, and process automation.
2. **Case Studies:** Examples of Blockchain implementation in land registries, such as those in Sweden and Georgia, were examined to identify best practices and challenges.

### 2.1. Literature review

As elucidated by Culha (2020), blockchain technology has emerged as a transformative force across a diverse array of technological domains, presenting a complex interplay of opportunities and challenges. Within the realm of property rights registration and management, blockchain has demonstrated exceptional adaptability, finding applications in areas such as resource production, storage, deployment, and the monitoring of supply chains, particularly during crisis scenarios. Below is a synthesis of significant scholarly contributions that explore the application of blockchain technology in property rights registration and management, derived from comprehensive bibliographic research.

- **Allam and Jones (2019)** proposed an innovative model for the transfer of air rights—a form of Transferable Development Rights (TDR)—in New York. Their mechanism leverages smart contracts with rigorously predefined temporal clauses to regulate pricing and the broader air rights market, thereby enhancing market efficiency and transparency.

- **Shahab and Allam (2020)** distinguished between tradable permit schemes (TBS) and Transfer of Development Rights (TDR), categorizing both as market regulation tools. While TBS pertains to the trading of specific rights, such as exploitation rights for natural resources or emission rights for harmful substances, the authors proposed a blockchain-based mechanism aimed at reducing intermediation costs, thereby streamlining the process and enhancing market integrity.

- **Kumara and Gopiprasad (2020)** advocated for the use of blockchain technology to improve the governance of the TDR process in India. They proposed the creation of a digital platform for TDR title trading, designed to ensure transparency and provide real-time updates to all stakeholders. According to the authors, this solution would bolster the credibility of the



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TDR mechanism while mitigating risks such as cartel formation and the commoditization of TDR titles.

- **Dwivedi et al. (2023)** introduce a novel framework for the tokenization of development rights, emphasizing collaboration with development authorities. Their approach addresses practical challenges related to record-keeping, land verification, and stakeholder identification by integrating publicly available data, thereby ensuring the accurate evaluation of development rights.

- **Konashevych (2020)** provides a critical analysis of the applicability of blockchain and other distributed ledger technologies in real estate, property rights, and public registries. The study offers a multidisciplinary perspective on the constraints and benefits of blockchain, highlighting its potential to serve societal needs in property rights management.

- **Sladić et al. (2021)** examine the current processes for real property transactions within Serbian land administration and explore how modern ledger technologies, such as blockchain, can enhance these processes. The study underscores the potential of blockchain to improve transparency and efficiency in property transactions.

- **Madushanka et al. (2024)** introduce "SecureRights," an advanced blockchain-based digital rights management framework. This innovative solution combines blockchain technology with digital watermarking, perceptual hashing, QR codes, and the Interplanetary File System (IPFS) to strengthen defenses against unauthorized use and streamline the assertion of digital rights.

- **Stefanović et al. (2023)** highlight the growing prominence of non-fungible tokens (NFTs) as a significant application of blockchain technology beyond cryptocurrencies. While NFTs have gained traction in digital art, their potential in fields such as land administration, healthcare, and supply chain management is increasingly being explored. The authors propose a new standard to facilitate fractional ownership of NFTs, expanding their utility across diverse applications. They also provide a practical implementation of this standard using the Solidity programming language.

- **Rudytsia (2022)** outlines the development of a property rights distribution module utilizing NFT fractionalization, based on blockchain technology. By leveraging the Ethereum blockchain and the ERC-1155 standard, this approach enables the creation, fractionalization, and sale of NFTs tied to users' property. The system ensures security and uniqueness through cryptographic algorithms, eliminating the need for third-party intermediaries while maintaining data fidelity and trust. This innovative solution addresses key functional requirements, such as the generation of unique NFTs and the management of fractional ownership, offering a modern approach to decentralized property rights management.

The aforementioned studies collectively underscore the transformative potential of blockchain technology in enhancing the management, security, and transparency of property rights. By addressing critical challenges such as intermediation costs, data integrity, and stakeholder trust, these contributions pave the way for more efficient and equitable systems of property rights registration and management.

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### **2.2. Case studies**

In countries like Sweden and Georgia, blockchain technology has been used in land registries, demonstrating it can improve transaction transparency, efficiency and security. Below is a rundown of these cases along with a bibliography for reference.

#### **Sweden - Lantmäteriet's Blockchain Pilot**

Lantmäteriet, the Swedish land registry authority has explored the use of the Blockchain technology for property transactions from 2016 onwards as a pilot. The pilot was launched in partnership with Chromaway, a blockchain technology company, some banks and real estate companies to ensure the efficiency, security and transparency of the property transaction system in Sweden (Lantmäteriet, 2016).

As stated above, Lantmäteriet has developed an automated system that uses blockchain technology for property transactions. This system acts as a safe custodial for important documents pertaining to the transaction including but not limited to purchase sales agreements and mortgage documents. In this case, the transactions are automated through smart contracts with ownership records set to update automatically once the precondition is met. This ensures that real-time visibility is available to all stakeholders whether they are buyers, sellers, banks or government authorities facilitating and expediting the processes, removing the manual waiting time. By leveraging the immutability of blockchain, the system ensures that property records remain tamper-proof, thus increasing trust among participants.

The pilot project demonstrated the potential of blockchain to reduce property transaction timelines from months to mere hours while also minimizing reliance on intermediaries and lowering transaction costs for participants (Lantmäteriet, 2016). However, full integration of blockchain into Sweden's land registry faces regulatory and legal challenges. Updates to the existing legal framework are necessary to fully utilize the technology's capabilities (Lantmäteriet, 2016).

#### **Georgia: Blockchain-Based Land Registry**

Georgia emerged as a leader in the implementation of blockchain technology for land registration in 2016. This innovative initiative, led by the National Agency of Public Registry (NAPR) in partnership with the blockchain development company Bitfury, aimed to establish a secure and transparent property transaction framework (NAPR, 2016).

Blockchain stores cryptographic hashes of property titles in Georgia, ensuring that land ownership records remain authentic and unalterable. The blockchain seamlessly integrates with Georgia's existing land registry platform, simplifying the verification processes for ownership and transaction histories. Additionally, property owners receive digital certificates backed by blockchain technology, serving as irrefutable proof of ownership. The system significantly reduces vulnerabilities to fraud, forgery, and corruption, thereby strengthening public confidence.

By mid-2017, over 1.5 million land titles had been registered on Georgia's blockchain system. This transparent and reliable approach attracted foreign investors and fostered greater

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public trust in land transactions (NAPR, 2017). While blockchain secures records, physical land surveying and disputes regarding boundaries remain dependent on traditional methods and legal resolutions (NAPR, 2016).

Both Sweden and Georgia exemplify the transformative potential of blockchain technology in land registries. Sweden’s pilot project underscores the efficiency of blockchain in reducing transaction times and costs, while Georgia’s implementation highlights its role in building trust and transparency on a national scale. However, broader adoption of blockchain in land registries faces challenges, including necessary regulatory reforms and integration with existing legal systems. These case studies demonstrate the promising future of blockchain in real estate, contingent upon the effective resolution of these hurdles.

### 3. Conceptual Framework Design

Using literature and case studies as source material, a conceptual structure for the DLB was created. This included:

- Utilizing Blockchain’s immutable public ledger, for the recording of TDR transactions.
- Implementation of compliance Check and Transfer Approval using Smart contracts.
- Interoperability with land registries and taxation systems.

The proposed mechanisms utilizes blockchain technology as a decentralized public ledger of immutable land titles and property rights. In addition to acting as a safe storage unit, blockchain technology is also inherently built to manage ownership. With Distributed Ledger Technology (DLT), users can directly manage their properties through peer-to-peer (P2P) transactions, eliminating intermediaries.

**Tokenization** forms the foundation of this system. Tokens are digital representations of assets, can be fungible (cryptocurrencies) or non-fungible (NFTs), enabling ownership and value transfer within blockchain ecosystems (Regner, Urbach, & Schweizer, 2019). Property rights NFTs provide a secure, transparent, and efficient way to manage property ownership and transactions on the blockchain. Property rights often need to be divided for various legal, financial, and practical reasons, enabling multiple stakeholders to share ownership, usage, or benefits from an asset as is the case in TDR management and transfer. Fractional NFTs (F-NFTs) address some of these issues by dividing property ownership into smaller, tradable shares, making real estate investments more accessible. Each token serves as a unit of account linked to a user’s blockchain address, with exclusive control secured through the user’s private key. These tokens are technologically integrated with cadastral data (e.g., geospatial information) and encumbrances such as leases, mortgages, superficies, and liens. The integrity of this linkage is ensured by trusted third parties authorized to certify ownership, deeds, and other property-related transactions.

**Smart contracts** are self-executing agreements with predefined rules stored on the blockchain (Szabo, 1997). They enable automation, reducing the need for third-party enforcement (Buterin, 2014). Tokens, which are digital representations of assets, can be fungible (cryptocurrencies) or non-fungible (NFTs), enabling ownership and value transfer within blockchain ecosystems (Regner, Urbach, & Schweizer, 2019).

Tokens differ fundamentally from cryptocurrencies. While cryptocurrencies are a medium of exchange and a mechanism to incentivize miners maintaining the blockchain

infrastructure, tokens represent specific property rights. Moreover, tokens can underpin derivative instruments, facilitating new economic relationships and activities such as Initial Coin Offerings (ICOs), Initial Exchange Offerings (IEOs), and Decentralized Autonomous Organizations (DAOs).

Once land titles and property rights are tokenized, traditional registries, such as cadastral systems, become redundant. Blockchain itself functions as a comprehensive registry, removing the need for repetitive registration processes. Although the initial onboarding of titles requires coordination with land authorities, subsequent transactions occur seamlessly on the blockchain, where data is immutable and irrevocable.

In our system design, we utilized various types of diagrams to effectively model and communicate different aspects of the system. Each diagram serves a distinct purpose and offers a unique perspective, ensuring a well-rounded understanding of the system's design.

Specifically, we employed three key types of diagrams, each addressing a specific dimension of the system:

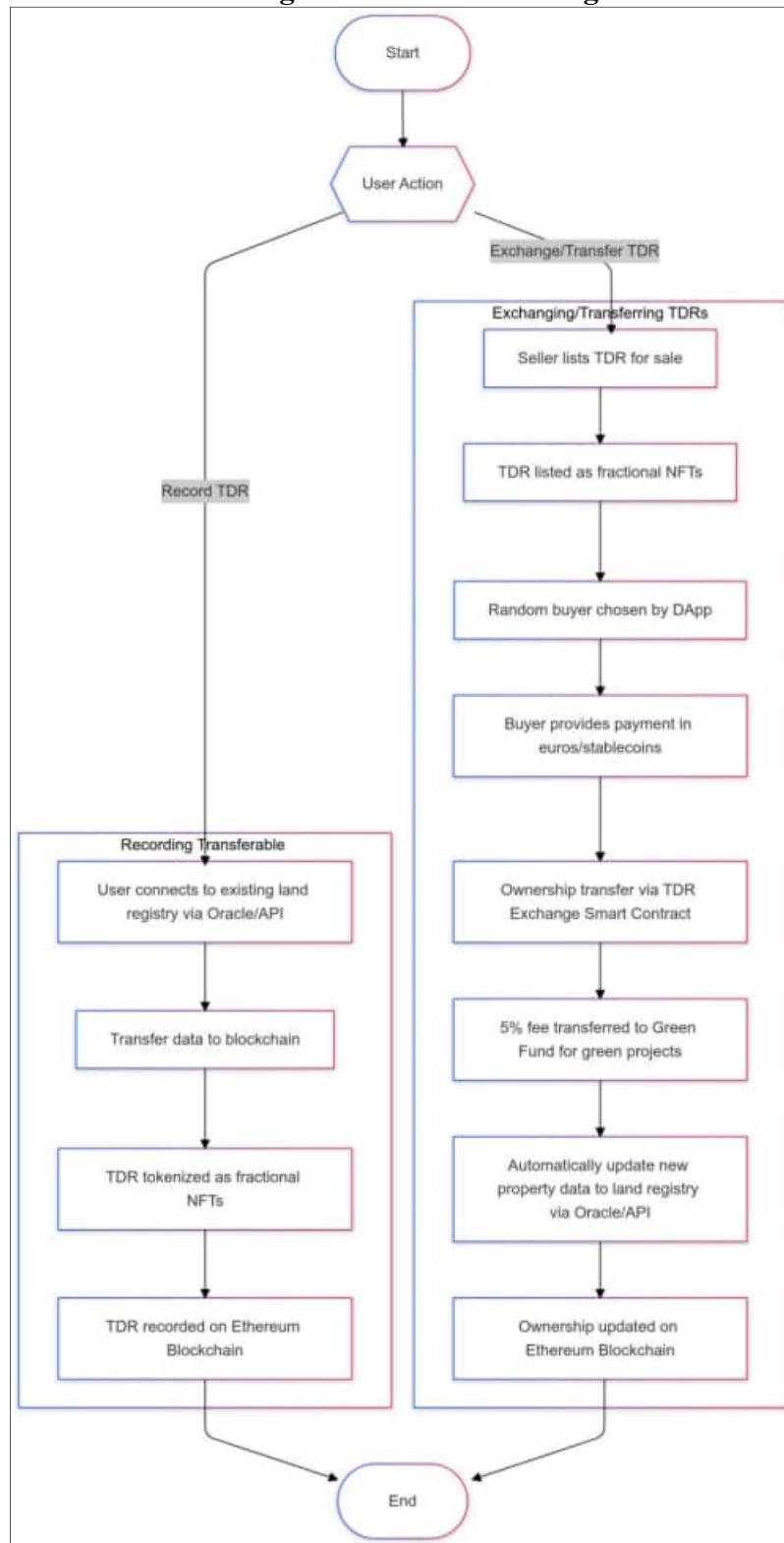
1. **Flowchart Diagrams:** These focus on the **behavioral aspect** of the system, illustrating how processes and workflows operate, including decision points and sequences of actions.
2. **Component Diagrams:** These emphasize the **structural aspect**, showcasing the system's physical or logical components and how they interact with one another.
3. **Class Diagrams:** These highlight the **data and relationships** within the system, detailing the entities, their attributes, methods, and how they relate to one another.

By combining these diagrams, we ensured a comprehensive representation of the system, addressing both its dynamic behavior and static structure, which is essential for effective design, communication, and implementation.

### ***3.1. Flowchart Diagram***

The flowchart Diagram (figure 1) is used to represent the flow of processes, logic, or workflows in a system. It visually describes the sequence of steps, decisions, and actions.

Figure 1 : Flowchart Diagram



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The logic behind the preceding flowchart is as follows:

1. **Start Node:**
  - The process begins when a user interacts with the dApp.
2. **User Actions:**
  - Users can either record a new TDR or participate in the exchange/transfer of TDRs.
3. **Recording TDRs Flow:**
  - The seller connects to an existing land registry using an **Oracle/API** to transfer their property data to the blockchain.
  - The TDR is tokenized as **fractional NFTs** for easier management and liquidity.
  - The blockchain records the tokenized TDRs, ensuring transparency and immutability.
4. **Exchanging/Transferring TDRs Flow:**
  - The seller lists the TDRs for sale as fractional NFTs.
  - The dApp randomly selects a buyer for the TDR using a deterministic algorithm or VRF (Verifiable Random Function) to ensure fairness.
  - The buyer makes a payment using **euros or stablecoins**, verified by the smart contract.
  - Upon successful payment, ownership is transferred via the **TDR Exchange Smart Contract**, and 5% of the transaction value is sent to the government for green projects.
  - The dApp updates the new property ownership details in the existing land registry via **Oracle/API**.
  - The blockchain records the completed transaction and updated ownership.
5. **End Node:**
  - The process concludes with all records updated both on-chain and in the external land registry.

As regards the Key Functionalities Highlighted :

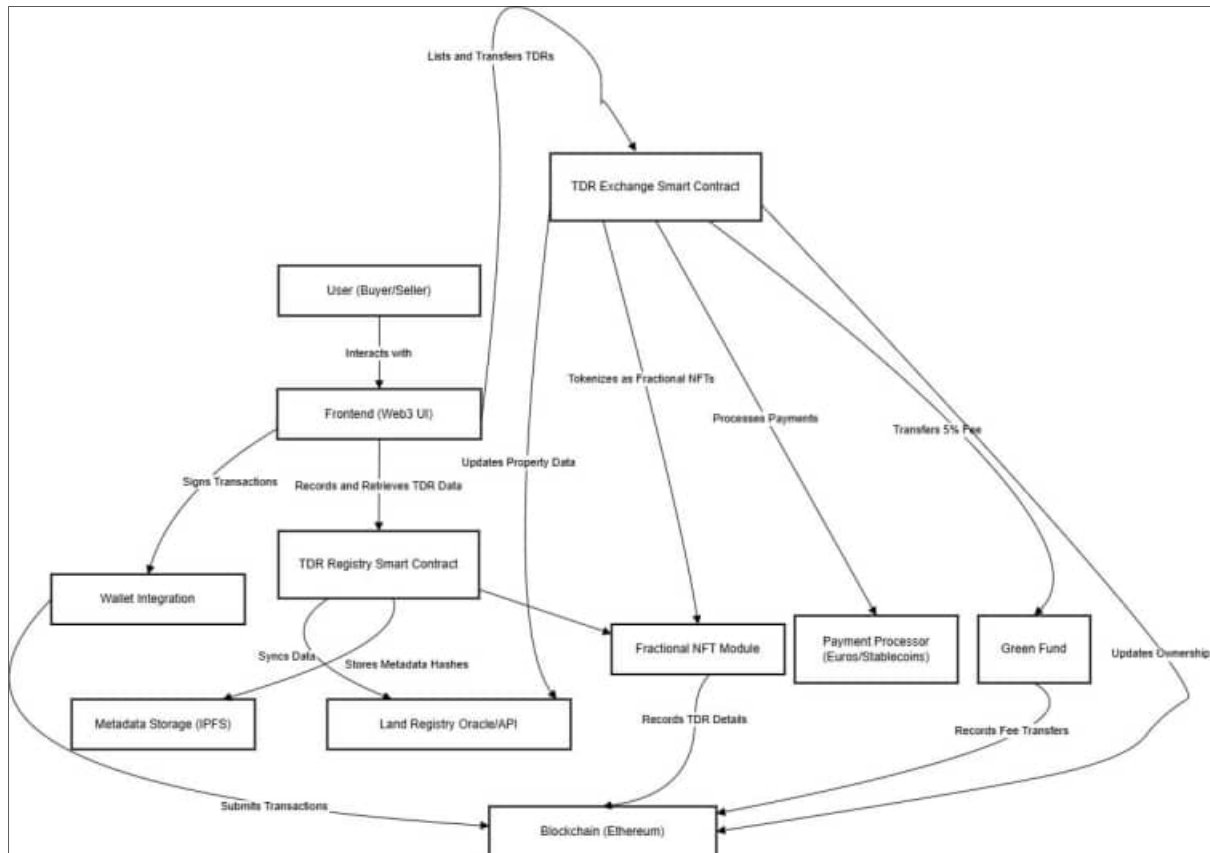
  1. **Integration with Existing Land Registry:**
    - Use of Oracle/API for seamless data synchronization.
  2. **Fractional NFT Tokenization:**
    - TDRs are tokenized to allow partial ownership and increased liquidity.
  3. **Random Buyer Selection:**
    - Ensures fairness and eliminates human intervention in selecting buyers.
  4. **Payment in Euros/Stablecoins:**
    - Simplifies currency handling while maintaining compatibility with blockchain-based payments.
  5. **Government Fee for Green Projects:**
    - A portion of transaction value supports sustainability initiatives.
  6. **Automatic Property Data Updates:**
    - New property ownership details are uploaded to the existing land registry system.

### 3.2. Component Diagram

The Component diagram is used to represent the physical or logical components of the **Digital Land Bank dApp** (figure 2) and their relationships. It focuses on the high-level structure of the dapp.



Figure 2 : Component Diagram



As regards the Components and Functionalities are the following :

1. **Frontend (Web3 UI):**
  - User interface enabling buyers and sellers to interact with the dApp.
  - Provides features like TDR listing, recording, and viewing ownership details.
2. **Wallet Integration:**
  - Allows users to sign and authorize blockchain transactions securely using wallets like MetaMask.
3. **Land Registry Oracle/API:**
  - Facilitates data synchronization between the blockchain and an existing land registry system.
  - Ensures that property data is accurately updated post-transaction.
4. **TDR Registry Smart Contract:**
  - Records and manages TDRs on the blockchain.
  - Links TDR metadata to decentralized storage via IPFS.
5. **TDR Exchange Smart Contract:**
  - Handles listing, buying, and transferring TDRs.
  - Implements the random buyer selection logic to ensure fairness.

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- ### 3.3. Class Diagram

### Figure 3 : Class Diagram



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The Component Diagram Key Highlights are the following :

1. **Core Classes:**
  - **User:** Represents the general user (both seller and buyer).
  - **TDRRegistry:** Handles TDR recording, linking with the land registry, and metadata storage.
  - **TDRExchange:** Manages TDR transfers, buyer selection, and fee deduction.
  - **Fractional NFT:** Implements TDR tokenization and NFT-based ownership transfer.
2. **External Integrations:**
  - **LandRegistryAPI:** Connects the dApp with an external land registry for data synchronization.
  - **PaymentProcessor:** Handles payments in euros or stablecoins.
  - **GreenFund:** Receives the 5% transaction fee for green projects.
3. **Ethereum Blockchain:**
  - Serves as the underlying decentralized ledger for storing transaction data and managing NFTs.
4. **Functional Flow:**
  - **Seller:** Lists and tokenizes TDRs through the TDRRegistry and FractionalNFT classes.
  - **Buyer:** Purchases TDRs using the TDRExchange, with payments validated by the PaymentProcessor.
  - **Fee Management:** Ensures a 5% fee is sent to the GovernmentTreasury.
  - **Registry Updates:** Automatically syncs new ownership data with the external LandRegistryAPI.

## 4. Discussion

It is clear that integrating Blockchain technology represents potential theoretical advantages of maximizing the DLB, but in order to accomplish its full implementation, many obstacles must be overcome. These include:

- **Investment in Technology:** The infrastructure for Blockchain-based systems require investments in hardware, software, and well-trained people.
- **Legal framework:** Current legislation should be revised to integrate Blockchain-based processes, which includes recognizing smart contracts legally.
- **Addressing Education and Training:** There's a need for stakeholders — including property owners, builders and government officials — to be trained in the application of Blockchain and its implications for TDR transactions.

Moreover, concerns about data privacy and scalability need to be addressed. While Blockchain ensures transparency, mechanisms must be in place to protect sensitive information. Additionally, the system should be designed to handle high volumes of transactions efficiently.

Although blockchain technology has a lot of promise to manage development rights by improving efficiency and transparency, there are a number of issues and concerns with its application.

Scalability is one of the main problems. Blockchain networks, especially public blockchains like Ethereum, include a lot of data and transactions involved in controlling

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development rights, which makes them very scalable. This involves handling a lot of property ownership, zoning, and development approval transactions, which might put a strain on these networks' capabilities. Public blockchains, despite being decentralized and transparent, frequently struggle with transaction throughput—the ability to handle a large number of transactions per second. This causes delays and higher transaction costs, which are especially important for large-scale urban projects that require frequent updates and transfers of development rights. Scalability difficulties become increasingly apparent as more users join the network, putting blockchain technologies' efficiency and cost in real-world development rights management applications to the test. Solutions such as layer 2 scalability, sharding, and other consensus mechanisms are being investigated to address these concerns, but widespread acceptance and effectiveness remain challenges (Vitalik, 2017).

Another problem is integrating with existing systems. Managing development rights requires compliance with legal frameworks, land registries, zoning regulations, and urban planning databases. Many of these existing systems are antiquated, paper-based, or inconsistent across jurisdictions, necessitating significant investment, time, and effort to integrate blockchain technology, posing a barrier to adoption (Grech and Camilleri, 2017).

Legal and regulatory ambiguity also impedes blockchain adoption for development rights. Blockchain applications must adhere to existing property laws, which vary significantly by country. The legal recognition of blockchain-based records, smart contracts, and digital tokens for development rights is still questionable in many jurisdictions, potentially leading to disputes and impeding adoption.

High initial costs present another significant concern. Implementing blockchain systems involves substantial expenses for infrastructure development, training, and integration. These upfront costs may not be justifiable for all municipalities, particularly in regions where alternative digital solutions or improvements to existing systems might be more cost-effective (Zhao et al., 2016).

The digital divide and accessibility issues are also critical challenges. Blockchain systems require access to technology, internet connectivity, and digital literacy, which could exclude marginalized or rural populations less equipped to engage with blockchain-based platforms, perpetuating existing inequities in property rights management (Huckle et al., 2016).

Although often a plus, blockchain's immutability also presents difficulties. It is difficult to change a record once it has been added. If inaccurate or fraudulent data is entered, this could be problematic because fixing it can be expensive and time-consuming, which would erode system trust (Crosby et al., 2016).

The energy-intensive nature of some blockchain systems, especially those that use Proof of Work (PoW), raises environmental issues. Concerns about sustainability are brought up by high energy use, particularly for governments or organizations dedicated to achieving climate goals (Vranken, 2017).

Another concern is reliance on smart contracts. Although smart contracts are crucial for automating the maintenance and transfer of development rights, errors or weaknesses in the code may result in exploitation or unexpected consequences. Furthermore, the rigidity of smart contracts may not account for the complexity of real-world scenarios requiring human judgment (Atzei et al., 2017).

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Another major obstacle is resistance to change. Adoption may be hampered by opposition from stakeholders, such as governmental organizations, legal experts, and developers used to traditional approaches, as blockchain-based administration of development rights constitutes a significant departure from conventional systems (Swanson, 2015).

Additional difficulties arise from the absence of standards in blockchain implementations for development rights. For users and policymakers, disparities in design, protocols, and governance lead to confusion, fragmentation, and interoperability problems (Hileman & Rauchs, 2017).

Last but not least, blockchain systems may become centralized as a result of reliance on private blockchains or control by certain entities, despite their decentralized promise. This would compromise the transparency and trust that blockchain is meant to offer (Narayanan et al., 2016).

One possible solution to the problems caused by the immutability of blockchain records is to use a Cross-Blockchain Protocol. A framework for "smart laws" is introduced by this protocol to address problems including inheritance disputes, access restoration in the event that private keys are lost, and the execution of court decisions. In this environment, trusted organizations, often known as "Digital Authorities," are essential. With governments enabling the conversion of title documents between formats, citizens are still free to select between traditional and blockchain-based systems. By enabling the use of numerous interconnected blockchains, encouraging technological innovation, and enhancing service quality, the Cross-Blockchain Protocol further increases user autonomy. Maintaining registries is no longer the government's responsibility; instead, it now establishes technical standards and puts smart legislation into effect. By establishing security protocols and regulating the criteria for blockchain inclusion in property registry networks, public authorities ensure system integrity and trustworthiness. Blockchain-enabled real estate tokenization thus transforms the traditional landscape, fostering innovation, efficiency, and enhanced security in property rights management (Zhang & Xue, 2018).

## 5. Conclusion

The integration of Blockchain technology into the Digital Land Bank represents a transformative approach to managing Transfer of Development Rights in Greece.

The proposed framework addresses key pain points in the current TDR system:

1. **Transaction Security:** Each TDR transaction is recorded as an encrypted block on the Blockchain. Fraudulent actions, such as duplicate sales of the same rights, are eliminated because each transaction is verifiable and immutable.
2. **Transparency:** The Blockchain ledger enables property owners, authorities, and stakeholders to view the history and current status of development rights. Blockchain's tamper-proof nature prevents data from being altered retrospectively, encouraging confidence.
3. **Increased Efficiency and Reduced Bureaucracy:** Smart contracts allow for the automated execution of transactions. For example, when a buyer meets established conditions (e.g., payment of fees, compliance with rules), the transfer of development rights occurs promptly and without user intervention.

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4. **Interoperability:** The DLB can communicate with other government systems, such as land registries and tax authorities, using application programming interfaces (APIs). This integration ensures consistency and reduces duplication of data.
5. **Cost reduction:** By automating operations and eliminating the need for intermediaries, the Blockchain-based system can reduce administrative costs.

However, realizing Blockchain's full potential necessitates coordinated efforts in technological development, regulatory reform, and stakeholder education.

Future research should center on piloting the proposed framework and evaluating its performance in real-world circumstances. By overcoming implementation challenges, the Blockchain-powered DLB can serve as a model for future urban planning developments around the world.

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## INFORMATION LITERACY FOR CULTIVATING SUSTAINABLE MINDSET

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### **Abstract**

Sustainable thinking and information literacy (IL) are essential for developing resilient, informed citizens with a sustainability-oriented mindset. IL provides individuals with critical 21st-century skills, empowering them to sustain and enrich democratic communities.

To better understand the role of IL in fostering sustainable thinking, this paper begins with a comprehensive literature review exploring key research clusters and emerging trends at the intersection of these concepts. The findings reveal a strong correlation between IL competencies - such as information evaluation, critical thinking, and ethical information use - and the cultivation of sustainable thinking. These skills are pivotal for fostering awareness of global challenges and promoting social inclusion.

Building on this foundation, the study explores the perspectives of students from the University of West Attica (UNIWA) and the University of Bologna (UNIBO) regarding the role of IL courses in secondary education and their influence on students' thinking. This quantitative study demonstrates that such courses significantly enhance students' critical engagement with information, equipping them to navigate complex information ecosystems responsibly.

Finally, to demonstrate practical applications, the paper presents a case study of an IL course taught to students in UNIWA's Department of Archival, Library, and Information Studies (ALIS). Inspired by the United Nations' 17 Sustainable Development Goals (SDGs), the course emphasizes defining information needs; searching, accessing and evaluating

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information; synthesizing new content; using information ethically; and sharing knowledge. The course equips students with transferable skills while raising awareness of sustainability issues, providing a model for integrating IL into broader educational curricula.

This paper highlights the potential of IL to cultivate critically engaged, sustainability-oriented learners. It underscores how embedding IL into education can better equip individuals to address global challenges.

**Keywords:** information literacy, sustainable goals, critical thinking, resilience, University of West Attica, University of Bologna

### Introduction

The 21st century presents humanity with unprecedented challenges, from climate change to resource depletion and growing social inequalities. In this context, sustainability has become a key priority, requiring individuals and societies to make informed, responsible decisions. At the same time, we live in an era of information overload, where distinguishing credible, relevant knowledge from misinformation is increasingly difficult. This makes information literacy (IL)—our ability to locate, evaluate, and effectively use information—an essential skill for sustainability efforts.

The term “sustainability” is defined variously across different contexts, but there is general agreement that highlights subjects about humans and their environments, understanding the complex relationships in diverse ecosystems, securing the well-being of future generations and valuing equity in socio-economic aspects (World Commission on Environment and Development, 1987).

Access to information has been recognized in the SDGs as a target under Goal 16.10 *“Ensure public access to information, because it enables people to make informed decisions that can improve their lives. Communities that have access to timely and relevant information for all are better positioned to eradicate poverty and inequality, improve agriculture, provide quality education, and support people’s health, culture, research, and innovation.”* Therefore, providing access to information as well as embedding IL courses in the curriculum in libraries context has been an important issue for these information organizations.

On the other hand, libraries as cultural institutions that serve all members of society without any discrimination, have both a legal and a moral obligation to enhance sustainability through IL courses. The central promise of the 2030 Agenda for Sustainable Development and its SDGs is to “leave no one behind” (LNOB), that could be interpreted in leaving no one illiterate and unfamiliar with reading and studying but reverse this fact through a more practical approach offered by libraries (Stark, 2011).

This paper explores the correlation of sustainability and IL, demonstrating their deep interconnection. IL is not merely a beneficial tool for sustainability but an essential component. Through a review of relevant literature and best practices, this study examines the role of IL in fostering informed decision-making, strengthening community initiatives, and enhancing sustainability practices. Additionally, it incorporates perspectives from students at the University of West Attica and the University of Bologna on the necessity of IL as a

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fundamental cognitive skill that shapes their mindset. Furthermore, it presents a case study of an IL course at UNIWA’s Department of Archival, Library, and Information Studies (ALIS), inspired by the UN's 17 Sustainable Development Goals (SDGs). The course develops key IL competencies while promoting sustainability awareness.

### Literature Review

The literature review was contributed based on two pillars: the first one is ‘information literacy’, and the second one is ‘sustainability’.

Literacy serves as a powerful instrument for both individual and societal advancement. Enhanced literacy leads to economic development, alleviation of poverty, and the fostering of democratic values, while simultaneously acting as a catalyst for transformation at both personal and community levels. It equips individuals with better problem-solving abilities. Nevertheless, the conventional understanding of literacy—defined merely as the ability to read, write, and perform basic arithmetic—has evolved in this era of technological innovation. Given its significant role in human and historical progress, literacy should be viewed in a broader context beyond traditional definitions (Adedokun, 2018).

According to the 1994 manifesto by IFLA and UNESCO, each library serves as a unique local information center, an “information hub” that connects the information requirements of its users with top-quality information services, by utilizing expertise and delivering accurate and objectively verified information. It could be described as the “local gateway” leading to knowledge and providing the basis for lifelong learning and the development of critical skill by implementing IL courses (Katsira & Koulouris, 2023).

One of the key theorists who described IL is Lloyd who states that, “*Information literacy is a practice that is enacted in a social setting. It is composed of a suite of activities and skills that reference structured and embodied knowledges and ways of knowing relevant to the context. Information literacy is a way of knowing*” (Lloyd, 2017).

IL is typically defined as the capability to recognize a need for information, find relevant sources, evaluate their credibility, and utilize them appropriately. The American Library Association (ALA, 2016) defines IL as "a set of skills that enable individuals to understand when information is required and have the capacity to find, assess, and effectively utilize the necessary information." In a time characterized by misinformation, these abilities are essential for navigating complex global challenges, such as those related to sustainability. There are five clear and distinct standards for IL, which include well-defined performance indicators and outcomes:

- a. The information literate student identifies the nature and scope of the information needed.
- b. The information literate student retrieves the required information effectively and efficiently.
- c. The student who possesses IL skills critically assesses information and its sources, integrating chosen information into their knowledge system and value framework.
- d. An information literate student utilizes information proficiently, either independently or as part of a community, to achieve a particular objective.

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e. A student with IL is aware of various economic, legal, and social considerations related to information use, ensuring they employ information ethically.

By embedding sustainability into the core aspects of IL, libraries may alleviate Sherman's main concern that “sustainability is a list of things one should do” rather than “a way of critically thinking about our individual and collective role in the world, as a way of informing individual and collective decisions” (Sherman, 2008). IL courses enhance with a focus on sustainability can help students accomplish each of these elements of critical thinking and prepare them to critically and sustainably engage with information in the real world.

Library science as a discipline should not be underestimated because information science drives the knowledge economy (Shafack, 2016). To Shafack the information profession is critical in the development agenda because it provides the platform on which to access necessary information that enhances the progress of human activities and it is closely linked to IL which helps people to access quality information to face socio-cultural and economic needs, thereby leading to healthy living and improved standard of living which ultimately brings hope for sustainable development.

Sustainability is not a synonym for environmentalism. Conserving natural resources for future generations is only one of the three components of the sustainable development concept (Kurbanoglu & Boustany, 2014). Sustainability is commonly defined by the World Commission on Environment and Development (1987) as "development that meets the needs of the present without compromising the ability of future generations to meet their own needs.". It encompasses three fundamental dimensions: environmental, social, and economic sustainability. Achieving sustainability requires long-term planning, critical thinking, and the ability to analyze diverse and often conflicting sources of information.

Libraries have long embodied the principles of sustainability, preserving knowledge and information across generations well before the concept gained widespread recognition (Connell, 2010). Their lending practices significantly contribute to environmental conservation by promoting the reuse of materials, thereby reducing the demand for paper and limiting deforestation (Jankowska, 2011).

The Green Library Movement, which seeks to minimize libraries' environmental impact (Antonelli, 2008), emerged in the early 1990s and gained momentum in the early 21st century. A key influence on this movement was the Talloires Declaration the first formal commitment to environmental sustainability in higher education (ULSF, 2001), signed by institutions in over 40 countries. This declaration, which emphasized fostering environmental literacy, promoting responsible citizenship, and integrating sustainability into university operations, played a pivotal role in motivating academic libraries to adopt greener practices.

By incorporating sustainability concepts like environmental literacy into the curriculum, there is an opportunity for significant impact due to the greater exposure it offers students to the subject and the methods for engaging with it through various interdisciplinary perspectives (Rowe, 2002). Nevertheless, sustainability should not be isolated within a specific area of study such as environmental science, as it spans a wide range of fields including the arts, humanities, economics, political science, and history (Barlett and Chase, 2004).



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At their core, sustainability and IL both depend on critical thinking and informed decision-making. Addressing sustainability challenges requires individuals to sift through a vast array of information, from scientific data and economic reports to government policies and corporate sustainability claims. Without strong IL skills, it is easy to fall prey to misinformation, greenwashing, or biased narratives. Scholars such as Kuhlthau et al. (2007) argue that sustainability challenges require interdisciplinary approaches, making IL a crucial enabler of effective action.

### Good Practices and Challenges

Integrating sustainability and IL requires education. Education for Sustainable Development (ESD), according to the United Nations Educational, Scientific, and Cultural Organization (UNESCO), is a foundational framework that equips students with the abilities and information needed to tackle global issues. Interdisciplinary programs in all levels of education that integrate sustainability and IL give students the ability to assess sustainability-related material critically and apply what they have learned in practical settings.

In the past, public libraries have been essential in ensuring that everyone has access to knowledge, and many are now expanding their mission to include sustainability education. According to Katsira and Koulouris (2023), libraries can serve as vital hubs for sustainability literacy in their communities by organizing workshops, curating specialized collections, and contributing to regional sustainability projects as vibrant cultural institutions. Some libraries, such as the Seattle Central Library (USA) and the Stuttgart City Library (Germany) have been designed with energy efficiency in mind, using advanced climate control operators and natural ventilation, geothermal heating and cooling system, while at the same time they embrace sustainable practices, such as minimizing paper usage and advocating for digital resources. At Vancouver's Public Library (Canada), the central branch has a green roof incorporating recycled materials in its construction. Simultaneously, it offers a range of sustainability-focused programs and workshops for the community (Papageorgiou, 2024). Local communities can apply IL as a way to induce sustainable change. For example, the Transition Towns movement uses shared online resources to help catalyze grassroots sustainability projects. Likewise, clear, accessible, well-organized information, such as the HEAL-link consortium is often critical to public programs that encourage recycling, energy efficiency and responsible consumption.

Many scholars view sustainable policies as a crucial factor for enhancing the environmental performance of libraries. Libraries in developed nations also struggle with adhering to sustainable policies. Only a handful of academic libraries in the United States have received LEED certification (Aulisio, 2013). Further, Jankowska & Marcum (2010) synthesized the existing literature on the topic of “green libraries” and found that academic libraries remained slow in either developing their own sustainability indicators or adopting from other organizations. Various studies indicate that no established guidelines exist to minimize printing waste management (Dempsey & Palilonis, 2012), and there is a lack of a sustainability policy for library collections (Marcum, 2009). Nevertheless, it remains essential to identify effective ways for libraries to operate as environmentally friendly entities and librarians to be well-engaged with sustainability issues (Noh, & Ahn, 2018).

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Different researchers have strongly argued that practicing sustainability holds greater significance than merely having eco-friendly library buildings. Alders (2018) highlighted the case of the National Library of Aruba, which encountered difficulties in forming strong partnerships with schools and other educational institutions to fulfill sustainable education objectives. Furthermore, many studies noted a deficiency in expertise and competencies and felt that professionals involved in environmental IL had not assumed their expected responsibilities (Abiolu & Okere, 2012). Other obstacles include public libraries investing in training citizens through environmental literacy, while not adopting effective sustainability practices.

The mission of green libraries was not explicitly stated. The primary challenge of educating users hinges not solely on having environmentally friendly buildings but also on sharing the educational responsibility with users (Binks et al., 2014). Beyond sustainable library construction, the principal challenge lies in implementing sustainability initiatives to raise public awareness (Btise, 2012). Most importantly, it is crucial to teach individuals that a green library does not necessarily need to be housed in a green building; rather, green actions represent a different challenge (Aulisio, 2013).

### **Information Literacy necessity: a quantitative analysis of students' perceptions**

This study presents the findings of a quantitative survey conducted between April and May 2023 at two universities: the University of West Attica (UNIWA) in Greece and the University of Bologna (UNIBO) in Italy. The survey aimed to explore students' perspectives on the importance of IL and its impact on their research skills.

The survey received approval from the Committee on Ethics and Research Integrity of the University of West Attica before the questionnaire's distribution. At UNIWA, the questionnaire was disseminated via email, resulting in a total of 254 responses. The survey was divided in three sections: the first collected demographic data, including age, gender, educational level, and country of origin; the second examined whether respondents had access to a school library during their middle school years; and the third assessed students' perceptions of IL and its impact on their research abilities. At UNIBO, the survey was conducted in person during a short-term Erasmus+ mobility program from April 17 to April 22, 2023. A total of 102 students completed the questionnaire after attending three instructional sessions on IL, which covered its definition, benefits for academic research, and the skills it enhances. This approach ensured that participants were familiar with the concept before responding to the survey.

The findings from this study provide valuable insights into students' awareness and attitudes toward IL, contributing to a broader understanding of its role in academic success. This section presents a quantitative analysis of the perceived importance of IL at different educational stages and its impact on lifelong research skills. The analysis includes Mode, Mean, and Standard Deviation to offer a comprehensive understanding of students' responses from UNIWA and UNIBO.

The table that follows (Table 1) reveals students' beliefs on the importance of IL courses from infancy. While the survey focuses on IL courses during secondary education, it is worth

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noting that some kindergartens are already introducing basic IL skills to toddlers, so they get familiar with simple strategies on informed decision making.

The mode analysis for this question indicates that the most selected rating for the significance of IL in infancy was a score of 4 for both the University of UNIWA and UNIBO. Nevertheless, respondents from UNIBO exhibited a significantly higher percentage of selections at this level, with 36.2% as opposed to 25.5% at UNIWA. Further statistical evaluation of the mean and standard deviation reveals that the mean score at UNIWA was 3.35, accompanied by a standard deviation of 1.28. On the other hand, students from UNIBO reported a mean score of 3.79 with a lower standard deviation of 0.94.

These findings imply that UNIBO students generally attach more significance to IL in infancy than their UNIWA counterparts. Moreover, the reduced standard deviation noted in the UNIBO group suggests a stronger consensus among respondents, while UNIWA students exhibited a greater variance in their perspectives regarding this matter.

*Table 1. Q1: Do you think that information literacy is important from infancy?*

| <b>Institution</b> | <b>Mode</b> | <b>Mean</b> | <b>Standard Deviation</b> |
|--------------------|-------------|-------------|---------------------------|
| UNIWA              | 4           | 3.35        | 1.28                      |
| UNIBO              | 4           | 3.79        | 0.94                      |

The following table (Table 2) highlights students' perspectives on the importance of implementing IL courses during secondary education (Junior School and Junior High School).

The mode analysis reveals that the most selected response regarding the importance of IL among middle school students was a rating of 5 from the respondents of UNIWA, with 58.6% choosing this option; on the other hand, UNIBO respondents most frequently opted for a rating of 4, with 42.2% of responses falling into this category. This indicates a strong acknowledgment of the significance of IL during this educational phase at both institutions.

Statistical analysis shows that the mean score for UNIWA was 4.49, accompanied by a standard deviation of 0.67, while UNIBO students had a mean of 4.17 and a standard deviation of 0.78. These results demonstrate that IL is generally regarded as highly important at the middle school level, as both mean scores exceed 4.0.

Moreover, the higher mean and lower standard deviation for UNIWA students suggest a greater and more consistent consensus on IL's importance during the years of this educational level. In contrast, the relatively higher standard deviation for UNIBO students indicates a wider range of responses, showing somewhat more variability in their perceptions.

*Table 2. Q2: Do you think information literacy is important at middle school?*

| <b>Institution</b> | <b>Mode</b> | <b>Mean</b> | <b>Standard Deviation</b> |
|--------------------|-------------|-------------|---------------------------|
| UNIWA              | 5           | 4.49        | 0.67                      |
| UNIBO              | 4           | 4.17        | 0.78                      |

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At Table 3, students were asked to answer if their research skills as university students would have been affected if they had attend at least one IL course during their secondary education. The mode analysis indicates that the most common response concerning the enhancement of research skills through IL was a score of 5 from UNIWA, with 46.7% of participants opting for this choice. In contrast, students at UNIBO demonstrated a more even distribution, with equal percentages of 42.1% each choosing ratings of 4 and 5.

The statistical evaluation shows that UNIWA had a mean score of 4.31 and a standard deviation of 0.80, while UNIBO had a mean of 4.11 and a standard deviation of 0.84. These findings confirm that students recognize the significant role of IL in improving their research skills, as evidenced by the high average scores from both universities.

Additionally, although UNIWA students rated the influence of IL marginally higher, the slightly larger standard deviation for UNIBO indicates a greater variety of responses, reflecting a wider range of views on this subject.

*Table 3. Q3: How much would your Research Skills be affected, if you had attended an IL courses at secondary education?*

| <b>Institution</b> | <b>Mode</b> | <b>Mean</b> | <b>Standard Deviation</b> |
|--------------------|-------------|-------------|---------------------------|
| UNIWA              | 5           | 4.31        | 0.80                      |
| UNIBO              | 4/5         | 4.11        | 0.84                      |

There is a clear agreement among both institutions regarding the importance of IL, particularly in its impact on middle school education and the cultivation of research skills. Students from UNIWA and UNIBO recognize the relevance of IL, pointing out its vital role in achieving academic success.

However, the views on the significance of IL in early childhood differ more significantly, especially among UNIWA students. This discrepancy indicates a broader range of perspectives on the necessity of IL during formative years, with some students placing a higher emphasis on its importance than others.

The findings also indicate that the middle school years are seen as a crucial time for acknowledging and integrating IL. The highest average scores at this educational level suggest that students from both institutions view middle school as a pivotal stage for developing IL skills, reinforcing the idea that early engagement with IL can have a lasting effect on academic achievement.

Additionally, both universities collectively acknowledge IL's role in enhancing research competencies. While there is general consensus on this matter, students from UNIWA seem to be slightly more persuaded of IL's influence on research development, as evidenced by the higher average scores noted in their feedback.

This statistical evaluation highlights the widespread acknowledgment of IL as vital for cultivating sustainability-oriented knowledge and facilitating informed decision-making, illustrating its significance across both institutions.

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### **From theory to action: an information literacy course redesigned for global challenges**

In light of the preceding discussion on the importance and necessity of IL, as well as its correlation with Sustainable Development, the Department of Archival, Library & Information Studies at the University of West Attica has redesigned the course "Information Literacy" to align with the United Nations' Agenda 2030— the blueprint of 17 Sustainable Development Goals that promote global peace and prosperity. Below, the innovative approach of the course (hereafter IL-SDGs course) is outlined, and its outcomes are highlighted, emphasizing the active participation of students.

The IL-SDGs course is designed with clear objectives, aiming to cultivate essential 21st-century skills through a constructive teaching approach in IL. Students engage with a range of critical competencies, including identifying informational needs by understanding what information is required, searching for and accessing information efficiently within vast information landscapes, and evaluating information—a skillset that will be further elaborated upon (Information Literacy Website, 2024).

Additionally, the course emphasizes the ability to study and synthesize content, transforming information into meaningful insights (Blachowicz & Ogle, 2017; Lapp, Flood & Farnan, 2016; McNamara, 2007; Santi & Reed, 2015; Snow, 2002), while also fostering the ethical and responsible use of information by promoting respect for intellectual property and proper attribution (HEALLEGAL; Creative Commons; EDUCABILITY, 2024; Kanaki, 2023; Secker & Morrison, 2016). Furthermore, students refine their ability to share knowledge effectively, from content creation to impactful dissemination.

What distinguishes this course is its applied learning approach, as students practice these skills through real-world topics directly aligned with the 17 Sustainable Development Goals (SDGs), ensuring both practical relevance and meaningful engagement.

Among the various skills emphasized in the IL-SDGs course, the ability to evaluate information is particularly significant for fostering sustainable thinking. This process involves multiple key criteria, including thematic relevance, which assesses whether the information aligns with the given topic, and temporal relevance, which considers the adequacy of the publication date. Accessibility is also examined, as restrictions or the lack of them on obtaining the full content may have implications for the levels of its credibility. Additionally, students assess source credibility by determining the trustworthiness of the publisher, while accuracy and reliability are evaluated to ensure the correctness of the presented facts. Objectivity is another crucial factor, requiring an analysis of potential biases in the information. Furthermore, validity and completeness are considered by examining whether the content is thorough and logically structured, while consistency is assessed by verifying whether facts and figures align across different sources. The evaluation process also takes into account popularity and presentation, ensuring that the information is professionally and engagingly presented, as well as the clarity, precision, and contextual appropriateness of language use (Keshavarz, EsmaeiliGivi, & Norouzi, 2020; Boothby, Murray, Waggy, Tsou, & Sugimoto, 2021; Habibi, Fatemi & Doshmangir, 2019; Rotboim, HersHKovitz & Laventman, 2019; Rethlefsen, Kirtley, Waffenschmidt, Ayala, Moher, Page & Koffel, 2021; Frampton, Whaley, Bennett, Bilotta, Dorne, Eales... & Schofield, 2022).



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By developing these competencies, students are better equipped to discern high-quality information, a skill that is essential in addressing global sustainability challenges. Moreover, this rigorous and thoughtful evaluation process reinforces responsible decision-making, further contributing to sustainable development efforts.

The students' efforts culminate in the creation of 92 IL-SDG blogs, which present rich, reliable content and diverse perspectives on Sustainable Development. Each blog serves as a reflection of their understanding of IL and global challenges while emphasizing the critical role of libraries and other organizations in advancing the Sustainable Development Goals (SDGs). To facilitate the dissemination of their work, students registered metadata on Omeka.net, an online platform for digital collections, ensuring systematic organization and accessibility. These blogs are publicly available at <https://infolitalhc.omeka.net/>, providing a valuable resource for individuals interested in sustainability, particularly libraries and other institutions seeking to engage with and contribute to SDG-related initiatives.

By the end of the course, students move beyond theoretical knowledge, engaging in the cooperative design of scenarios that bring their learning to life. These activities include role-playing library workshops in class, focused on sustainable living, climate change, and renewable energy, aiming to inspire environmental action. Additionally, students brainstorm and propose literacy programs and technology training initiatives that help address educational barriers and reduce inequalities. Many student teams think of and present in class cultural events and discussions on gender equality, peace, health, and sustainable consumption that foster awareness and encourage meaningful dialogue. Furthermore, students transform the class into a community innovation space that promotes creativity, and collaborative problem-solving. These experiential learning opportunities not only deepen students' understanding of key issues but also empower them to drive meaningful change as future information professionals within their communities.

The course yields transformative outcomes, significantly enhancing students' IL skills. By mastering the full spectrum of IL competencies, students are better prepared for success in academic, professional, and personal contexts. Additionally, they develop a deeper understanding of the Sustainable Development Goals (SDGs), enabling them to connect global challenges with actionable solutions and actively contribute to sustainability efforts at both local and global levels. Moreover, the course fosters a sustainable mindset, encouraging habits of thinking and acting that emphasize collaboration, inclusion, and resilience.

Ultimately, the course aspires to nurture learners who are not only well-informed but also inspired to take action. It aims to instill a mindset that prioritizes knowledge sharing and collaboration, breaking down silos to address global challenges collectively. Additionally, it promotes social inclusion and equity, fostering a world free of stereotypes and exclusions. Most importantly, it encourages students to envision and work toward a sustainable future where all individuals can thrive. By integrating IL into educational frameworks, this course equips learners with the resilience, awareness, and leadership skills necessary to tackle complex global challenges and contribute to a more sustainable world.



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### Conclusion

To establish a community that is more aware and liable, sustainability and IL must coexist. This paper demonstrates how IL empowers people and communities to actively participate in social and environmental initiatives, fight misinformation, and make environmentally friendly decisions. However, addressing problems with information access, complexity, and bias is crucial to achieving these benefits in their entirety.

Policymakers, educational institutions, and libraries all contribute to bridging this divide. Future generations will be better equipped to make sustainable decisions if we integrate sustainability literacy into IL programs, pledge adequate access to information, and use digital tools to enhance comprehension.

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Session:

**“Urban Environment and Sustainability”**

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# ASSESSMENT OF THE EFFECT OF GREEN ROOFS ON URBAN STORMWATER MANAGEMENT IN THESSALONIKI, GREECE

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## Abstract

Related to the 17 Sustainable Development Goals for the environment, the global community has realized that urban development requires a holistic approach. With respect to the urban environment, infrastructure, public spaces, quality of life and economy are important factors to consider. Excessive urban construction has resulted in tragic consequences both on the climatic conditions (increase of temperature and surface runoff) and deterioration of air quality. This study explores the environmental impact of green roofs on urban stormwater management. Due to climate crisis, extreme weather events occur more frequently, and cities are experiencing floods, which affect not only the life of the residents, but also the economy.

Green roofs, as a Nature Based Solution (NBS), function as rooftop gardens with soil layers that absorb and store rainwater, reducing runoff and easing pressure on drainage systems during heavy rainfall. Although considered a modern solution, green roofs have ancient roots, providing aesthetic, cooling, and shading benefits across various cultures. Technological advancements have made green roofs more efficient, making them integral to sustainable urban development today. In addition to stormwater management, green roofs offer ecological and social benefits, such as improved building energy efficiency, mitigation of the urban heat island effect, air quality enhancement, noise reduction, visual appeal, and psychological benefits for urban residents. However, challenges include higher installation costs, increased water needs, and added structural load.

Thessaloniki, the largest urban center in northern Greece, faces significant flooding due to high-density development and limited open spaces. This study analyzes the layers of green roofs -drainage, insulation, planting substrates and plants- and develops an optimal configuration tailored to Thessaloniki's environmental needs. A simulation using SWMM (Storm Water Management Model) in the study area demonstrates that while green roofs effectively reduce stormwater runoff, they do not comply as a complete solution for urban flood management.

**Key words:** Green Roofs, Stormwater Management, Urban Floods, SWMM, Thessaloniki

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# ACHIEVING URBAN SUSTAINABILITY THROUGH CIRCULARITY: THEORIES AND PRACTICES

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## Abstract

Cities are crucial interfaces between natural and socioeconomic systems, hosting over half of the world's population. Their rapid growth leads to increased concentration of people, economic activities, and social interactions. This urbanization poses significant global environmental and socioeconomic challenges. Cities can play a pivotal role in addressing these challenges by adopting Sustainable Development principles and considering economic, environmental, social, and governance factors equally. However, despite global efforts to promote Sustainable Development, its implementation remains a challenge. In this context, Circular Economy has emerged as a promising approach to contribute to Sustainable Development in urban contexts. The aim of this thesis is to explore this dynamic in urban contexts by exploring the research question of this thesis: How does the Circular Economy contribute to urban sustainability and to what extent does it give equal emphasis to the environmental, economic, social and governance aspects of Sustainable Development? To answer the research question, this thesis utilized secondary data, including scientific papers, United Nations reports, and European Union documents. Initially, a literature review was conducted to gain a theoretical understanding of Sustainable Development and the Circular Economy and their connection. Furthermore, these two concepts were studied through a case study of the city of Amsterdam in order to gain empirical knowledge about the implementation of Circular Economy in urban contexts. The findings highlight that the social dimension of Sustainable Development is often neglected in favor of economic and environmental dimensions. Furthermore, the research emphasizes the importance of governance in facilitating the transition to a Circular Economy and achieving urban sustainability. This thesis contributes to the understanding of the role of the Circular Economy in achieving urban sustainability, highlighting the need for a balanced approach that addresses the economic, social and environmental dimensions of sustainability equally through effective governance modalities.

**Key words:** Sustainable Development, urban sustainability, Circular Economy, social sustainability, governance



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### **Km Vert (Green Kilometer project) SYSTEM FOR URBAN REGENERATION**

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#### **Abstract**

Urban abandonment is a phenomenon linked to the socio-cultural and economic changes occurring in modern cities, often leading to the degradation of disused residential and industrial areas. However, these places, initially considered unattractive, can become opportunities for urban development if regenerated, with the involvement of local communities in the process. Archaeology plays a fundamental role in this regeneration, helping to strengthen territorial and socio-cultural identity through different dimensions: socio-cultural (exchanges and migrations), historical-artistic (democratic awareness), urban (history of settlements), industrial (transformation processes), climatic (environmental changes), energy (evolution of resources), and experimental (validating archaeological interpretations). The accelerating pace of climate change and the inability of cities to adapt require urgent intervention. The "Km Verde" project responds to this need, aiming to transform an urban street into an attractive area centered on the interests of citizens. It is not just a street reorganization but a radical and innovative intervention that promotes sustainable urban regeneration capable of attracting both tourists and residents. "Km Verde" should not be seen as an isolated intervention, but as the first step in a broader, more inclusive, and dynamic urban vision intended to improve the quality of life. Furthermore, the project uses modern technologies, such as Artificial Intelligence, to develop urban solutions that interact with the socio-cultural fabric of the area, offering more targeted and effective solutions. If successfully implemented, "Km Verde" could become a model for other cities, addressing similar challenges in a context of social, economic, and environmental change.

**Key words:** Urban abandonment, Regeneration, Territorial identity, Industrial archaeology, Climate change, Km Verde, Artificial Intelligence

**Km Vert (Green Kilometer project)  
System for Urban regeneration<sup>138</sup>**



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<sup>138</sup> Master Urbanisme et Aménagement course Mobilité, Ville et Architecture in Rabat, Morocco, by Xavier Dejardins and Andrea Marcuccetti

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### Introduction

Contemporary cities are profoundly shaped by socio-cultural and economic changes that, if not properly managed, often lead to the abandonment of certain urban areas. The abandonment of residential and commercial spaces is a phenomenon primarily affecting peripheral zones and historical districts, such as areas around old factories, where buildings and spaces that once thrived are now left to deteriorate. However, these initially uninviting places can be transformed into new opportunities for urban development through regeneration processes that actively involve local communities. This is where the "Km Vert" project comes in – an urban regeneration initiative distinguished by its visionary and radical approach to the transformation and use of the urban fabric. The marketing component should not be overlooked; creating a logo provides clear recognition for the project, which also has the added advantage of fostering social cohesion and attracting economic resources through customized merchandising.



The logo<sup>139</sup> will:

in fact, be customized according to specific contexts, such as the version used for the University course: Mobilité, Ville et Architecture in Rabat, Morocco, thereby giving the project a "tailored" identity:



### Urban Regeneration and the Role of Archaeology

In the context of urban regeneration, archaeology plays a fundamental role—not only as a discipline that studies the past, but also as a tool to recognize and enhance territorial and socio-cultural identity. Regeneration is not merely a physical operation aimed at restoring buildings; it is a process that must consider various aspects:

- **Socio-Cultural:** The restoration of historic places must take into account the social exchanges, migrations, and invasions that have shaped cities, contributing to cultural diffusion.

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<sup>139</sup> Created by Andrea Marcuccetti©

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- **Historical-Artistic:** Historical analysis helps develop a more aware, democratic, and inclusive society, built upon a shared heritage that narrates the city's history.
- **Urban:** Every regeneration project must preserve the historical memory of the urban settlement to understand the evolution of the place and its connection to the present.
- **Industrial:** Industrial memory represents an important chapter in the city's past and must be preserved in relation to economic and technological changes.
- **Climatic and Energy:** Urban regeneration must consider climate change and energy resources, making adaptation to new environmental scenarios a fundamental objective.
- **Experimental:** Archaeological research can benefit from experimental protocols to verify and reinterpret urban heritage within an innovative context.
- **Religious:** Research into the various religious sensitivities present in the territory that have contributed to shaping the socio-cultural landscape, while also considering the ongoing migratory flows, which have now become an integral part of current migration dynamics, each with their own religious beliefs and sensitivities.

### The "Km Vert" Project and the Challenge of Climate Change

Climate change, with its rapid progression and cities' inability to adapt, led to the birth of the "Km Vert" project. This initiative seeks to transform an existing kilometer of road into a green space through a simple yet radical operation. This is not a "colonial" intervention, imposed from above without a connection to the local reality, but rather a project that incorporates the **Genius loci**—the distinctive character of the place—in an inclusive, attractive, and sustainable manner. The goal is to create a high-quality, non-standardized intervention that reflects the identity and needs of the city. The choice of a "Km Vert" represents a move away from the "mineral city" and a step towards creating a more livable "vegetal city" urban environment capable of responding to the challenges of climate change.

### Analysis of the City and Project Definition

A fundamental aspect of the "Km Vert" project is the in-depth analysis of the urban context, starting with an understanding of the city's livability, its socio-cultural fabric, and territorial challenges. The selection of the kilometer to regenerate must be based on several factors, such as its socio-cultural relevance and its potential to attract both citizens and tourists. The chosen street must be viewed not only as a physical route but also as a starting point for a regeneration process that will have long-term effects on the entire city. The final goal is to stimulate widespread interest in creating further "Green Kilometers" that can gradually expand, triggering a domino effect that involves the community in a process of change and innovation.

"Km Vert" becomes a shared space for all the buildings that face it, with residents using it collectively—through gardens, urban farms, playgrounds, social spaces, or simply for strolling—while also remaining open to other citizens during exhibitions, concerts, or casual walks.

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### Design methodology

1. **Identity of the Place:** Every place has an inherent identity that must be respected and enhanced. The design must take into account the cultural, historical, and social specificities of the area. For example, cities like Jerusalem, Montréal, New York, or Florence each have a unique identity that guides their evolution. Identifying this identity allows for the development of a project that not only integrates with the territory but also highlights its singularity. The cities are Jerusalem (religion), Montreal (lingua), Singapore (nation building), Honk Kong (materialism), Beijing (political power), Oxford (learning), Berlin (tolerance and intolerance), Paris (romance), New York (ambition), Florence (renaissance), and Rom (empire).
2. **Urban Analysis:** A functional and socio-cultural analysis of the city is essential to understand the needs and desires of the citizens. The analysis should also include a study of vegetation and green spaces, with particular attention to tree species that can adapt to future climate changes.
3. **Design of the "Green Kilometer":** The design of a "Green Kilometer" must begin by identifying a stretch of road that is not necessarily straight but has significant potential for transformation. The chosen road must be connected to future urban expansion prospects and designed to reduce urban heat, with trees and green areas as the main protagonists. This intervention aims to create a "public environment" that becomes an integral part of citizens' daily lives.

### Artificial Intelligence Applied to Urban Design

Artificial intelligence (AI) is a crucial resource for the urban design of the future. Thanks to its ability to process data and simulate complex scenarios, AI can be used to improve the quality of projects and offer new innovative and sustainable solutions. In the case of "Km Vert," AI can be employed to analyze urban morphology, predict climate change impacts, suggest solutions for energy resource management, and create intervention models that respect the local socio-cultural context. AI, therefore, not only supports designers and administrations but also contributes to raising citizens' awareness, opening up new horizons for inclusive urban development while maintaining its socio-cultural vocation.

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(image AI, 1-12 created by Andrea Marcuccetti© course Mobilité, Ville et Architecture in Rabat, Morocco)



image AI 1



image AI 2



image AI 3



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image AI 4



image AI 5



image AI 6



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image AI 7



image AI 8



image AI 9

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## Conclusions

The "Km Vert" project is not merely an urban regeneration initiative but a truly innovative and transformative vision of the very concept of the city. In an era marked by climate change and the urgent need for sustainability, "Km Vert" offers a concrete and practical response to the environmental, social, and cultural challenges that modern cities face. Rather than being

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an isolated intervention, this project represents the first step of a broader system of urban transformation that could expand globally in the future. Its ambition goes beyond simply regenerating a kilometer of street, aiming to trigger a virtuous cycle that involves the entire city, fostering a renewal process rooted in the cultural and social heritage of the territory.

### **Urban Regeneration as a Continuous Process**

"Km Vert" is part of a paradigm of urban regeneration that recognizes the deep connection between the city and its community. In a world where urban development models have often led to the separation of residential, commercial, and natural spaces, the project offers a vision where public spaces become the beating heart of the city. Every regenerated kilometer is not just an aesthetic or functional improvement to the street but a process that transforms the urban environment into a space for social interaction, active participation, and sustainability. Every intervention becomes an opportunity to strengthen the local community, providing inhabitants not just with physical space but also a sense of belonging and collective responsibility.

The idea of creating a network of "Green Cities" aligns with this direction. This is not a mere sum of individual interventions, but a movement that connects different urban areas, uniting kilometers of regeneration into a large integrated design. The connection between these green areas can become a true network of urban resilience, capable of effectively addressing climate and social challenges. "Green Cities" will not only be places where trees and nature play a central role but also places that tell a story of recovery and adaptation, where local traditions are valued and integrated into a project of innovative development.

### **The city as a Living Ecosystem**

In this context, the city is no longer seen as a static entity but as a living ecosystem, constantly evolving and adapting to the needs of its time. The "Km Vert" project proposes a more resilient city, capable of responding to climate change and social challenges. Sustainability becomes the guiding principle, not just in environmental terms, but also in terms of social justice and cohesion. Urban regeneration must go beyond simply creating green spaces or ecological infrastructures: it must also involve the enhancement of human capital, strengthening local communities, and creating opportunities for civic participation. In this way, the city becomes an inclusive place where all citizens, regardless of their origin, social class, or background, have access to common resources that improve their quality of life. The inclusivity of the "Km Vert" project is also reflected in its collaborative approach. Local communities are invited to actively participate in the regeneration process, not only as beneficiaries but as key actors. The idea of involving citizens, institutions, and other stakeholders in a constant and productive dialogue is one of the key elements of this approach. "Km Vert" is not a top-down solution but a proposal born from the bottom up, from listening to the needs and desires of the community.

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### **The Social and Cultural Dimension of Regeneration**

Urban regeneration, such as that proposed by "Km Vert," also has a strong cultural dimension. Every intervention is an opportunity to rediscover the history of a place and to memorialize the traditions that have shaped it. However, culture should not remain anchored to the past; it must be a living element that renews and adapts to the needs of contemporary society. The project thus becomes a tool to celebrate and integrate local culture into an innovation process that does not sacrifice historical memory but uses it as a starting point to build the future. Reflecting on what constitutes a place's identity thus becomes a key resource for designing cities that are truly sustainable, not just environmentally, but also socio-culturally.

### **Towards a Global "Green City"**

The "Km Vert" model also provides an opportunity for broader reflection on the future of global cities. While many cities still follow development models that emphasize expansion and growth at the expense of quality of life, "Km Vert" promotes an alternative paradigm, where environmental quality and social health are the priorities. The creation of "Green Cities" represents a concrete alternative to the model of uncontrolled urbanization, creating spaces that promote physical, mental, and social well-being. In this sense, "Km Vert" is not just a project for one city but an idea that could be applied globally, as part of a movement to radically rethink how we design and live in our cities.

### **Sustainability as a Global Objective**

Finally, one of the most significant aspects of "Km Vert" is its commitment to sustainability in its broadest sense, encompassing not only environmental eco-sustainability but also social and economic sustainability. Regenerating a kilometer of street is not just an ecological or aesthetic improvement but a new opportunity to develop local economies, attract investment, and create spaces that are economically sustainable. The project is not merely an expenditure but an investment in the city's future, offering long-term benefits in terms of well-being, social cohesion, and economic growth. Furthermore, the integration of crowdfunding as a potential financing tool adds a dimension of direct participation, allowing citizens to be actively involved in funding and managing change.

In summary, "Km Vert" represents an opportunity to rethink the future of our cities. It is not only an urban regeneration project but a movement that invites communities to imagine and build more livable, inclusive, and sustainable cities. Each regenerated kilometer becomes a step towards a "Green City," a place where the environment, culture, and people are at the center of the development process. The project challenges us to reconsider our relationship with the urban environment and recognize that true regeneration comes through active citizen engagement, the enhancement of local identities, and the adoption of innovative solutions that can address global challenges such as climate change and sustainability.



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# THE MULTIFUNCTIONAL ROLE OF BOTANICAL GARDENS FOR THE SUSTAINABLE DEVELOPMENT OF CITIES: AN URBAN RENEWAL STUDY WITH THE CREATION OF AN ARBORETUM AT THE UNIVERSITY OF THESSALY IN KARDITSA, GREECE

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## **Abstract**

The innate need for contact with nature led to the creation of urban green spaces, which are however quite often degraded and encroached upon, amid bad urban building practices. The use of sustainable materials in urban renewal projects and especially wood, is a practice which in recent years shows increasing trends, even in the light of halting environmental degradation due to the use of unsustainable materials, but also in combination with a series of other goals and practices, such as those discussed in this article. Moreover, urban regeneration programs themselves have, for years, given high priority to the element of environmental footprint. Botanical gardens can play a significant role in the above mentioned initiatives, especially those located in urban areas.

The present paper investigates the historical evolution of botanical gardens as multifunctional urban green spaces. A parallel objective was to investigate the role of modern botanical gardens in the sustainable development of cities, in combating climate change and its impacts to urban areas, in protecting, restoring and promoting sustainable use of terrestrial ecosystems and in halting biodiversity loss.

As far as the practical context is concerned, this includes the regeneration procedures design of an urban green area in the city of Karditsa, that belongs to the University of Thessaly, and the enactment of a proposal regarding the creation of a model botanical garden, describing its structure and individual functions.

**Key words:** wood, sustainability, urban regeneration, arboretum



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# INTEGRATING SUPPLY CHAIN PRACTICES TO MITIGATE CIRCULAR ECONOMY RISKS: A QUALITATIVE STUDY OF THE GREEK FURNITURE SECTOR

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## Abstract

This study explores the intersection of Supply Chain Integration (SCI) and Circular Economy (CE), aiming to assess how integrating SCI practices within CE frameworks influences organizational performance. The purpose of this study is to provide businesses with insights to facilitate a smoother transition to CE models. By leveraging integrative practices, organizations can better manage CE-related risks, optimize resource utilization, and enhance operational efficiency. As organizations increasingly transition toward circular and sustainable business models, they encounter novel challenges and heightened risks, particularly within the context of CE practices. SCI implementations are essential for managing such risks and uncertainties. Furthermore, there is limited empirical evidence regarding the effectiveness of SCI in mitigating the specific risks associated with CE adoption. Utilizing a qualitative research approach, this study focuses on selected companies within the Greek furniture sector, analyzing how these organizations implement and benefit from SCI-CE operational efficiencies. Notably, this integration enables companies to achieve cost savings and environmental gains by effectively recycling and repurposing waste materials, ultimately contributing to a more resilient and sustainable supply chain.

**Keywords:** Circular Economy (CE), Supply Chain Integration (SCI), Sustainable Business Models, Risk Management, Resource Optimization

## 1. Introduction

The European manufacturing sector faces both environmental and economic regulations. The increased global competition, the development of new manufacturing markets, logistic

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implementations, and reduced tariffs on imported products challenge European-based companies. Moreover, given the worrying rate at which global consumption is increasing, the traditional linear economy model is proving to be an unsustainable manufacturing practice (European Environmental Bureau, 2017). On the other hand, increased demand for low-cost items and high labor, energy, and raw material costs within the internal market put intense pressure on European furniture organizations. To cope with these threats, new techniques and innovative strategies are required to renew the sector and make it more sustainable (Suzanne et al., 2020). Supply chain management adapts the circular economy's principles as a solution to significant global challenges such as climate change and resource depletion.

The circular supply chain emerges as a key factor in addressing resource scarcity and the issues of consumer-added value and profitability. The perspective of a world in which nothing is squandering, what is often seen as "waste" is valued and actively reclaimed. All products are gathered after their initial use for purposes such as reuse, remanufacturing, or recycling over generations. The dream of a circular economy (CE) is not only ambitious but essential (Šimelytė, 2025).

Moreover, supply chain integration and implementation of reverse logistics are crucial factors for supply chain management efficiency. Those functions involve practices such as the collection, sorting, and processing of products and all kinds of materials that have reached the end of their lifespan, so they cannot re-enter the production process. This integration reduces waste, enhances resource efficiency and aligns with the circular supply chain's goals. Despite the increased prominence of the CE approach in academic, practitioner and policy circles, its implementation subsists limited and fragile (Gregson et al., 2015). Driven on a CE, based on circular design and production, circular business strategies encompass the retrieval of products, by-products, waste and cross-sector collaborations extending beyond traditional supply chain boundaries (Dervojeda et al., 2014; WEF, 2014). The technological infrastructure necessary for success remains to be developed.

Summarizing, this study examines the relationship between circular supply chain management and SCI and related CE risks in the Greek furniture sector. Specifically, this paper aims to:

- Identify the main challenges and risks of Greek furniture manufacturers that face in switching to circular business models.
- Assess the role of SCI in strengthening supply chain resilience and reducing disruptions related to CE adoption.
- Examine the best practices and strategies followed by companies in the Greek furniture sector in integrating SCI and CE principles.
- Formulate successful strategies and research approaches for policymakers to facilitate the transition toward sustainable and circular supply chains.

## 2. Literature Review

Within the realm of Circular Economy (CE), the focus is on moving beyond the traditional linear model of the economy based on a "take-make-dispose" mentality to a closed-loop system prioritizing resource efficiency and recycling (Geissdoerfer et al., 2017). The usage of practices related to CE, including recycling, remanufacturing, and eco-design, is gaining

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momentum within the furniture industry as firms seek to comply with environmental regulations and align with consumer demand for sustainable products (Bocken et al., 2016).

The furniture industry aligns closely with CE principles, because it uses durable materials such as wood, metal and textiles that can be repurposed or recycled (Jawahir & Bradley, 2016). However, it should be noted that the complex nature of furniture design and composite materials often make CE methods very difficult to adopt (Nasir et al., 2017). Bright contrast with this approach represents the nailing and gluing in furniture manufacturing, which makes it difficult to separate the portions for recycling, and this can create significant technical barriers bank (Merli et al., 2018).

As far as the implementation of CE practices is concerned with various technical and financial risks, as well organizational and administration issues arise (Nasir et al., 2017). In the furniture industry, technical risks are significantly due to the nature of product design and the challenges associated with material recovery (Jawahir & Bradley, 2016). For instance, incorporating composite materials in furniture manufacturing complicates the separation of components for recycling, which presents significant obstacles to CE adoption (Merli et al., 2018).

Moreover, financial risks arise from the elevated costs linked to recycled materials and the necessary investments in CE infrastructure (Kalmykova et al., 2018). Companies frequently navigate a dilemma between the increased expenses of sustainable materials and the necessity to remain competitive within the market (Lieder & Rashid, 2016). Organizational risks are related to cultural transformation, and ensuring supply chain partners are aligned with CE objectives (Tukker, 2015). For example, businesses must invest in training programs to cultivate a sustainability-oriented culture and ensure all employees are on board with CE goals (Bocken et al., 2016).

The embedding of digital technologies in supply chains supports the implementation of reverse logistics, which allows organizations to recover and reintegrate products at the end of their life cycle (Akinade & Oyedele, 2019). However, the implementation of digital technologies requires capital investment and technical expertise, posing a challenge for small and medium-sized furniture businesses (Kingsberg, 2014).

Government policies and some standards by the industry are significant factors for adopting practices of CE (Andrews, 2015). An example of a supportive policy framework is the EU's Circular Economy Action Plan “*for a cleaner and more competitive Europe*”, which sets targets for waste reduction and resource efficiency, in order to guide society to CE (Kalmykova et al., 2018). However, this is delayed by the absence of supportive policies and incentives in some regions towards CE practices, especially in developing countries (De Jesus & Mendonca, 2018).

### 3. Methodology

A multiple case study methodology is adopted for this research. A qualitative research method involving the in-depth examination of multiple cases has been chosen in this study (Yin, 1984; Eisenhardt, 1989; Miles & Huberman, 1994). Specifically, the major aim of the present research is to investigate how circular economy is related to SCI practices in the Greek furniture industry.

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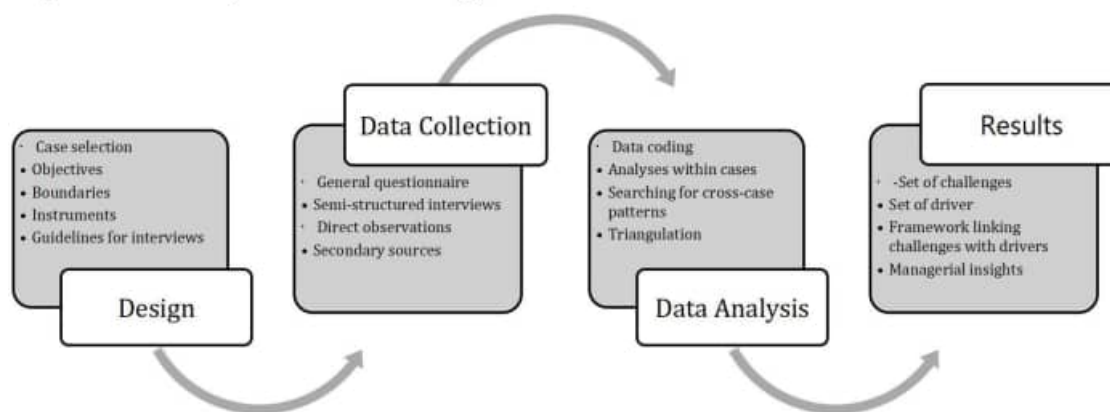
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A comprehensive research protocol is developed to ensure methodological rigor, covering study design, data collection, analysis procedures and results documentation (Voss, et al, 2002; Yin, 2009; Murray et al., 2017).

The selection of case study followed by purposive sampling is based on two key criteria: First, companies must have implemented CE initiatives involving value chain or supply chain redesign, and second the participating companies were strategically chosen to represent diverse supply chain echelons and value-creation stages. Figure 1 illustrates the empirical methodology of this study.

Figure 1: The empirical methodology



Source: (Sekaran, 2003)

The data-collecting process aims to guarantee a thorough awareness of the possibilities and difficulties related to CE methods applied in the furniture industry.

Semi-structured interviews have been selected for data collection. Initially, a pilot interview has been conducted to test and refine the interview protocol. The insights gained from this pilot study have been used to clarify and improve the questions for the subsequent interviews. Specifically, three in-depth interviews have been conducted with managers or operational staff to ensure a comprehensive understanding of the company's experiences with CE and SCI practices, while direct observations have been made during visits to the companies' facilities. In order to enhance the validity of the findings, triangulation has been conducted with secondary sources, including company documentation, websites, and industry reports. This approach aims to affirm the collected data through interviews and observations.

The data analysis process entangled several steps to ensure the reliability and validity of the results:

- **Data Coding:** The interview reports were encrypted to identify key factors and hidden patterns related to CE challenges and SCI impact to CE.
- **Triangulation:** The interview findings also were triangulated with secondary data to enhance the validity of the study (Vos et al., 2002).
- **Framework Development:** A conceptual framework is developed from analysis that links the identified challenges with potential levers to overcome them.



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The interview transcripts have been sent back to the respondents for validation, and the final case results have been reviewed and confirmed by the informants to minimize observer bias (Yin, 1984). The usage of multiple data sources and the triangulation of findings further enhance the validity of this study.

In conclusion, the data collection methodology aims to provide a comprehensive understanding of the challenges and opportunities associated with CE and SCI practices in the Greek furniture sector. The usage of semi-structured interviews, direct observations and secondary sources combined with a data analysis process ensure the reliability of the findings.

### 4. Empirical results

In this empirical research, three companies active in the Greek furniture sector were selected, being at different levels and phases of the supply chain, the companies, named Alpha, Beta, and Gamma, provide a diverse range of perceptions about CE practices and the associated risks.

Alpha Company is a raw material supplier of binders & additives used in the furniture industry. Beta Company is a wholesaler that manufactures wooden frames, energy and thermo panels, shutters, and exterior-interior wooden constructions. Finally, Gamma Company is a retailer that is involved in the design and production of kitchen furniture, wardrobes and wooden frames (Table 1).

Table 1: Case study companies

|                             | Alpha Company                                                                                                     | Beta Company                                                                                   | Gamma Company                                                            |
|-----------------------------|-------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------|
| <b>Founded</b>              | 1977                                                                                                              | 2005                                                                                           | 1970                                                                     |
| <b>Location</b>             | Thessaloniki, Greece                                                                                              | Karditsa, Greece                                                                               | Kozani, Greece                                                           |
| <b>Product/service</b>      | Development & Application of Industrial Technology for Binders & Additives, Production of Amino & Phenolic Resins | Manufacturing wooden frames, energy and thermo panes, shutters, exterior-interior construction | Design and production of kitchen furniture, wardrobes and wooden frames. |
| <b>Role in supply chain</b> | Supplier of raw materials                                                                                         | Manufacturer, Wholesaler                                                                       | Manufacturer, retailer                                                   |
| <b>Interviewees</b>         | Researcher- Technologist                                                                                          | Production Manager                                                                             | Production Manager                                                       |

Alpha Company has implemented Circular Economy (CE) practices for the past three to five years focusing on strategies such as using recycled materials, eco-design, and minimizing waste through reuse and recycling. These initiatives have not significantly increased costs, but they present operational challenges, including a lack of specialized knowledge, difficulty in modifying production processes, and inconsistent quality of recycled materials. The company faces financial constraints and quality management issues, but CE adoption has led to product differentiation and a reduced environmental footprint. However, consumer demand for sustainable furniture remains very low, limiting its competitive advantage.

Supply Chain Integration is crucial for Circular Economy success. Alpha Company collaborates with universities and research institutions and uses Enterprise Resource Planning

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(ERP) and Artificial Intelligence (AI) for supply chain management. However, integration remains moderate due to a lack of transparency and limited real-time information sharing. While technology has improved efficiency, its potential in optimizing CE processes is yet to be fully realized.

Alpha Company in order to gain CE advantages should strengthen supplier collaboration, enhance supply chain transparency and invest in recycling innovation. Greater government support, regulatory incentives, and training programs are also needed. Additionally, increasing consumer awareness of sustainable products could boost demand. Moreover, Alpha Company has made progress in CE adoption, but it should overcome supply chain challenges to fully realize its potential. A well-integrated circular supply chain will improve sustainability and competitiveness in an evolving market.

Beta Company has implemented CE practices for over six years, focusing on eco-design, waste minimization, and material recycling. These efforts have significantly reduced production costs and environmental impact. However, challenges such as a lack of expertise, difficulty in sourcing sustainable suppliers, and limited government incentives persist. Regarding SCI, the company faces low supply chain transparency and minimal digital integration. While it employs ERP and CRM tools, full integration is lacking. Collaboration with sustainable suppliers and energy reduction strategies support its sustainability goals, but further efforts are needed. The future includes adopting advanced digital technologies, such as AI, to optimize operations and improve both CE and SCI effectiveness. Strengthening governmental support and investment in CE initiatives will be crucial for overcoming existing barriers.

Finally, Gamma Company applies CE practices to a limited extent. Some of the limited-scale practices include recycled or recyclable materials in production, eco-design focusing on sustainability, durability and the use of wood and fabrics from sustainable sources.

Although the company's management acknowledges the contribution of CE to sustainability and the reduction of environmental impact, they struggle to adopt CE strategies due to a lack of financial resources and insufficient governmental support. Additionally, while they recognize that integrating supply chain processes could positively contribute to CE development, its implementation is hindered by a lack of suitable infrastructure and technology. It is noted that the company does not use any supply chain management software or technology. According to the company, developing CE strategies requires access to expertise, infrastructure, and technology, which they lack due to insufficient funding and the absence of state support.

## 5. Conclusions

This study examines the integration of SCI practices within CE frameworks in the Greek furniture sector, focusing on how such integration minimizes CE-related risks and enhances operational efficiency. Drawing on a qualitative case study analysis of three companies, namely Alpha, Beta, and Gamma, this empirical research reveals the different levels of CE adoption and the challenges that businesses face in implementing sustainable initiatives.

There is evidence that companies actively involved in CE efforts, such as Alpha and Beta, have achieved cost savings, differentiation, and environmental benefits. However, these

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benefits come with issues such as budget constraints, lack of expertise, supply chain inefficiencies and lack of government incentives. Gamma Company with minimal CE activity struggles to incorporate sustainable practices due to constrained resources and a lack of incentives.

Supply chain integration affects significantly the supply chain resilience and the further adoption of circular economy practices. Companies leveraging digital tools such as ERP and AI demonstrate improved efficiency, but the full potential of digital transformation in circular supply chains remains untapped. Additionally, collaboration with suppliers and research institutions emerge as a key factor in overcoming operational challenges. However, transparency and real-time information sharing across supply chains remain areas of concern.

For Greek furniture manufacturers to successfully transition toward circular supply chains, a holistic approach is needed. This approach includes stronger supplier collaboration, investment in digitalization, and policy interventions that provide financial and government support. Increasing consumer awareness of sustainable furniture products is also essential to drive demand and incentivize businesses. To advance the relationship of SCI and CE, future research should focus on the following areas:

- **Quantitative Analysis of SCI Impact:** Large-scale empirical studies to measure the direct effects of SCI on CE performance metrics, such as waste reduction, resource efficiency, and cost savings.
- **Cross-Industry Comparative Studies:** Investigating how SCI and CE integration varies across different types of industries to identify sector-specific best practices.
- **Technological Advancements in SCI for CE:** Exploring the role of emerging technologies like AI, machine learning, and digital twins in optimizing circular supply chains.

Addressing these research gaps will provide deeper insights into how Supply Chain Integration can facilitate the transition to a Circular Economy and inform more robust policy and managerial strategies.

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**FROM QUANTITATIVE TO QUALITATIVE SERVICES: HOW TO PROMOTE  
INTEGRATED PLANNING FOR THE REVISION OF THE SERVICE  
PLAN OF MANTUA, MUNICIPALITY IN ITALY**

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**Abstract**

Traditionally, Italian municipalities assessed public services through metric measurements regulated by decrees establishing urban planning standards, since 1968.

However, in the 21<sup>st</sup> century, a paradigm shift occurred, moving from a quantitative to a qualitative approach in planning, focusing on service quality, citizen well-being, and urban sustainability. This change was formalized by regional laws that introduced plans like Service Plans and promoted experiments for more sustainable and resilient cities.

During the pandemic it was highlighted the need to reassess the urban complexity of cities to better meet community needs. In this context, "proximity" emerged as a key strategy to create dynamic cities with diversified functions and services accessible to all. This shift in urban planning calls for municipalities to revise their planning tools using a holistic, multidisciplinary approach, ensuring more responsive cities to evolve into social and environmental challenges.

In this regard, the Municipality of Mantua initiated a revision process with our operational contribution for the PGT, its urban planning tool, experimenting with three iterative intervention methods:

1. Re-reading the availability of proximity services and facilities in Mantua through critical analysis and the creation of multi-characteristic sheets to map their distribution across the territory, which is currently fragmented.
2. Re-defining the traditional subdivision of the territory into administrative units, transforming them into "urban proximity systems", autonomous and heterogeneous units with distinct identities and public services.
3. Re-thinking an urban strategy that organizes the territory along two main spines: one urban, fostering interactions between functions and services, and one natural, integrating the landscape through green connections.

This experimental initiative demonstrates how an integrated planning approach can foster a polycentric urban vision, enhancing quality of life and the environment in line with sustainability and resilience principles.

**Key words:** integrated planning, qualitative services, community needs, sustainable approach, proximity urban strategy



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### **1. From quantitative measures to qualitative services: the transformation within Italian Urban law**

The transition from quantitative services, defined in the territory through urban planning standards, to qualitative services, which emphasize aspects related to quality of life, is a complex process that over the years has required a thorough revision of the regulatory and legislative framework of our country, as well as a cultural and managerial shift in territorial governance by the local authorities.

In this long process of regulatory evolution, this paper aims to identify and highlight only some of the urban planning laws that have helped guide the development, growth, and planning of the territory towards a new paradigm, one increasingly focused on the qualitative rather than the quantitative aspects of services. Below, it is possible to observe how urban planning has had to address various needs over the years and translate them into regulations, some of which are still used to govern territorial discipline.

Indeed, although urban planning was already regulated by a series of laws that had addressed the issue of planning the built city and its expansion, it was the National Urban Planning Law No. 1150 of 17 August, 1942, one of the longest-standing in the view of national legislation, that marked a turning point in the approach to this discipline in Italy, as it introduced, for the first time, an organic planning of cities. Its purpose was to guide and coordinate the urban planning activities of each territory, as well as the development and layout of built-up areas. Furthermore, it aimed to ensure an urban order that would meet the needs of industrial development, while also creating a healthier and more functional urban environment, by establishing the rules for the city's expansion (Mazzeo & Calenda, 2011).

The approval of the National Urban Planning Law thus introduced the possibility for all municipalities to adopt a PRG (General Regulatory Plan), making it a requirement only for a limited number of them. This instrument defined the physical and functional structure of the entire territory and included functional zoning, infrastructure networks, and various areas for the development of public facilities. The law, therefore, laid the foundation for a potential rational governance of the territory and the management of its construction activities.

However, this law did not achieve the expected impact, as the wartime events delayed its implementation for at least a decade. The damage caused by the war became progressively evident, and the need to rebuild the war-damaged settlements led to the introduction of new regulations for the reconstruction of cities.

It was only towards the second half of the 1960s, following several catastrophic events such as the landslide in Agrigento, the floods in Florence, and the exceptional high tide in Venice, that the debate on the severity of the urban and building situation in urban centres was revived. The need for an urban planning reform aimed at "rebalancing" the development of cities, which had until that point grown predominantly according to quantitative criteria, became evident.

Awaiting a necessary reform of the National Urban Planning Law, Law No. 765 of September 1, 1967, was approved. This law modified the important law of 1942, with the aim of limiting construction in municipalities lacking urban planning tools, such as the PRG, while encouraging the development of plans for territorial regulation. The most important innovation of this law was the introduction of the definition of "urban planning standards"

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that is, the determination of the minimum amounts of public or publicly accessible spaces, expressed in square meters per inhabitant, that must be reserved in planning documents (Law 765/1967).

Subsequently, these standards were defined in quantitative terms by Interministerial Decree No. 1444 of April 4, 1968, which implemented the measures outlined in Law No. 765/1967. They were set at a minimum of 18 m<sup>2</sup> per inhabitant for residential settlements, distributed as follows: 9 m<sup>2</sup> for public green spaces, 4.5 m<sup>2</sup> for education, 2.5 m<sup>2</sup> for parking, and 2 m<sup>2</sup> for facilities of common interest. Moreover, the decree addressed the need, considering the simultaneous requirement for municipalities to adopt a General Regulatory Plan, to manage urban growth while ensuring a balanced relationship between private and public settlements. To this end, it introduced the six "homogeneous territorial zones," which divide the territory for the regulation and monitoring of the application of urban planning standards, defining different building regulations for each of them (DM 1444/1968).

The unified path of Italian urban planning legislation, which had been very clear up to that point, ended in the 1970s when it was decided to apply the constitutional provision that assigned administrative and legislative competence in urban planning matters to the Regions, rather than exclusively to the State, within the framework of the principles of national legislation. This transfer of urban planning competences from the State to the Regions is highlighted by Presidential Decree No. 616 of July 24, 1977. This decree led to a gradual fragmentation and regulatory divergence within our country, as the Regions began to diversify their urban planning policies for territorial regulation. This transitional period represents the emergence of an increasing autonomy of the Regions in managing urban planning policies, in response to new development needs and a renewed approach to planning (DPR 616/1977).

The first significant and evident break between national and regional legislation occurred between 1990 and 2001, when the experiments of these years, in addition to diverging from the indications of national legislation, clearly showed a lack of a system of rules shared by all. This process of regulatory differentiation undergoes further acceleration in 2001, when the constitutional reform of Title V was approved through Constitutional Law No. 3 of October 10, 2001, which further modifies and complicates the relationships between local and central administrations (Mazzeo & Calenda, 2011).

In this reform, "Territorial Governance", which includes urban planning regulations, is inserted among the subjects of "concurrent legislation" between the Region and the State. The definition of territorial governance encompasses everything related to land use and the location of facilities or activities, falling under the concurrent legislative authority of regions with ordinary statutes. Thus, it includes not only urban planning and construction but also other aspects of territorial management (Barbieri, 2023). With the introduction of the concept of "Territorial Governance," it is argued that territory becomes the reference point for regulation aimed at satisfying differentiated interests that cannot be encompassed within the traditional land use regulations specific to urban planning. The field of territorial governance relates to the regulation of land uses, as does the original urban planning, but it "expands the perspective" to include various public interests that deserve special care and protection, which fall within different areas and fields of regulation (Urbani, 2015).

Starting from this concept of territory, in 2005, Parliament had reached a unified draft of urban planning reform that, if approved, could have become the main guiding regulation for

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the entire country. In this draft, the definition of Territorial Governance was as follows: "A set of activities related to knowledge, evaluation, regulation, planning, localization, and implementation of interventions, as well as supervision and control, aimed at pursuing the protection and enhancement of the territory, regulating its uses and transformations, and managing mobility in relation to territorial development objectives" (Mazzeo & Calenda, 2011).

This reform of Title V resulted in a paradigm shift in the history of urban planning: whereas before the regulations focused on quantitative parameters and predefined urban planning standards that determined the physical and spatial distribution across the territory, with the introduction of the concept of "Government of the Territory", planning is now seen as a process that seeks to sustainably manage territorial development. It also focuses on the creation of sustainable, accessible, and inclusive urban spaces, improving the well-being and quality of life of citizens. Defining high-quality public services, shifting the focus from the quantity specified in Interministerial Decree No. 1444/1968, represents a necessity to address and meet the needs of citizens, develop social cohesion, foster a sense of security and belonging to the local community, and ultimately enhance the legitimacy and effectiveness of public action within a constantly evolving context (see Figure 1).

Although the first generation of regional laws only raised the quantitative threshold set by Interministerial Decree No. 1444/1968, a new phase of legislation began that attempted to translate territorial governance into regional legislation, without the creation of a new National Law for all the territory.

**Figure 1: The evolution of the Italian Urban Law. Source: Author**



### ***1.1 The evolution of Urban Law in Lombardy Region***

As previously highlighted, following the revision of Title V of the Constitution, a phase began in 2001 marked by the introduction of a series of new regional laws incorporating the term "Government of the Territory" in their titles. The principles underlying these regulations are unified in intention, yet they are structured and organized in different ways. This variation arises from the absence, in the previous years, of a reform to the National Urban Planning Law, particularly regarding the general and common provisions related to territorial governance. This lack of reform limited effective coordination between the various Regions. This is evident in the fact that each Region replaced the previous PRG (General Regulatory Plan) with a new planning tool at different times, which took on various names.

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Under the same definition, therefore, a series of different tools have been generated, revealing a substantial dichotomy between the regions still rooted in the traditional urban planning of the National Urban Planning Law No. 1150/1942, and the regions that have instead followed the reformist model of recent years (Mantini, 2015).

In this change of direction, a significant path is that of the Lombardy Region, which, as early as 2001, approved a Regional Law (No. 1 of January 15, 2001) that introduced, for the first time, the document of the Service Plan as a mandatory component of the General Regulatory Plan, for the implementation of a concrete public service policy. This plan represents the tool of transition from quantitative standards to qualitative criteria, enabling the maintenance and development of society and community. In this regard, urban standards have been rethought, shifting to a more coherent and integrated public service plan for the city, assessed in terms of its actual feasibility. The objective was not only to meet demand in quantitative terms, but also to serve the territory qualitatively by providing services that enhance urban quality and sustainability (Regional Law 1/2001). The Lombardy Region, therefore, is a region that immediately understands the need for this shift in paradigm from quantitative to qualitative and incorporates this provision into the Service Plan, as well as into the reform of the "Government of the Territory" for territorial development.

Subsequently, Regional Law No. 12 of March 11, 2005, "Law for the Government of the Territory," in implementation of Article 117 of the Constitution, defines the regulations for territorial governance in Lombardy, specifying the forms and methods of exercising the competences assigned to the Region and local authorities. It also emphasizes the importance for municipalities to adopt a Service Plan. With this law, indeed, the Region promotes the objectives of reducing land consumption, urban and territorial regeneration, and environmental sustainability within urban planning tools, with reference to the conservation of territorial, environmental, and energy resources. This law also introduces several important changes to urban planning regulations:

- It regulates the "Service Plan" as one of the three fundamental documents that must make up the PGT, the Territorial Governance Plan;
- It abolished the previous regional regulations, marking the definitive shift from a "quantitative" approach to a "qualitative" one.

The Territorial Governance Plan (PGT) represents the evolving planning tool of the General Regulatory Plan, serving the same function of enabling municipalities to define the urban planning of their territory. The PGT is structured into three main documents:

- The Plan Document;
- The Service Plan;
- The Rules Plan.

The Plan Document defines a reference framework for the economic and social development of the territory, as well as a knowledge framework of the municipal territory, reflecting the transformations that have occurred. It identifies the objectives for development, improvement, and conservation that hold strategic value for territorial policy.

The Service Plan, on the other hand, is included as a necessary document to ensure a comprehensive provision of areas for public facilities and public interest, potential areas for public housing and green spaces, ecological corridors, and the green system connecting rural and built-up areas, as well as between road infrastructure and urbanized areas. It also ensures

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a rational distribution of these areas across the municipal territory, supporting the functions established and planned. Through the Service Plan, to meet the needs expressed by the users of services across the entire territory, it is possible to prioritize the evaluation of the facilities serving the functions established in the municipal area, also considering factors of quality, usability, and accessibility. In cases of identified insufficiency or inadequacy of these facilities, the plan assesses the need for development and integration of existing services and outlines the implementation methods.

The Rules Plan, finally, defines within the entire municipal territory the areas of consolidated urban settlement, regulates land use, and identifies the areas and buildings subject to higher-level protections. It thus establishes the regulatory aspects and quality elements of the built and consolidated city (Regional Law 12/2005).

Although these urban planning laws had been approved years earlier, it is only with the beginning of the second decade that Lombardy began to focus on a more integrated and strategic management of the territory, starting with the drafting of the first "Territorial Governance Plans", which replaced the previous urban planning tools. These plans were approved for all municipalities in Lombardy, establishing rules for urban and territorial planning, with a focus on issues such as quality of life, environment, mobility, energy efficiency, land and service management. It should be noted that the reason of this change was also linked to the increasingly evident need to respond to progressively complex challenges, such as urban growth, climate change, and the controlled management of resources and land.

The PGT, from the beginning, has been recognized as a tool capable of governing the complex phenomena occurring in the territory, also responding to new urban needs. However, more than 20 years after the approval of the law, a revision and redefinition of the issues and needs are now required, as the urban challenges faced by contemporary cities have highlighted numerous criticalities, vulnerabilities, and fragilities within the territories, revealing the real need for a rethink in terms of inclusion, sustainability, and resilience.

Therefore, this reconsideration can promote an alternative vision of the city, one that is more effective and capable of renewing and enhancing its role within a constantly evolving context. Such transformation must be governed through urban planning tools capable of connecting traditional policies with innovative actions and paradigms that find expression in already tested forms, such as sustainability, resilience, proximity, and various potential strategies for urban regeneration. Many municipal administrations, in response to these new urban needs and a renewed interest in urban planning, have begun working towards improving their urban planning tools by initiating a series of collaborations to revise their urban planning instruments, starting with the themes and issues that must be addressed to reassess the urban complexity of contemporary cities.

## **2. The new needs of contemporary cities into urban planning tools**

Cities were originally designed to foster community life, relationships, economic growth, and innovation (Carta, 2019). They were cities of proximity, where services were easily accessible for everyone near their houses. However, as cities developed in the 21<sup>st</sup> century with increasingly functional territorial divisions, the idea of a "human-scale" city was replaced by the "city of distances." Manzini (2021) claims that cities in the last century were designed for



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efficiency and specialization, requiring people to move between functional zones, creating continuous mobility. This model, dominant in 20<sup>th</sup> century urban planning, began facing crises by the century's end due to environmental pollution, traffic congestion, reduced quality of life, and citizens' detachment from their communities. Events like the pandemic and other challenges have intensified these issues, prompting a deeper reflection on the limitations of this model for future urban planning. The two years marked by the pandemic, indeed, acted as an accelerator of the effects induced by multiple global crises (energy, economic-financial, environmental, and climate) that affected countries around the world in different ways, but created similar conditions of risk and uncertainty. The extensive and profound consequences that began to be observed in the territory highlighted its vulnerabilities and urban fragilities. Furthermore, the inhibition of movement to reach various functional locations and key activities emptied the cities and prompted many urban planners and academics to envision a dimension that would recover the concept of urban proximity, attributing new meanings to a tradition of work on the neighbourhood scale, which has already been widely experimented with in the past (Gabellini, 2024).

Proximity has deep roots in urban planning, with past planners shaping the national and international debate for years. Within our research project, we aligned the starting point of our reflection with the introduction of the concept of "The Neighborhood Unit", theorized by Clarence Perry in 1929. In his idea, the city is understood as a system of interrelated autonomous units characterized by: size, which revolves around the school as a recurring parameter for defining the space needed for the citizens' neighbourhood life; boundaries, defined by major communication roads, but also by more natural internal networks; open spaces, parks, and recreational areas; areas for services and neighbourhood shops (Pavia, 2022).

A few years later, in 1944, Patrick Abercrombie began rethinking urban planning in London within the framework of the "County of London Plan" (1943) and the "Greater London Plan" (1944). Through these two plans, the urban planner aimed to combat urban sprawl in England after World War II by creating distinct, self-sufficient communities connected by an efficient infrastructure network. Inspired by Ebenezer Howard's concept of the "Garden City," Abercrombie proposed the reorganization of the city through decentralization, thereby reducing the population density in central London and promoting the creation of more balanced urban centres. To address this need, the city was divided into four zones: the Inner Urban Ring, the Suburban Ring, the Green Belt, and the Outer Ring. Abercrombie conceived, based on this concept, satellite cities that were independent but connected to London through a network of infrastructure, services, and appropriate spaces, improving quality of life and reducing traffic congestion. What Abercrombie proposed, therefore, was a model that emphasized the need to promote an efficient system of roads and infrastructure capable of connecting different parts of the city (Abercrombie, 1944).

Around 40 years after Abercrombie, the New Urbanism movement emerged in response to the problems caused by uncontrolled urban sprawl and the separation of residences, commerce, and public spaces in the suburbs. Its goal was to combat urban sprawl by promoting compact, high-density, mixed-use development, improving environmental, economic, and social quality. New Urbanism advocates for the creation of human-scaled neighbourhoods with services accessible by walking or cycling (CNU, 2021). Furthermore,



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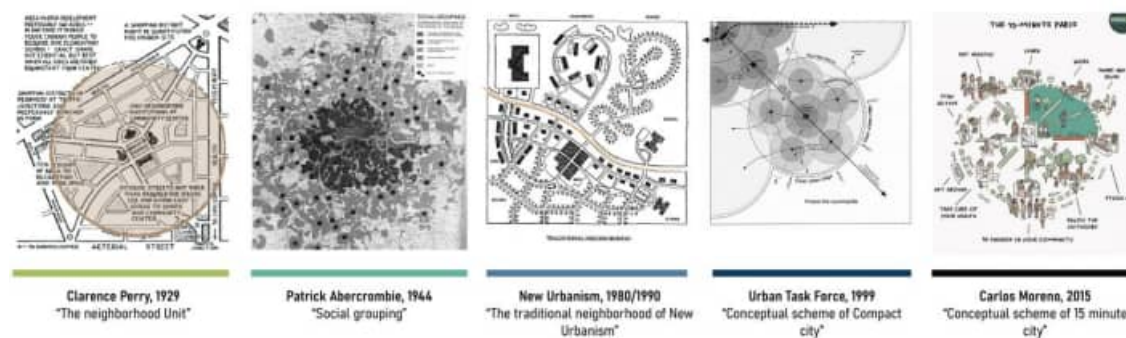
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since the Charter of the New Urbanism was ratified in 1996, it has influenced urban planning by emphasizing how neighbourhoods should reflect the unique identity of each place and the growing need for environmental sustainability (CNU, 2024), with functions and services that promote the creation of vibrant communities. The idea behind New Urbanism, therefore, starts from the characteristics of the place and the community; as a result, this movement does not aim to promote a model that can be replicated across all areas, but rather encourages the idea of selecting where to apply it, which approach to use, and how to make interventions sustainable for both the territory and the community.

In the same years, in 1990, many of these principles began to spread in the United Kingdom as well, thanks to the Urban Task Force, founded in 1999 under the leadership of Richard Rogers. In its final report, titled "Toward an Urban Renaissance," the Task Force proposed a vision for urban regeneration in declining English cities, focusing on high-quality public spaces, density, and mixed uses to improve liveability and the quality of cities. Their model envisioned the creation of compact cities, where car use was limited, and green spaces were increasingly accessible and easy to reach. The work of the Urban Task Force raised awareness about the importance of integrated urban planning, focusing on urban regeneration, improving mobility, enhancing accessibility to public spaces, and promoting equitable urban and social development. From their model, the need to integrate anthropic and natural elements for urban regeneration emerges, ensuring that every citizen has access to vibrant and safe communities, with essential services accessible on foot, by bicycle, or via public transport (Urban Task Force, 1999).

In the twentieth century, the idea of a compact "human-scaled" city, where services are nearby and there is a functional mix of services, was replaced by models based on the "cities of distances" previously described. It was revived only in 2015, when, within the context of the ongoing transformation of European cities and beyond, the concept of the "15-minute city" was introduced by urban planner Carlos Moreno. Moreno (2021) refers to a city in which all essential services and functions necessary for human life, such as living, working, shopping, healthcare, learning, and leisure, are located within 15 minutes walking or cycling distance from one's house. During the pandemic period, this idea of the city gained value and recognition in national and international debates, evolving from a complementary urban condition in strategic planning to becoming a fundamental and constitutive element of the new urban paradigm for city planning (see Figure 2).

**Figure 2: The evolution of proximity concept into urban schemes. Source: Author**



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Acknowledging the driving force of this concept of the city and the long-term reflections that have allowed for a better disciplinary contextualization, there is now a gradual shift away from the strict notion of the “15-minute city” toward a more dynamic idea of the city - one based on proximity, which is not limited solely to theoretical and temporal aspects. Reflecting on the city in terms of proximity means considering the added value of attempting to “ground” and experiment with an urban strategy that can take root within planning as a foundational tool for territorial development. It involves analyzing the characteristics of the territory, reinterpreting its complexity and urban needs, and implementing strategies that practically respond to the continuous challenges of contemporary cities within planning instruments.

From this perspective, an important need emerges for all municipal administrations: ensuring that their urban planning tools could address these new urban challenges in a sustainable and resilient way. For this reason, many cities have recently undertaken the process of revising their planning instruments, though they have encountered the significant complexity that urban planning practices and processes entail.

### **3. An iterative method for the revision of urban planning tools. The experimentation through the PGT of Mantua**

Today, revising an urban plan means setting a dynamic and complex process that requires an integrated and multidisciplinary vision because it must address numerous challenges: managing urbanization, attempting climate change, promoting social equity, advancing sustainable mobility, and fostering collaboration among stakeholders while considering the needs of different communities from a sustainable development perspective (Giaimo, 2024). From this arises the need to experiment with new urban concepts and paradigms that can counter planning tools that are exclusively regulatory and non-generative, overly focused on quantitative aspects and not oriented toward describing qualitative ones.

Based on these new insights and needs, the Municipality of Mantua has also initiated the revision process of its urban planning instrument, the Territorial Governance Plan (PGT), approved in 2012. In this revision process, the municipal administration has been supported by our research laboratory at the Politecnico di Milano, the Unesco Research Lab - Mantova Campus, to foster collaborations that combine diverse know-how and technical skills to define a tool capable of responding to various urban needs.

The underlying goal of this collaboration is to experiment with an integrated planning approach based on key concepts that can be rediscovered within the discipline but have faded over time; rethinking an instrument in terms of proximity and sustainability, for example, represents one of the potential challenges that the administration has decided to pursue in this revision.

The agreed-upon approach for this long process of revisiting multidisciplinary themes and issues is based on a reiterative method. This iterative and progressive approach means that the revision process occurs through successive phases, each of them must improve upon the previous one. It is not a linear sequence but involves the continuous repetition and refinement of analyses and strategies in response to emerging conditions. Every verb referring to this reiterative method is composed of the functional morpheme “ri” placed at the

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beginning of a lexeme to modify or better specify its meaning (Losco, 2015). This morpheme refers to the possibility of “repeating x times” and represents an iterative value that expresses an action or process carried out repeatedly, thereby ensuring greater flexibility and the ability to dynamically respond to emerging challenges and needs.

Urban planning, in its continuous redefinition of territorial governance processes, has often employed this morpheme to indicate new solution perspectives in response to the periodic crises of urban transformation, with the aim of modifying the paradigms and reference meanings for many interventions (Losco, 2015).

In the revision process of the Mantua Municipality’s PGT, this reiterative method was experimented with by articulating the long path into three progressive phases:

- **Re-reading** the characteristics and peculiarities of the territory and population through a critical analysis of the availability of proximity services in the Mantuan territory, by drafting multi-characteristic sheets.
- **Re-defining** the traditional configuration of the territory into administrative neighbourhoods, to move towards new urban geographies characterized by autonomous and heterogeneous units, named "Proximity Systems".
- **Re-thinking** planning based on an urban strategy that organizes the territory along two main axes: an urban one, which promotes interactions between mobility and proximity services, and a natural one that integrates the landscape through the creation of green connections within urban settlements.

Each of these phases represented an important advancement step in our research, allowing us to gain greater insights into the territory and the strategies that can be introduced for the city's future planning.

### ***4.1. Re-reading the territorial characteristics to construct a knowledge-based, analytical, and interpretive framework***

Through an analytical framework established in the initial phase of "re-reading the territory", the sociodemographic profiles of the population and the provision of public services in terms of proximity were examined. The demographic analysis, covering the period from 2019 to 2024, aimed to highlight how population composition, distribution, and structure have changed, revealing fragility and social vulnerability. Vulnerability, as described by Ranci (2007), refers to social and economic transformations that lead to insecurity across various social classes. The analysis focused on the most vulnerable categories, aiming to reduce exposure to risks and promote resilience, strengthening individuals' capacity to face adversity (ISTAT, 2020). The investigation, now conducted over six consecutive years, has revealed a heterogeneous and dynamic territory, with a positive trend in population growth, demonstrating internal dynamism and offering insights into the evolution of the settlement.

Alongside the socioeconomic analysis, the distribution of public services across each administrative neighbourhood was examined both quantitatively and qualitatively. The goal was to assess whether existing facilities and public spaces could support an urban proximity strategy. Rather than focusing solely on their size, the aim was to recognize the role these services could play in reorganizing the city to manage future transformations. This involved evaluating the facilities mapped in the municipal Service Plan, considering their quality,

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consistency, and contribution to urban well-being. The analysis of services produced six thematic maps for each of the eighteen administrative neighbourhoods examined, which highlight: the analysis of public services; the analysis of the characteristics and densities of the settlement system; the review of intangible services of social and proximity value; the analysis of mobility and urban accessibility; the system of green spaces and waters; and the elements of urban characterization (Borini, 2024). The produced sheets allow for both an individual and a continuous reading across the entire territory of the presence or absence of relevant characteristics and peculiarities that must be considered for the revision of the Service Plan, drafted based on the concept of qualitative proximity services that are increasingly accessible and reachable by all through various forms of mobility (see Figure 3).

**Figure 3: Example of the “Green and water system” sheet and overall vision for the entire territory. Source: Author**



### **4.2. Re-defining the organization of the territory through the definition of "Proximity Systems"**

The initial re-reading of territorial characteristics reveals a fragmented view of the municipality, showing the need to move beyond traditional sector-based, dimensional, and administrative divisions into neighbourhoods. These divisions no longer adequately represent the socioeconomic heterogeneity and public services endowment of modern cities.

Although initially conceived as fundamental urban units, intended to constitute both an integral part of the consolidated city and urban centralities endowed with functional autonomy, over time neighbourhoods have progressively finished to reflect that original concept. They have increasingly become peripheral areas lacking their own identity and authority and are

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more and more considered within urban planning instruments solely as an administrative function of the territory.

In urban planning, territories are divided into these administrative neighbourhoods to facilitate the management and development of smaller city sections. However, these areas are often defined by rigid boundaries, typically marked by large infrastructures or main services, limiting connections with surrounding areas. They lack the flexibility to adapt their functions and structures to new urban challenges. One key challenge is the need for greater proximity and sustainability, characterized by more primary services, green spaces, slow mobility, and an improved quality of life.

Working on the proximity strategy, therefore, requires an internal urban reorganization that attempts to address the issue of overcoming the center-periphery dichotomy, based on a system of diffuse centralities capable of rebalancing the urban potential of each individual neighbourhood. This concept of neighbourhood must be understood in a broader and more flexible sense to adapt to the multiplicity of elements needed to create connections between the city, the territory, and nature (Capestro, 2012). The redesign of the overall organizational structure of the territory evolved from an initial attempt to reconfigure only the geographic limits of administrative neighbourhoods, by defining the “Urban Identity Areas”.

These areas reinterpreted the administrative neighbourhood units, defining spatial entities with social, cultural, and economic homogeneity. While recalling historical neighbourhoods, they introduced more fluid boundaries, addressing new needs. Proximity, in this vision, is not just a principle for isolated areas but an integrated strategy connecting urban and natural elements across the territory. The initial goal of this new subdivision was to overcome the static concept of neighbourhoods and reinterpret them based on urban issues. However, the “Urban Identity Areas” proved inadequate in describing dynamic, functionally autonomous centres. By recalling traditional neighbourhood boundaries, they failed to address the territory's needs or create connections beyond those limits. This highlighted that integrating proximity as an urban strategy requires not just new spatial divisions but a rethinking of the role these areas play in fostering proximity and sustainability issues.

This planning approach moves away from the static, fragmented city model, proposing an interconnected system of centralities that defines a polycentric vision. Proximity finds new expression in this polycentric urban model, which contrasts with the monocentric model, where a single large center dominates services, employment, and production. In contrast, polycentrism seeks an urban structure with multiple important centres that ensure a balanced functioning of the territory. These centralities need not be identical; instead, through differentiated functions and varying settlement weights, they form a system of functional hubs (Rauhut, 2016). Polycentrism, therefore, represents a network of connections among centralities that, when linked, create dynamic zones within the territory.

Based on this idea of polycentrism, we attempted to identify “Proximity Systems”, that are areas substantially heterogeneous with respect to their spatial, morphological, social, cultural, and economic characteristics. These systems function both autonomously - ensuring the interweaving of various proximity networks - and in synergy with other systems present in the territory. Proximity systems represent centralities that, regardless of their spatial and geometric configuration, can activate territorial dynamics, creating functional relationships among the different area, overlapping, and adapting to needs of a continuously evolving city.



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They are conceived as open systems toward a plurality of urban networks that structure themselves within the territory. They are composed of functional nodes defined by the presence of historical identities and ancient settlement nuclei, collective and social public services, and gathering places for people, which are distinguished by their ability to generate connections with the other surrounding elements and systems (Borini, 2024). These are urban organization models based on both functional and relational continuity in the territory, dictated by the presence of autonomous and independent entities that define a new urban polycentrism, definitively moving away from the monocentric model that for years has characterized the city - periphery dichotomy (Rauhut, 2016).

Through the definition of “Proximity Systems”, it is possible to observe the urban geographies of the territory in their differences and complexities, approximating functional boundaries for centralities that define networked relationships and flows. In the Mantuan territory, 14 proximity systems have been identified to reinterpret the centralities and highlight its intrinsic and extrinsic characteristics. The intrinsic characteristics refer to the constitutive elements of the individual systems, such as spatial structure, the functions they perform, population density, mobility, and accessibility to primary services. The extrinsic characteristics, on the other hand, emphasize the relationships these systems establish with the surrounding systems by considering the physical, social, and economic connections that enable urban integration. The presence or absence of these characteristics allows for a distinction among the proximity systems, articulated as follows:

1. **Urban.** These are characterized by their own functional and relational autonomy, being equipped with urban centralities that offer a variety of primary and essential services. They are systems that include central areas for the development of the territory, possessing a certain urban dynamism and attractiveness even externally. The aim is to achieve improvements in proximity by proposing planning policies that should consolidate functional self-sufficiency, increase accessibility to public services, and foster connections with nearby centralities.
2. **Periurban.** These are areas located at the margins of urban areas, in a transitional zone between urban and rural territory. They are areas not completely urbanized and not entirely rural, which are dislocated from the main services. Being located far from centres, they possess little functional autonomy and do not guarantee self-sufficient internal dynamism. They represent systems still in the development phase and awaiting new strategies, highly attractive in terms of planning to promote a possible more controlled and balanced expansion of the city.

Working on peri-urban systems in terms of proximity means attempting to experiment with specific approaches for each area of the territory that intend to guarantee integration among the various urban and residential functions, ecological needs, and the development of different infrastructures.

3. **Border.** These are systems that do not possess their own functional autonomy, as they represent predominantly residential, commercial, or productive areas that develop in continuity with neighbouring municipalities and, therefore, do not require the presence of proximity services. They are located near municipal boundaries and gravitate towards close municipalities. Their main issue is the lack of urban centralities with strong functional identity, which does not allow for system autonomy and defines a fragmented



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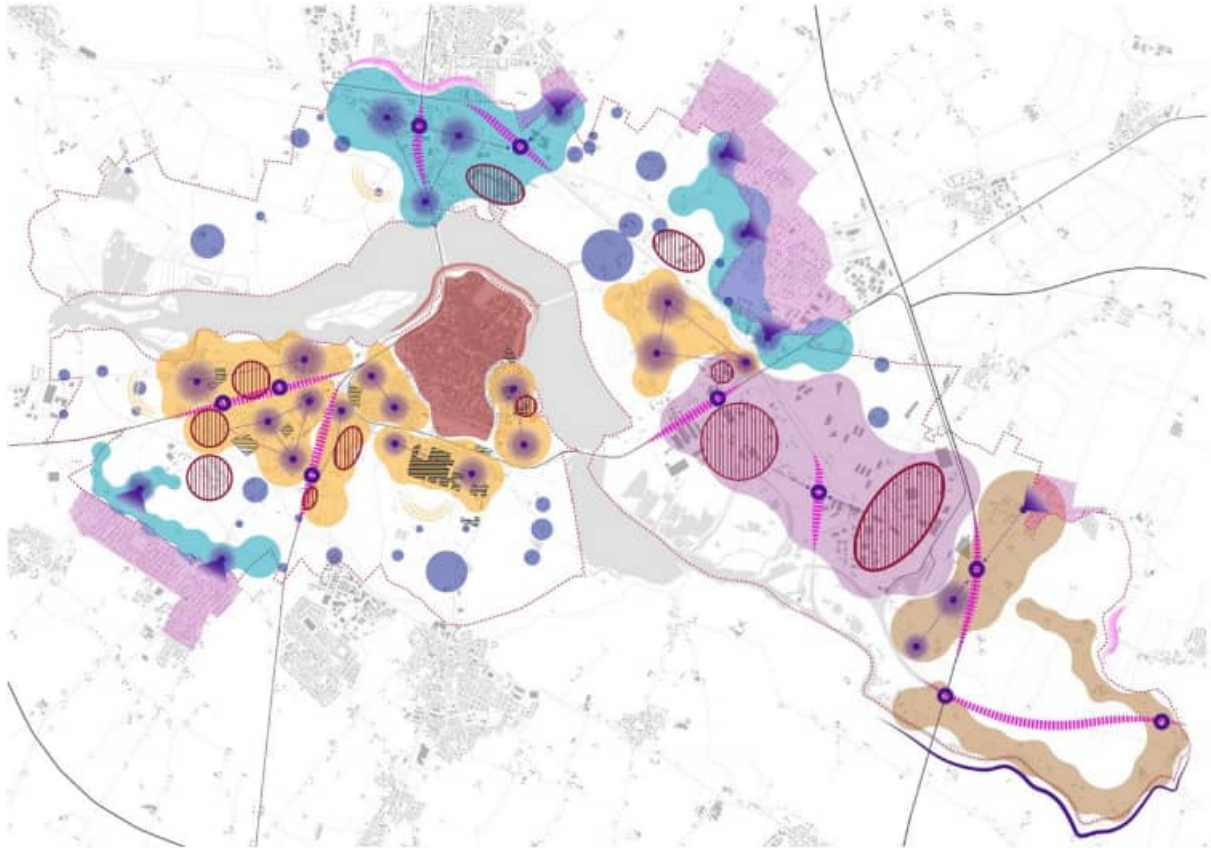
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development along the border. For these areas, it is necessary to adopt a different, integrated, and inter-municipal proximity strategy that allows for improved connections and ensures the integration of functions and services through policies shared with neighbouring municipalities.

These three articulations of proximity systems describe most of the municipal territory and allow for the orientation of proximity design in three different work directions. In addition to these systems, there are three more categories of elements that cannot be considered “systems” because they refer to very different portions of the territory, each of which has intrinsic characteristics that must necessarily be considered individually. Reference is made to:

1. **Industrial/Production Clusters.** These clusters indicate sectoral and geographic concentrations of companies, defining portions of territory that are predominantly mono-functional. These areas, heavily infrastructure, are dedicated to specific production activities and must integrate, in their development projects, the creation of sustainable and resilient ecosystems. Such an approach is crucial to promote the decarbonization of the industrial sector. To achieve this goal, sustainability strategies must be adopted to steer industrial development toward increasingly sustainable models that lead to a green, low-impact transition.
2. **Diffused Settlements.** These are residential aggregates that are distributed in a scattered manner throughout the territory. They define concentrations of individual elements that do not have their own functional autonomy in the territory and for which proximity strategies cannot be envisaged, as they do not contribute to integrating any urban dynamics. However, for these, it is possible to strengthen the connection systems and the network of links among the different dispersed settlement aggregates so as not to isolate them within the territory.
3. **Historic Center.** This represents an extremely delicate territorial area endowed with its own urban identity and high historical and testimonial value. It must be treated separately from other parts of the territory as it already exhibits its own internal dynamism and urban proximity in which everything can be easily reached, although it still requires improvement. Indeed, historic centres need an urban proximity strategy that develops their economy and, above all, implements a requalification and innovation of the commercial network and services for the socioeconomic relaunch of the inner urban areas (see Figure 4).

**Figure 4: Different characterization of “Proximity Systems” into the territory and their description**



The definition of proximity systems and their subsequent differentiation and classification within the territory constituted the first tangible result that allowed us to direct our research toward new models of urban planning to be experimented with and implemented. Indeed, these systems were considered in the subsequent phases as study models to experiment with, on which to attempt to establish proximity strategies and actions that allow cities to be planned based on new urban and community needs.

#### ***4.4. Re-thinking urban planning based on the “proximity urban strategy”***

To assess whether the proximity systems, previously defined and described, can truly represent the new urban geography of the Mantuan territory in a polycentric vision, it's essential to experiment with proximity strategies that integrate urban sustainability and resilience. This marks the first phase of operational verification, based on theoretical and analytical insights. The goal is to propose a strategic-structural planning approach that assesses the applicability of proximity. For proximity to drive sustainable urban regeneration and ecological transition, it's crucial to establish an urban framework guiding new planning.

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Starting with the proximity systems, the aim is to slowly redefine existing urban structures through integrated planning of urban and natural elements.

This urban framework articulated into two main axes: one infrastructural, focused on slow mobility and public services, and one natural, connecting the green and blue infrastructures of the territory. These axes serve as foundational structures that provide stability to proximity systems, guiding the development of proximity actions and strategies.

To date, primary and secondary roads are the main transport infrastructures, enabling long-distance movement between functional proximities (Manzini, 2021). The dominance of cars has pushed pedestrians and cyclists into smaller portions of the road, creating potentially dangerous conditions. These groups often lack continuous routes, as paths are interrupted and insufficient for safe use. As transport infrastructures expand to accommodate cars, they become more energy-consuming, polluting, and unsafe. Meanwhile, public space for pedestrians has decreased, impacting safety, air quality, and contributing to environmental, social, and aesthetic issues in modern cities.

The definition of a slow mobility axis, connecting multiple functional nodes through a diversified network, is crucial for promoting a more sustainable, proximity-oriented city. The challenge in urban areas is to improve accessibility by shifting away from car-dependent transportation and encouraging alternative modes of transport, fostering sustainable practices. These strategies often also involve urban planning tools already in use, such as the “Biciplan”, which organizes and regulates development. The Biciplan is a tool that sets the objectives, strategies, and actions necessary to promote the development of all aspects related to cycling, thus intensifying the use of the bicycle as a means of transport for various activities in the city (MIT, 2018).

This tool, adopted by the Municipality of Mantua in 2014, has guided us in identifying the optimal paths, both existing and planned, to form the slow mobility axis. These paths need to be developed, expanded, connected, or enhanced to create a continuous slow mobility network across the territory. Specifically, for Mantua, an important hub for interregional cycle paths, the axis must be divided into two routes: one with a landscape character, due to the city's cultural and natural significance, including lakes that define a slow mobility cultural route; and one with an urban character, extending within the city to ensure a continuous network connecting with neighbouring municipalities' main infrastructures.

While in the case of the landscape routes almost all the paths are on their own right-of-way and are separated from vehicular traffic, in the urban settlement one can find both dedicated routes and shared ones, which must be rethought also in relation to improved natural quality. It follows, therefore, that the slow mobility axis is significant to ensure that all citizens can live and enjoy open and public spaces as a common good through a network of connections that allows access to different proximities (see Figure 5).

For the slow mobility axis to be effective, it must not be seen merely as a continuous linear infrastructure but as a dynamic element that integrates the places and public spaces it passes through, strengthening their connection to the surrounding context. The axis acts as a mediator, expanding or contracting like a diaphragm to link spaces with different characteristics. The identification of priority cycling and pedestrian routes along the axis has been determined in relation to the strategic centralities in the territory, focusing on their

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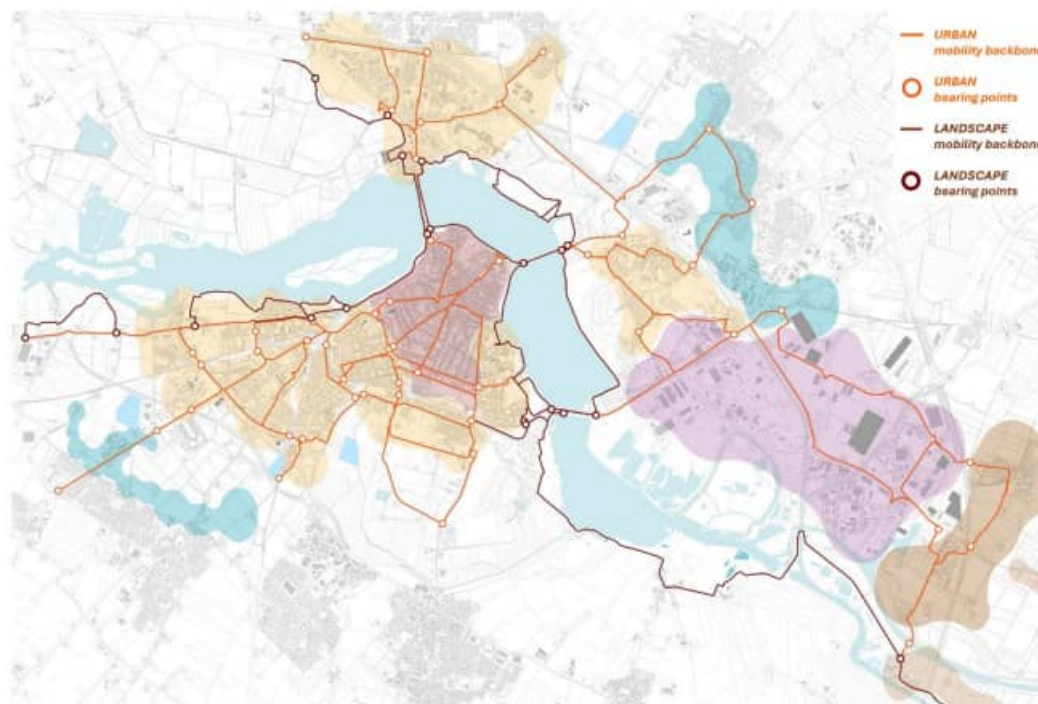
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functional reintegration into the urban system and organizing existing or planned urban and proximity facilities within public or publicly accessible private spaces.

Therefore, the slow mobility axis plays a strategic role in urban planning by promoting sustainable mobility that reduces traffic congestion and regulates vehicular flows, which affect environmental quality and urban safety. Enhancing accessibility and intramodality among proximity systems through intermodal mobility offers an opportunity to transform cities by systematizing both existing and planned physical infrastructures, along with the services distributed among them. This approach creates a cohesive framework within the territory, improving urban dynamics and sustainability.

**Figure 5: The slow mobility backbone inside the urban territory. Source: Author**



A second, more natural axis overlays the mobility axis, aimed at improving urban and environmental quality of life. It recognizes the need to promote green spaces to counteract biodiversity loss and enhance resilience and sustainability, addressing issues like land consumption, pollution, and traffic congestion. Redefining the relationship with nature is a key challenge for contemporary cities. Nature plays a crucial role in reshaping parts of established cities and is essential for their future development. Integrating nature into urban areas requires structured development based on existing or potential natural elements, fostering a harmonious relationship between nature and the city.

This reflection emphasizes the need to structure the project within proximity systems along a natural axis, which may sometimes overlap with the mobility axis. The strategy focuses on strengthening the environmental system's protection, both within and beyond urban areas, and enhancing the continuity of green spaces. The goal is to identify areas with



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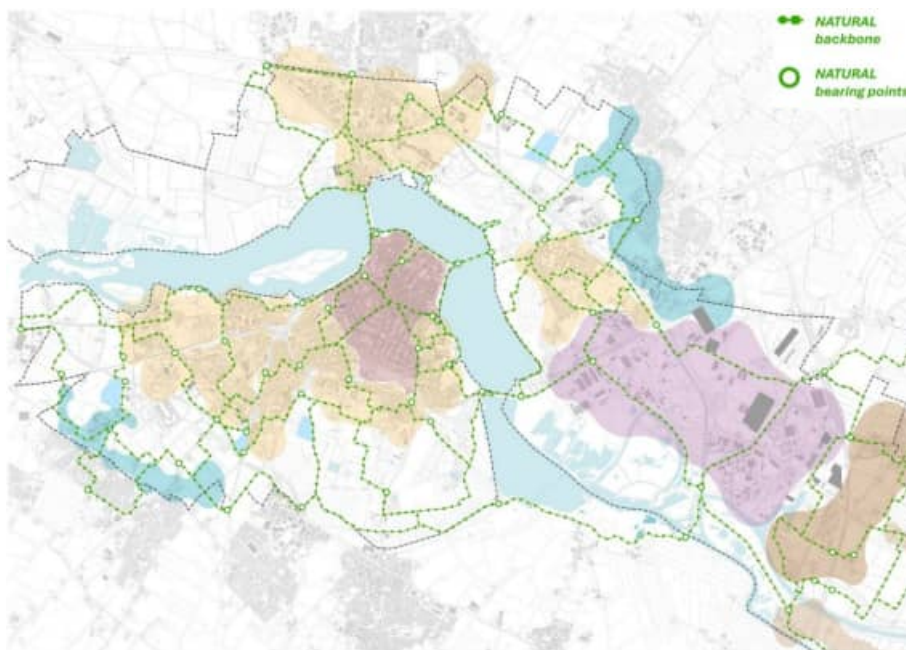
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significant natural characteristics, enhancing the ecological and environmental heritage defined by the Municipal, Provincial, and Regional Ecological Network, using these areas as the foundation for the natural axis. The natural axis acts as a guiding principle in urban design for a proximity city, promoting green actions that improve quality of life, community well-being, and economic sustainability. Thus, the natural axis does not have solely an ecological purpose within the consolidated urban fabric but plays a collective, aesthetic, and social role; it is about green spaces that allow the city to breathe and guarantee a continuous connection among the various natural elements of the territory. In the vision of urban development in terms of environmental sustainability, we still consider a dual direction of work.

The first of an ecological and environmental nature, aims to promote the presence of natural areas for biodiversity, wetlands, and blue infrastructures, which allow the city to move in a more ecological direction starting from the definition of the municipal ecological network. This network is developed especially into rural and non-urban areas, allowing ecological connections with areas even outside the municipal border of Mantua. This first direction of work is applied within one of the documents of the Service Plan, the Municipal Ecological Network, but does not represent the focus of our research.

The second axis of a social-natural nature offers people the opportunity to enjoy natural spaces by improving access to parks and green areas and creating green pathways that promote slow mobility and support mental and physical well-being (Mansur et al., 2022). The natural axis is not seen as a simple linear infrastructure, but as a network of spaces and green areas with varying natural values that enhance the city’s liveability. Multifunctional solutions based on nature, like Nature-Based Solutions (NBs), are prioritized. These include permeable surfaces, green roofs, riparian forests, Sustainable Drainage Systems (SDs), rainwater gardens, and wetlands, all of which help improve urban resilience and promote sustainable development by increasing soil permeability (ICLEI, 2017) (see Figure 6).

**Figure 6: The natural backbone inside the urban territory. Source: Author**



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Rooting the proximity project in the territory through the overlap of urban and natural axes highlights the need for continuous coordination among the territory's various elements. In some areas, these elements intersect, while in others, they follow separate paths. This process requires a radical shift in territorial planning, as existing urban structures must be rethought in terms of sustainable mobility, natural spaces, and integration among different elements of the territory. This change cannot be immediate but must evolve gradually.

As highlighted in the text, while the focus is on axes, the goal is to create an urban framework with multiple analytical layers that capture key elements of the territory, such as services, infrastructure, functional nodes, and green spaces. These elements are then assigned a role in the transition to integrated planning. Experimenting these two axes, which complement each other in terms of proximity, sustainability, and resilience, must occur within urban planning tools like the Service Plan. This shift moves from a quantitative approach, based on urban standards, to a qualitative one that anticipates strategic functions in each proximity system, addressing the actual needs of the territory and its communities.

The next phase, focused on application, involves a detailed assessment of each axis within the individual proximity systems. This phase will aim to define strategies and concrete actions to enhance existing services and facilities and design the integration of additional strategies to strengthen proximity as an urban planning approach.

### **5. Conclusion: The role of proximity for rethinking qualitative urban planning for sustainable and resilient cities**

In relation to the various issues and needs that have emerged in this research, particularly regarding how to address the numerous urban challenges affecting contemporary cities, the necessity of experimenting with the proximity strategy in urban planning has been highlighted. This strategy considers a progressively more sustainable and resilient development of the territory.

In this sense, as already emphasized in the paper, proximity requires a paradigm shift that must necessarily be considered in this phase of reviewing urban planning tools and policies. This is essential to enable municipal administrations to experiment with and innovate new urban strategies that no longer trust solely in a quantitative measurement of phenomena and service standards to be added to the territory. Instead, these strategies promote high-quality services that can be evaluated based on their ability to trigger change towards greater sustainability, improved urban quality of life, and a better environment.

Rethinking planning tools in this direction, integrating proximity and sustainability, reshapes both the content that must be highlighted in urban projects and the final objectives to be achieved through the plan revision (Bonfantini, 2023). It means planning cities that better respond to citizens' needs, that are more flexible in finding efficient solutions to urgent challenges, and that can quickly adapt to continuous and sudden changes, becoming increasingly resilient and sustainable.

Following this approach, prioritizing quality over quantity becomes essential for interpreting a constantly evolving territory, where measuring its effects and the multiple characteristics that define it is becoming increasingly complex.



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# SUSTAINABLE DEVELOPMENT AND THE GREEK PHARMACEUTICAL INDUSTRY

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## Abstract

The purpose of this paper is to investigate the contribution of the Greek Pharmaceutical Industry to sustainable development in Greece.

According to the United Nations (<https://unric.org/en/united-nations-sustainable-development-goals/>) the 2030 Agenda unanimously adopted in 2015 by world leaders includes the following 17 Sustainable Development Goals:

1. No poverty, 2. Zero hunger, 3. Good health and well-being, 4. Quality education, 5. Gender equality, 6. Clean water and sanitation, 7. Affordable and clean energy, 8. Decent work and economic growth 9. Industry innovation and infrastructure 10. Reduced inequalities, 11. Sustainable cities and communities 12. Responsible consumption and production, 13. Climate action, 14. Life below water, 15. Life on land, 16. Peace, Justice and strong institutions, 17. Partnerships for the goals.

In this study, the contribution of the Greek Pharmaceutical Industry to the implementation of the 17 goals of Sustainable Development was examined. For this purpose, a bibliographic study was carried out from which important conclusions are drawn regarding the role that the Greek pharmaceutical industry must play in the sustainable development in the Greek area and especially in the field of good health and well-being, in decent work and economic development, in the field of innovation, in responsible consumption and production.

In addition to the main conclusions, the paper proposes prospects for the development of the Greek Pharmaceutical Industry when it comes to maximizing the contribution to Sustainable Development in Greece as well as global competitiveness. A further but equally important goal would be the development of the Greek Pharmaceutical Industry in the context of reducing the environmental footprint in the present but also the establishment of better living conditions, as well as a more promising future, for next generations.

**Key words:** Greek pharmaceutical industry, sustainable development

## Introduction

The Greek Pharmaceutical Industry is a constantly growing sector of the Greek Industry. (Golna et al, 2013). Its presence in Greece is truly dynamic and actively intertwined with the social challenges and ongoing health needs of the population. (Tsakanikas & Moustakas, 2020, Simopoulou, 2022).

It is called upon to face many challenges such as:

- The increase in life expectancy and therefore the need to address chronic health problems

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- Addressing problems due to changes in urban environments. The accretive air pollution is a great factor of many respiratory- related diseases and even some cancer cases. Moreover, the pressing lifestyle often leads to the increasing levels of mental diseases such as anxiety and depression that the industry has to deal with.

- Addressing pandemics. The covid19 pandemic is a great example of an unforeseen issue that the pharmaceutical industry in general had to deal with. The need for an immediate solution was great and due to the fast action that was taken, in just a short amount of time, not only was a vaccine created, but also a medicine.

- Tackling addiction problems. Dealing with detoxication is a huge issue that the industry has to handle. For the patients are mostly hard to comply with any sort of medication, the industry has to find a way to minimize the withdraw symptoms that such treatments often cause, for they are the main reason why patients fail to continue the detoxication process.

- Tackling problems stemming from lifestyle changes (sedentary life, obesity). The extremely exhausting every day routine often leads to uncontrollable food consumption and lack of will to exercise. Such factors are amongst the main ones that lead to cardiological issues, diabetes, and other diseases that affect the majority of the population.

- Need to create new effective vaccines. Due to the constant mutations happening in both bacteria and viruses, the constant need of new vaccines in order to deal with the new immune microorganisms is great.

- Need to create new effective antibiotics. The lack of effective antibiotics is one of the biggest challenges that the industry has to face. For the bacteria keep getting immune to the already existed medications, the fear of eventually running out of drastic antibiotics is a major issue that bothers all scientists globally. For such reason, the need to create new, effective antibiotics is great.

- Need to treat cancer. Cancer has always been a huge challenge in the field of pharmacy. Not only is the cause hardly known, but the ways to treat it are also limited and most of the times not really effective. Research is constantly focusing on finding more innovative ideas to treat such a disease, while also minimalizing the side- effects, and in some cases process has already been made, but the industry has a long way to go, until it can effectively treat cancer. (Economic & Industrial Research Foundation, 2020)

### ***Sustainable development***

Sustainable development is a type of development that secures one's needs in the present but also ensures that future generations will likewise be given the same opportunities in meeting their needs.

The whole concept of sustainable development was formed in the late twentieth century for the impact of the human activity on the natural environment was threatening during those times. (European Environment Agency, 2020, Lampard, 1965). For such reason, the need of establishing ways of reducing waste, minimalizing the use of raw materials, as well as adopting eco friendly methods when it comes to production was great. (Adams et al, 2020, Broughton 2005, Alcayna et al, 2023).

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### *Sustainable development timeline*

In 1962, the impact of the human activity on human health and animal species was brought up by Rachel Carson, an American marine biologist, who presented her research on toxicology, ecology and epidemiology, in her book ‘Silent Spring’.

In 1967, the use of DDT, used for killing mosquitoes, is forbidden by law, due to the formation of the Environmental Defense Fund (EDF), which pursues legal solutions to the environmental damage. The EDF takes legal means in order to stop the DDT spraying on Long Island’s marshes.

In 1968, Paul Ehrlich, a German physician and scientist published “the population bomb”, a book about mass starvation due to our impact on the environment. At the same time, the concept of ecological sustainable development was mentioned in the Biosphere (Intergovernmental Conference for Rational Use and Conservation of the Biosphere)

In 1969, Cuyahoga River in Ohio (United States) catches on fire due to the great oil pollution that was happening at the time. This event brings attention to the matter of water pollution and leads to the Clean Water Act, the Great Lakes Water Quality Agreement and the creation of the United States Environmental Protection Agency—one of the first national departments of the environment in the world

In 1971, Greenpeace was founded in Canada in order to stop nuclear weapon test and tries to promote environmental care through civil protest.

In 1972, the United Nations Conference on the Environment was organized. The Stockholm Conference was the incubator for the establishment of many National Organizations for the protection of the environment as well as the establishment of the United Nations Environment Program (UNEP). Also, the Club of Rome publishes the controversial limits to growth

In 1973, the United States of America passed a law on endangered plant and animal species, thus contributing to the preservation of species and the balance on the planet and in the ecosystem. The CHIPKO movement is also born by women in India, which aims to preserve the sustainability and development of forests as well as the broader preservation of the environment, leading, among other things, to the establishment of the role of women in environmental issues.

In 1974, with the publication of Rowland and Molina in the Journal Nature, on the negative effects of chlorofluorocarbons (CFCs) on the ozone layer, a major debate was opened about finding ways to avoid the destruction of the ozone layer and protect the earth's atmosphere.

In 1975, the Worldwatch Institute was founded in the United States of America with the aim of raising public awareness of environmental threats and growing environmental problems, which led to the establishment of the annual publication of the State of the World since 1984. Furthermore, the CITES convention on trade in endangered species of animals and plants was established, promoting the protection of endangered species of flora and fauna.

In 1976, Habitat, a United Nations conference on human settlement, was organized, marking the first time that human settlement and its connection to environmental problems were linked at a global conference.



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In 1977, a United Nations conference was held on Desertification, a phenomenon that can cause various environmental, as well as ecological and economic problems. The green belt movement also begins in Kenya with the aim of promoting tree planting and preventing and reversing desertification.

In 1978, The Organization for Economic Co-operation and Development (OECD) began to explore the links between the environment and the economy, which laid the foundation for the publication of the 1987 report, Our Common Future.

In 1979, a convention on long-range transboundary pollution of the environment is established.

In 1980, the World Conservation Strategy was published by the International Union for Conservation of Nature (IUCN). The publication includes a section called "Towards Sustainable Development", which analyses problems related to habitat destruction, social inequalities, excessive population growth and the resulting problems and end up seeking to adopt a strategy to address the problems and inequalities. The World Report 2000 is also published, recognizing the importance of preserving biodiversity and diversity as well as preventing species extinction.

In 1982, the World Resources Institute was founded with the aim of finding solutions related to human health, environmental sustainability. In the same year, the law of the sea was established, regarding finding solutions and establishing rules regarding the pollution of marine ecosystems. In the same year, the UN World Charter for Nature advocates the principles of respect for all forms of life and the need to maintain environmental balance.

In 1984, a great chemical disaster happened in India, when one of the factories in Bhopal had an enormous number of methyl isocyanate gas leakage. This led to instant death of four thousand people and up to twenty thousand deaths in general. Those who survived, suffered with great respiratory problems and blindness. This incident established the need for environmental safety. During the same time, almost a million people died from starvation in Ethiopia due to drought.

In 1985, the Antarctic ozone hole was discovered by British and American scientists. Moreover the world meteorological society and the international council of scientific Unions predicted global warming, by measuring the levels of carbon dioxide and other gases in the atmosphere.

In 1986, one of the greatest chemical incidents and environmental crises took place, when the Chernobyl nuclear station exploded. The radiation level where not only deathly for work members and civilians that were exposed to it, but also for the environment. Those who survived the explosion died later from several cancer cases. The soil, air and water remained polluted and so the natural ecosystem as well as the agriculture was set back.

In 1987, the Montreal protocol was established. This agreement regulated the production and consumption of those gases that were worsening the greenhouse effect. Such gases, when exposed to the atmosphere damage the protective ozone layer leading to higher percentages of radiation.

In 1988, the Intergovernmental Panel on Climate Change (IPCC) is established to evaluate and assess environmental data.

In 1989, the Stockholm Environmental Institute is founded to conduct local and international studies on the environment.

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In 1990, The International Institute for Sustainable Development (IISD) is founded in Canada and the publication of the journal Earth Negotiations Bulletin begins in 1992.

In 1991, the Global Environment Facility was established, which, after its restructuring in 1994, proceeded to provide financial assistance to developing countries to adopt changes related to climate change, water and pollutant management.

In 1992, the Business Council for Sustainable Development published Changing Course with the aim of promoting the correlation between Sustainable Development and entrepreneurship, thereby promoting Sustainable Development. Also in the same year, the Earth Summit, the United Nations Conference on Environment and Development (UNCED) was held in Rio de Janeiro, where important agreements were signed such as: Agenda 21 Action Plan, Rio Declaration, Non-Binding Principles on Forests and also the foundations were laid for agreements such as the conservation of biodiversity, climate change, the fight against desertification.

In 1993, The first meeting of the United Nations Commission on Sustainable Development takes place.

In 1994, China's Agenda 21 is published, which is a white paper related to environmental issues as well as population issues.

In 1995, the World Trade Organization (WTO) was established, recognizing links between trade routes and environmental impacts.

In 1996, To ISO 14001 is established as a voluntary environmental standard to ensure environmental safeguards.

In 1998, A controversy begins over genetically modified organisms and international concerns are raised about the safety of these products.

In 2000, Millennium Development Goals. Agreement between a large number of leaders at the global level and the adoption of goals that must be met by 2015 regarding issues of environmental pollution, discrimination against women, poverty, etc.

In 2002, The World Summit on Sustainable Development takes place in Johannesburg

In 2004, Delhi is mandating the use of natural gas in buses and cars in an effort to control environmental pollution.

In 2005, The Kyoto Protocol, which concerns legal commitments by developed countries to control and reduce greenhouse gases and to establish a clean development mechanism, enters into force.

In 2007, Montreal Protocol on chlorofluorocarbons (CFCs) responsible for the destruction of the planet's ozone layer.

In 2009, The Summit G20, is held in Pittsburgh with guidelines for sustainable development in the 21st century as well as for limiting the consumption of fossil fuels that pollute the environment.

In 2010, agreement of nations on the equitable distribution of resources.

In 2015, United Nations approval of the global agenda to achieve 17 Sustainable Development Goals by 2030

The sustainable development of the pharmaceutical industry has a significant impact on human lives and society in general, since its development is equivalent to improving people's health and quality of life.

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Additionally, it can contribute to achieving the goals of the UNITED NATIONS, the 2030 Agenda unanimously adopted in 2015 by world leaders includes the following 17 Sustainable Development Goals, especially in the areas of good health and well-being, Industry innovation and infrastructure (International institute for sustainable development, 2012).

### ***Sustainable development goals***

According to the United Nations, the 2030 Agenda unanimously adopted in 2015 by world leaders includes the following 17 Sustainable Development Goals:

- 1.No poverty,
- 2.Zero hunger,
- 3.Good health and well-being,
- 4.Quality education,
- 5.Gender equality,
- 6.Clean water and sanitation,
- 7.Affordable and clean energy,
- 8.Decent work and economic growth
- 9.Industry innovation and infrastructure
- 10.Reduced inequalities,
11. Sustainable cities and communities
12. Responsible consumption and production,
13. Climate action,
14. Life below water,
15. Life on land,
16. Peace, Justice and strong institutions,
17. Partnerships for the goals.

The establishment of those goals by 2030, will not only lay the foundation for a more sustainable future, but also ensure better life conditions for both present and future (United Nations, 2015).

### **Methodology**

A bibliographic study was carried out and the contribution of the Greek Pharmaceutical Industry to the implementation of the 17 goals of Sustainable Development was examined. More specifically, the study focused on the role that the Greek pharmaceutical industry must play, in the sustainable development in the Greek area and especially in the field of good health and well-being, in decent work and economic development, in the field of innovation and also in responsible consumption and production.

Nowadays, there is a growing awareness of the development of the pharmaceutical industry in the context of adopting manufacturing practices that ensure environmentally friendly processes(Evangelinos, 2014), saving raw materials and water, waste reduction strategies and recycling.(Batsouli, 2022). For the natural resources are limited and the use of those for both experimental and medical purposes is great, the need of adopting more green

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methods, as well as working with raw materials sparingly is of great value. (Milanesi et al, 2020).

The Pharmaceutical Industry provides services of research, production and sale of pharmaceutical products necessary for human health. Taking into account the increasingly aging population and the need to deal with serious diseases that afflict humans, the development of the pharmaceutical industry should be considered granted. The role of the industry should be to design new and improved molecules, in order to treat a greater range of diseases, including resistant pathogens and also orphan diseases. In order to achieve such goal, a great number of experiments and protocols are to take place and a greater number of resources is to be used. So not only does the industry have to look for the best ways to save raw materials but also spare water and energy.

***A. According to the Sustainable Development Goals, 2030 for Greece (Hellenic Statistical Authority, 2024):***

### ***1. Regarding the goal of good health and well-being:***

It is stated in the Agenda that:

*"3.2 By 2030, end preventable deaths of newborns and children under the age of five, with all countries aiming to reduce neonatal mortality to 12 deaths per 1,000 births and child under-five mortality to 25 deaths per 1,000 births*

*3.4 By 2030, reduce premature mortality from noncontagious diseases by one third through prevention and treatment and promote mental health and well-being'*

*What the pharmaceutical industry can do:*

In order to achieve such goals in the field of good health and well-being the pharmaceutical industry should focus on improving people's health by researching for the safest and most effective drugs possible and with the aim of treating diseases of a greater range and of all kind, no matter the number of patients affected by them. For such purpose, the use of high-quality raw materials in the drug production and adoption of safest techniques and adequate protocols must also be implemented. So, the industry should start:

1. Investing in research for safer and more effective medicines. In order to achieve that, it would be of great value to establish stronger linkages with university institutions to enrich knowledge. The University could become a breeding ground for young scientists so that knowledge can be transferred and transformed into innovative medicines. Moreover, it could be useful to focus on funding research programs in collaboration with universities and scientific organizations and also extensive clinical studies and collaboration with foreign organizations.

2. Finding funds to invest in research for "orphan drugs", drugs aimed at patients suffering from rare diseases. One of the greatest problems that the healthcare system has to face and deal with is the treatment of the so called “orphan disease”. Those diseases affect only a small number of patients around the world and so the pathological causes are mostly unknown, due to the lack of research that stems from the inadequate fundings. The outcome of such lack is that those patients do not take specific medication and so the symptoms get worse due to the non-targeted treatment.

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3. Using high-quality raw materials. Collaboration with reliable suppliers who adhere to international quality standards and comply with good management practices for environmental safety and available resources, within the framework of sustainable development.

4. Adopting developed safety systems for production techniques and methods.

5. Encourage the patients to mention any possibly side-effect. Clinical test might take place, but given the fact that the number of volunteers is only a small percentage of the general population, unknown side effects might appear. Clients should be kindly requested to write down any medicine-related effect that might occur, in order to help the industry improve.

The Greek Pharmaceutical Industry is a reliable and rapidly growing sector that produces reliable pharmaceutical preparations, but there is always room for improvement in order to contribute to the achievement of the goals of the 2030 agenda.

According to the Association of Pharmaceutical Companies in Greece, a focused pharmaceutical policy is essential:

- An increase in state pharmaceutical subsidies is required (Chimonas, 2024).
- Rationalization of pharmaceutical spending and effective management of available health funds by promoting control mechanisms through the strengthening of digital reforms as well as the adoption of necessary therapeutic protocols. (Chimonas, 2024).
- Promoting investments in research and innovation sectors in order to make the environment more attractive for investments in clinical studies with the ultimate aim of promoting the health of citizens. (Chimonas, 2024).

### ***B. According to the Sustainable Development Goals, 2030 for Greece (Hellenic Statistical Authority, 2024)***

#### ***2. Regarding decent work and economic development:***

It is stated in the Agenda that:

*"8.5 By 2030, achieving full and productive employment and decent jobs for all women and men, including young people and people with disabilities, and ensuring equal pay for work of equal value"*

*What the pharmaceutical industry can do:*

The Pharmaceutical Industry should contribute to equal employment opportunities by establishing equal payments and also equal development prospects for both genders. Moreover, the industry must not exclude people with special need and disabilities but focus on finding ways to make work more accessible and to also provide a more welcoming environment. Lastly, when it comes to better working conditions, the pharmaceutical industry is obligated to provide a safe environment with well tested machineries and safety protocols that are to be followed by anyone.

1. Recognition of the different capabilities of each employee regardless of gender or special characteristics (Taylor, 2021): The pharmaceutical industry should ensure that there will be equal representation of both genders and no racial inequalities. Each person should be

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evaluated for their mind and will of providing not only for the company but also for the society and should be rewarded equally for the outcome and effort that they make.

2. Formation of special conditions for serving people with special needs in the workplace (Vasquez, 2024): Like many other industries, the pharmaceutical industry lacks of inclusion of people with special needs and disabilities. For such reason, great minds fail to adapt to the already set conditions of the working environment. The industry should form new conditions and prospects for people with special needs.

In order to achieve a more accessible lab the industry can start by using height-adjustable workbenches and wheelchair accessible sinks. Moreover, the safety measures, such as the lab's emergency shower and eyewash station should be accessible by everyone.

3. Continuous checks on the safety of workplaces and machinery and use of special safety protocols: In order for the pharmaceutical industry to achieve a stable and health working environment, safety protocols should be established and followed so as to minimize the hazardous factors. The machinery and equipment should be regularly tested and every member present, especially in the laboratory section should be careful of their actions.

The Greek Pharmaceutical Industry is a reliable and rapidly growing sector that promotes occupational safety with respect for human rights, but there is always room for improvement in order to contribute to the achievement of the goals of the 2030 agenda.

***C. According to the Sustainable Development Goals, 2030 for Greece (Hellenic Statistical Authority, 2024)***

### ***3. Regarding the field of innovation:***

Regarding the Industry sector, innovation and infrastructure

It is stated in the Agenda that:

*"9.4 Until 2030, upgrade infrastructure and retrofit industries in order*

*to make them sustainable, increasing the efficient use of resources and encouraging the adoption of more clean and environmentally sound technologies and industrial methods, with all countries taking action in this direction, according to their respective capabilities.*

*9.5 Strengthening scientific research, upgrading the technological capabilities of the industrial sector in all countries, and especially in developing countries, including, by 2030, the encouragement of innovation and the substantial increase in the number of workers in research and development by 1 million, as well as the increase in spending on research and development in the public and private sectors"*

*What the pharmaceutical industry can do:*

The Greek Pharmaceutical Industry is a reliable and rapidly growing sector that promotes innovation, but there is always room for improvement in order to contribute to the achievement of the goals of the 2030 agenda.

The pharmaceutical industry should invest in new innovative ideas and practices that will improve the drug production and preservation. In order to achieve that, not only must the industry be more open to adopting new methods and protocols, adapting the already existed ones and even changing the facilities and machinery, but to also include younger scientists with innovative ideas and great will of providing to the society. Such new ideas must be well



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heard and not downgraded, for they are the future of the development of the medical field. So, the industry should start (Kavvatha, 2024):

1. Investing in innovative ideas and practices
2. Investing in innovative production methods
3. Investing in innovative machinery
4. Collaborations with universities with the aim of collaborating with young scientists with innovative ideas and visions for a promising tomorrow in the pharmaceutical industry and in the medicines produced.
5. Investing in innovation means investing in promoting people's health and better living conditions

According to the European Green Deal (European Council of Europe, 2019), the goal for Europe is to reduce pollution and restore the balance of ecosystems in nature by 2050. The main objectives of the European Green Deal are:

1. Climate neutrality
2. Circular Economy
3. Clean Industry
4. Healthier environment
5. More sustainable agriculture
6. Climate Justice and Equity

Especially in the field of “Clean Industry”, the goal is to promote cleaner, more sustainable and more energy-efficient industries.(Mitoula & Oikonomou, 2010, Karytsas & Theodoropoulou, 2014).

One goal could be to find ways to reduce energy consumption.(Bhutani & Kakatkar, 2024, Talbi, 2017).

According to Industry, Plant Team Editorial Team, Garakis, 2021, ways to achieve the desired energy reduction in Industries are proposed:

1. Special skylights with glass blocks could be used which would allow natural light to penetrate them and the space to be naturally illuminated without requiring energy consumption.
2. It would possibly help to structure working hours so that natural lighting sources are used as much as possible, and to a lesser extent energy-intensive sources.
3. Investing in energy systems that use green energy sources, using photovoltaic energy production systems.
4. Using lighting systems with lighting and motion sensors, in order to avoid unnecessary energy consumption at times when it is not required, for example, the periods of time when natural lighting is sufficient to meet work needs or for example, activating lighting with motion when the presence of people in the space is detected, such as in the restrooms.
5. Use of eco-friendly energy-saving lamps
6. Use of smart elevators with energy-saving systems and materials.

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### ***D. According to the Sustainable Development Goals, 2030 for Greece (Hellenic Statistical Authority, 2024)***

#### ***4. Regarding the field of Responsible consumption and production (target 12)***

It is stated in the Agenda that:

*"12.2 By 2030, achieving sustainable management and adequate use of natural resources"*

*What the pharmaceutical industry can do:*

The pharmaceutical industry should invest in green methods with respect for the conservation of natural resources, playing its role in providing for the future of the next generations (Stefanopoulos, et al. 2009). In order to achieve that, the industry must collect raw materials in the smallest amounts possible for research purposes, while also minding for the natural environment, the maintenance of the flora and fauna of each ecosystem and the ethical aspect of such experiments.

A great alternative would be to invest in finding ways of creating artificial substances so as to reduce the collection of natural resources that would be used as raw materials. Since the very beginning of medication and drug design process has of course been made. Not too long ago, people were still using natural sources, such as plants and animal parts as remedies. That led to a big number of ecosystems destroyed in order for the treatments to continue. Nowadays, plants are still a great source of natural resources, but thanks to the development of the synthetic chemistry, most drugs are artificial.

When it comes to the solvent selection, the pharmaceutical industry should adopt safer and more sustainable solvents that will have minimum impact on the environment. For such purpose, water, carbon dioxide, or other environmentally friendly solvents should replace the traditional organic solvents.

A great way of reducing raw material is taking advantage of catalysts, substances that increase the rate of a chemical reaction and reduce the amount of a reagent needed in order to achieve a higher efficiency.

In order to reduce waste, the pharmaceutical laboratories should establish methods to reuse raw material and take advantage of biodegradable resources. Moreover, they should focus on minimizing the steps of a chemical reaction, and also make good use of as many final products as possible. This would lead to fewer unused byproducts that would otherwise be considered waste.

An important goal could be to find ways to reduce water consumption, using know-how to improve the ways of manufacturing and using devices and reagents, so that we can lead to lower water consumption or to the use of technologies that use water recycling, thus leading to the reduction of the waste of our planet's water resources, (Pantazopoulos, 2023).

An important goal could be to find ways to reduce waste generated both during the industrial production process and during the subsequent use of products by consumers.

1. Use of recyclable materials in packaging materials. The packaging itself should be made out of recycling materials and expired drugs should be collected separately in order to be recycled or destroyed in an ecofriendly way (Kostakis, 2015).

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2. Use of Laser techniques to replace labels on packaging. This action might seem small, but given the amount of medicine produced annually, such a small difference could really help in minimalizing the plastic waste.
3. Use of water-soluble or biodegradable packaging. Creating packaging out of biodegradable materials could help with the recycling process.
4. Recycling at all stages of the production process.
5. Use just as many medicine products as needed. A great problem that the Greek pharmaceutical industry faces is the number of unused and expired drugs that go down the drain annually. The reason why, is the already pre-existed and pre-packaged medicine that may be more than what the patient might need. That could mean, more pills of a specific drug that one would need for treatment, and so, the extra number of pills would be unused. A good solution would be a mass production of the same drug without it being commercially packaged. In such way, the patient would only ask the pharmacists for a standard number of medicine and there would be zero waste.

## Conclusions

Sustainable development is of great value for it provides a more promising future for the next generations. The pharmaceutical industry can play a great role in such a development given the fact that it can upgrade the well-being and health condition, establish a welcoming and fair working environment and achieve sustainable use of natural resources.

Regarding the health conditions, the pharmaceutical industry plays a great role in minimalizing diseases through safe and well tested medicine. (Milanesi et al,2020). In order to achieve that, research programs must be funded and collaborations with other organizations and even universities must be ensured. The raw materials that are used for the drug synthesis should be clean of toxic byproducts and safe to use and the origin of them, especially when it come to natural resources should be verified.

All safety protocols should be followed by everyone and the machinery, as well as the equipment should be regularly tested, in order to minimize the hazardous factors and ensure the safest working environment possible. In the field of safety, toxic, organic solvents are encouraged to be replaced by eco friendly ones, such as water, or carbon dioxide so as to reduce water and air pollution and also establish healthier working conditions.

The pharmaceutical industry should be open to diversity and include both genders and all races equally. Work of equal value should be rewarded likewise and development prospects should be open to everyone. People with special needs and disabilities should be treated equally and should be welcomed in the industry. For such thing to happen however, changes must be made, such as altering the laboratory equipment in order to make it more approachable.

In the field of innovation, it would be beneficial for the industry to be more open to younger people and encourage their members to think outside of the box. Such innovation could range from creating artificial reagents, so as to minimize the use of natural resources, to finding clever ways of saving energy. Moreover, new, innovative technics could be useful for a better drug absorption and bioavailability.

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## INDUSTRIAL SYMBIOSIS - SITUATION IN MAURITIUS

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### **Abstract**

Industrial symbiosis, a key field within industrial ecology, focuses on utilizing waste or by-products from one entity as resources for another, fostering environmental and economic advantages. Central to this concept is the reuse of resources and waste minimization, driven by collaborative opportunities and synergies often facilitated by geographical proximity (Chertow, 2000).

Essentially, industrial symbiosis establishes connections between companies or industrial facilities, enabling one organization's by-products or waste to serve as raw materials for another. By integrating industrial symbiosis practices, industries can significantly reduce waste generation and lessen the need to extract raw materials, repurposing waste from one sector as valuable inputs for another (Chertow, 2007). Various factors influence this approach, including environmental benefits, cost savings such as reduced greenhouse gas emissions, and addressing issues like natural resource scarcity and waste diversion from incinerators and landfills. Ultimately, industrial symbiosis leverages symbiotic collaborations and business partnerships to create closed-loop systems.

The paper's main aim is to present the idea of industrial symbiosis and the possibilities for industrial symbiosis in Mauritius. The paper analyzes the term industrial symbiosis, opportunities and challenges for industrial symbiosis. The third part of the paper studies the possibilities and challenges of industrial symbiosis implementation in Mauritius and presents good practice cases. Based on the research results, conclusions and recommendations for further research on this important topic are given.

**Keywords:** Industrial symbiosis, opportunities, challenges, Mauritius

## INTRODUCTION

Industrial symbiosis is a cooperation between several separate, often geographically close entities, i.e., companies working closely in industrial parks or clusters, exchanging different resources (e.g., by-products, water, energy and materials) (Chertow, 2007). Those resources

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are used as replacements for raw materials that would otherwise be bought from elsewhere or considered waste (Clift and Druckman, 2015). Industrial symbiosis has been essential to the circular economy concept in recent decades. Based on the circular economy, products are designed to be disassembled and reused, focusing on recovery from the end of the life cycle. Four sources of value creation are emphasized: Minimizing material consumption, maximizing successive cycles and time in each cycle, diversifying reuse throughout the value chain, and maintaining uncontaminated material streams. These principles drive material productivity and offer long-term advantages over traditional linear business models (Lamba et al., 2024). Based on the report (Ellen MacArthur Foundation, 2019), there are three main circular economy principles: 1) waste and pollution prevention, 2) materials use and reuse, and 3) natural systems regeneration. The first principle focuses on the importance of environmental impact at the design stage for reducing the use of virgin raw materials and, therefore, minimizing waste generation. The second principle focuses on extending the life cycle of materials and products using different strategies (i.e., reuse, repair, remanufacturing). The third principle emphasizes the prevention of environmental damage and the active improvement of the environment by returning valuable nutrients to ecosystems.

**Figure 1.** Industrial symbiosis illustration



Source: Chat GPT, 2024

The illustration highlights the mutual benefits and sustainable exchange within the framework of an eco-industrial park. It emphasizes the value for the participating companies and shows a network of interconnected industries that exchange resources such as energy, water, raw materials and waste products. Although industrial symbiosis and circular economy

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target sustainability, they have different focuses. The circular economy includes materials and products from different sectors. Industrial symbiosis focuses on industrial waste and by-products and represents a practical tool and targeted strategy for implementing a circular economy in industry by optimization of resource use. While it contributes to a more circular economy, it does not necessarily lead to the complete closure of material loops. On the other hand, the circular economy examines a broader perspective, including upstream methods, waste prevention, and a holistic attitude to sustainable development. Despite their different characteristics, the boundaries between the circular economy and industrial symbiosis are often blurred, and there is considerable overlap between the two concepts.

This paper explores the concept of industrial symbiosis and highlights recent research in the field. The first section offers a literature review, discussing the definition, challenges, and potential for developing industrial symbiosis. The second section provides an overview of prominent examples of industrial symbiosis globally and assesses its feasibility in Mauritius. Finally, the paper concludes with key findings and proposes directions for future research.

## LITERATURE REVIEW

The most traditionally used industrial symbiosis definition (IS) (Chertow, 2000) states that IS links traditionally detached businesses in a cooperative method to achieve competitive advantage through the physical exchange of materials, energy, water and by-products. The essential elements of IS are the collaboration and synergistic opportunities afforded by geographical proximity (Chertow, 2007). Lombardi and Laybourn (2012) presented a renewed definition of IS. This definition was summarized by Domenech et al. (2019) as follows: "Industrial symbiosis (IS) is a systems approach to a more sustainable and integrated industrial system that identifies business opportunities that leverage underutilized resources (such as materials, energy, water, expertise, assets, etc.)." Domenech et al. (2019) further explain that IS includes organizations working in different sectors of activity engaging in mutually beneficial transactions to reuse waste and by-products by finding innovative ways to source input and optimize the value of the residues of their processes, for example, by using waste or by-products from one activity as inputs for another activity."

The European Committee for Standardization (CEN) (2018) recently initiated the process to address the need to define IS. The agreement on IS was reached in 2019. They defined the IS as the use of underutilized resources (e.g., by-products, waste, energy, residues, water, capacity, logistics, expertise, equipment and materials) by one company or sector from another, with the result that the resources can be used productively for longer. However, this process is not yet complete, and CEN is planning a series of consultations and standardization dialogs to define the roadmap for the standardization of IS in 2025.

IS involves collaboration between companies or industries to exchange materials, by-products, energy and water to share services, utilities and facilities (Costa and Ferrão, 2010). The realization of IS requires the identification of potential symbiosis opportunities. Therefore, identifying viable opportunities for resource exchange between industries is critical to advancing IS in practice. There are different types of resources for IS synergies, and they include raw materials, by-products, energy resources, water, utilities and infrastructure assets, logistics services, expertise skills and specialized knowledge (Domenech and Davis, 2011;

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Erceg et al., 2017; Henriques et al., 2021; Fraccascia et al., 2021; Činčurak Erceg, 2024; Erceg et al., 2024).

This resource exchange results mainly from production processes that can be used by other processes of the same or another company to replace production inputs (e.g., energy, water, raw materials, waste) or to create new products (Albino and Fraccascia, 2015). Thus, industries that adopt IS can achieve economic and environmental benefits by simultaneously reducing production costs and creating environmental and social benefits for the companies (Tadeo et al., 2017; Yuan and Shi, 2009). The necessity for reducing the environmental impact and the growing demand for new resources have drawn attention to expanding IS practices regionally to achieve more effective results (Kokoulina et al. 2019).

Economic benefits (Maillé and Frayret, 2016) and improved profitability are often the main drivers of IS, usually resulting from sharing by-products or reduced waste disposal costs. Gabriel et al. (2017) have identified the pursuit of waste recovery opportunities as a new catalyst for IS initiatives. For energy-intensive industries, energy efficiency is a significant motivator (Karner et al., 2017). In addition, companies recognize the potential benefits of sharing services, utilities and knowledge (Wu et al., 2016). Studies (e.g., Golev et al., 2014; Rahman et al., 2016; Järvenpää et al., 2018) emphasize the complex nature of industrial symbiosis and highlight several barriers and facilitators that influence its adoption. Key facilitators for IS include economic incentives, supportive regulatory frameworks and increased awareness, while barriers include inadequate infrastructure, weak legal backing and limited access to information.

Industrial symbiosis encounters various financial, technical/technological, social, economic, regulatory, policy, management, informational, and geographical barriers and challenges. Additionally, different studies (Järvenpää et al., 2018; Rahman et al., 2016; Domenech Aparisi, 2010; Golev et al., 2014) have identified organizational barriers such as lack of trust between units, emotional resistance, risk and uncertainty, cultural differences, limited commitment to sustainable development, collaboration challenges and low community awareness. Golev et al. (2014) categorized barriers into two main types: 1) technical barriers and 2) non-technical barriers. Alternatively, they can be divided into 1) "hard" and 2) "soft" barriers (Järvenpää et al., 2018:78). Hard barriers relate primarily to technical and economic issues, while soft barriers relate to institutional, regulatory, social and cultural factors. Despite the extensive documentation of these barriers, Golev et al. (2014:142) point out a significant gap as there is a lack of real-world case studies detailing how these barriers are identified and overcome and a lack of a consistent methodology for analyzing them.

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**Figure 2.** Common non-technical IS barriers



Source: adapted from Scaler, 2020; Erceg et al., 2024

On the other hand, there are some technical/technological ("hard") barriers to IS implementation. Studies (Heeres et al., 2004) mention waste exchange technical feasibility as an IS barrier. Van Beers et al. (2007) stated potential concerns for the capture, recovery and reuse of bioproducts. The authors further noted that many IS opportunities were prevented from being implemented due to the availability of recovery technologies. Additional technical barriers were connected to wastewater regeneration and reutilization of solid waste (Liu et al., 2018). Gibbs (2003) studied the situation in which local companies "do not fit together", Costa et al. (2010) stated nonexistence of manufacturing technology potential recycling technologies, and Sakr et al. (2011:1166) concluded that an important technical barrier is "the absence of local expertise capable of identifying and assessing industrial symbiosis opportunities."

Finally, Matti (2021) identified six key policy themes that directly or indirectly promote industrial symbiosis: eco-innovations, resource efficiency, materials security, green growth, pollution and waste reduction, and the reduction of greenhouse gas emissions.

## INDUSTRIAL SYMBIOSIS IN MAURITIUS

### *Mauritian Context*

Located in the Indian Ocean, Mauritius has successively been occupied by the Dutch, the French and the British. The island gained independence in 1968 from the British, who



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occupied the island since 1810. Over the years, the Mauritian economy has undergone significant economic transformations. After independence, the island relied significantly on the agricultural sector, and following major economic reforms undertaken by different governments, the country evolved into a more diversified and dynamic economy. The service sector is the economy's central pillar, contributing to nearly 68% of the economy (Strafin, 2023). In 1992, the island was classified as a Small Island Developing State (SIDS) following the United Nations Conference on Environment and Development held in Rio De Janeiro. Although SIDS accounts for only 1% of the total GHG emissions, they face serious challenges such as natural calamities, including cyclones, climate change, biodiversity loss, waste management and global crisis (United Development Programme, (UNDP), 2023a). SIDS also faces limited natural resources such as energy, water, mineral and agricultural resources. According to UNDP (2023a), the island is not an exception to the other SIDS due to its vulnerability to external economic shocks and the impact of global warming, natural disasters and biodiversity loss. As a fast-developing economy that generates significant waste due to the increasing volume of industrial and economic activities, waste management has become a primary concern for local authorities and policymakers. This paper, therefore, focuses on the valorization of waste in a productive chain as part of the Industrial Symbiosis (IS) strategy (Cárcamo and Peñabaena-Niebles, 2022). The next part of the paper details the waste generation in the country, following the regulatory framework governing waste management and the various strategies and techniques adopted by companies to reduce solid waste and promote the use of clean energy, amongst others.

### ***Waste Management in Mauritius***

Strategies to valorize waste aim to transform waste and by-products into valuable resources, thus reducing the need for new materials. Waste is any material that is discarded since it is no longer usable. Waste is classified into solid, liquid, gaseous, and hazardous waste. With the growing concern regarding environmental sustainability, innovative ways should be deployed to manage and dispose of waste responsibly and sustainably (Sharma et al., 2024). According to Kowlessur (2020), an average of 1.26 kg of solid waste is generated daily in SIDS. These solid wastes are dumped in open areas (UNEP/ISWA, 2024) or burnt in the backyard (Agamuthu and Herat, 2014).

As a SIDS, Mauritius generates significant waste annually, mainly from household items, industrial by-products, wastewater, industrial effluent, medical waste and gases produced from industrial processes. In 2021, the country produced 1,488 tons of waste daily (543,196 tons annually) (Ministry of Environment, Solid Waste Management and Climate Change, 2023). Figure 2 shows the different types of waste generated in the country. These wastes are disposed of at the Mare Chicose Landfill (Figure 4), the only landfill in Mauritius spanning over 48 hectares. Managing the waste at the national level costs the government around Rs1.5 billion. The activities include waste collection, transportation of the waste to the landfill, and the operation and maintenance of the landfill.

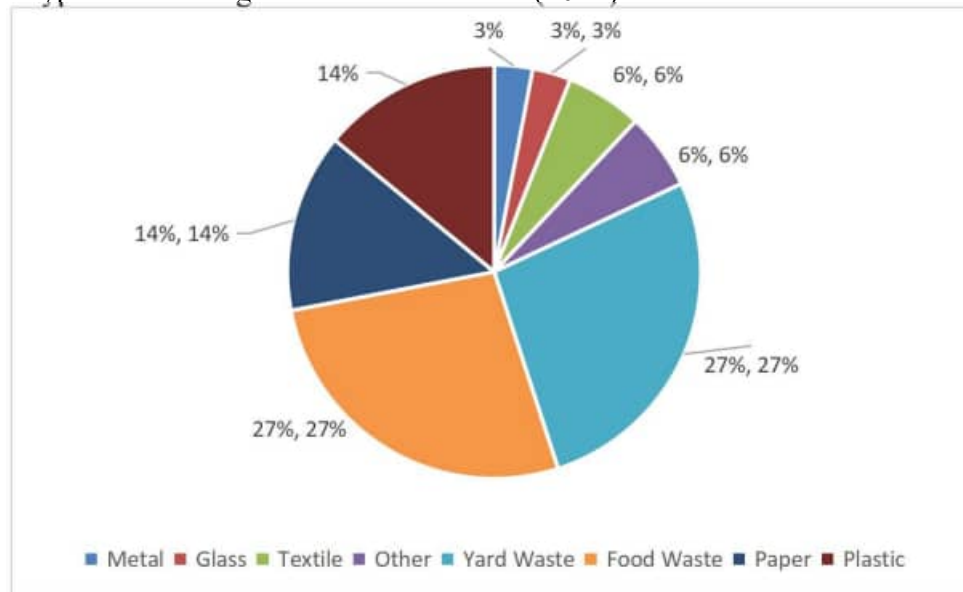


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**Figure 2:** Types of wastes generated in Mauritius (2021)



Source: Ministry of Environment, Solid Waste Management and Climate Change, 2023

With the growing volume of waste, waste management has become a serious challenge for the Mauritian government. Several factors have contributed to the increasing volume of waste, including:

- The population is increasing (presently, the population of Mauritius is around 1.3 million compared to 1.2 million and 900,000 in 2000 and 1980, respectively).
- Increase in economic activities (14.74 billion USD in 2018 and 4.73 billion USD in 2000)
- Increase in lifestyle - High consumption of packaged goods and other disposable items
- Industrialization - Constructing Smart Cities and other industrial buildings produces more industrial waste.
- Improvement in the standard of living leads to increased demand for products.
- Increase in the number of tourists visiting the country (from 732,000 in 2000 to approximately 1.3 million in 2024- this industry is considered one of the significant generators of waste throughout the different activities of the value chain such as accommodation and hospitality, transport, recreational facilities as well as the organization events and festival).

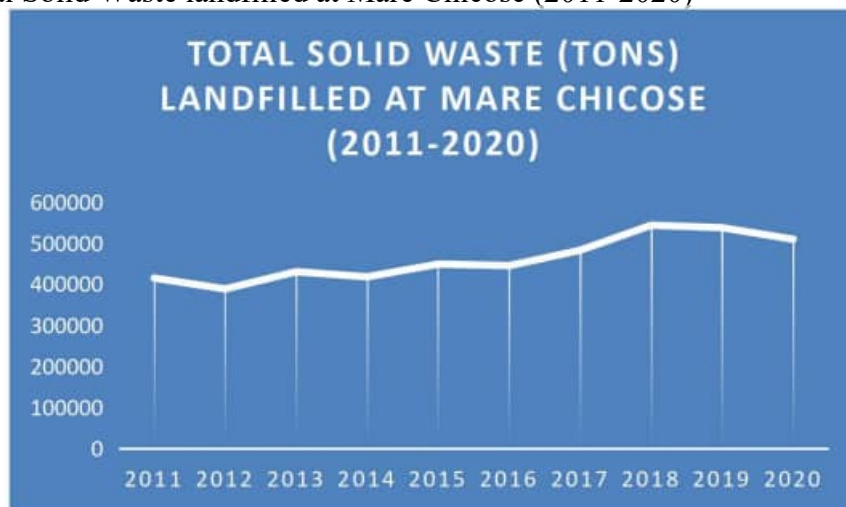
The increasing trend in the volume of waste (Figure 3) requires significant investment in waste management infrastructure, changes in waste management policy, and national public awareness campaigns.

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**Figure 3:** Total Solid Waste landfilled at Mare Chicose (2011-2020)



Source: Ministry of Environment, Solid Waste Management and Climate Change, 2021

**Figure 4:** Mare Chicose Land Fill



Source: Luxconsult, 2024

Table 1 below details the types of waste disposed of at the Mare Chicose landfill site from 2019-2020.

**Table 1:** Types of waste disposed of at the Mare Chicose landfill site (2019-2020).

| Waste Material          | 2019         | 2020         |
|-------------------------|--------------|--------------|
| Domestic and Commercial | 514,020 Tons | 475,942 Tons |
| Construction            | 9,578 Tons   | 16,082 Tons  |
| Total                   | 537,147 Tons | 509,094 Tons |

Source: Ministry of Environment, Solid Waste Management and Climate Change, 2021

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### ***The legal framework for managing waste in Mauritius***

The current legal framework for ensuring environmentally sound management of waste in Mauritius comprises the Environment Protection Act (EPA) of 2002, as amended in 2008, the Local Government Act (LGA) of 2011, as amended in 2018 (Ministry of Environment, Solid Waste Management and Climate Change, 2023) and the Waste Management and Resource Recovery Act 2023 (Mauritius National Assembly, 2023). The EPA (2002 as amended in 2008) and the LGA (2011 as amended in 2018) aim at protecting the environment and determining the local authorities' responsibilities in waste management, while the Waste Management and Resource Recovery Act (WMRRA) (2023) provides for a holistic approach in the management of waste in the country. The aim of the WMRRA (2023:13) is *"To provide for the regulatory framework to ensure the environmentally safe and sound management of solid and hazardous wastes and a sustainable waste management system through the adoption of a circular economy approach focusing on waste reduction, reuse, material recovery and recycling and to provide for matters related thereto."* The WMRRA (2023) aligns with the overarching principles of industrial symbiosis, which is based on the principles of the circular economy and the promotion of efficient use of resources and minimizing waste through the collaboration of multiple industries. Subsequently, several regulations have been promulgated under the EPA and the LGA to enhance environmental protection.

These regulations include the following:

- Environment Protection (Standards for Hazardous Waste) Regulations 2001
- Local Government (Dumping and Waste Carriers) Regulations 2021
- Local Government Act (Registration of Scavenging Contractors) Regulations 2004
- Environment Protection (Collection, Storage, Treatment, Use and Waste Oil) Regulations 2006
- Local Government Act (Registration of Recycler and Exporter) Regulations 2013

Moreover, other regulations, including the Environment Protection (Banning of Plastic Bags) Regulations 2020 and the Environment Protection (Control of Single-Use of Plastic Products) Regulations 2020, have been issued to ban the usage of plastic bags and to control the single-use of plastic products, respectively. The Ministry of Environment, Solid Waste Management and Climate Change are considering making Mauritius a plastic-free country as soon as possible since plastic wastes account for more than 12% of the total waste, and this trend is likely to increase with the new trend of life.

### ***Regulations on waste management as a source- "Segregation at Source Regulations."***

As the landfill is becoming saturated, in 2023, the Minister of Local Government and Disaster Risk Management highlighted the importance of having a regulatory framework to manage waste at source, which will, inter alia, define the roles of the different stakeholders such as households, local authorities and the industrial sector amongst others on waste segregation (UNDP, 2023b).

On top of creating green jobs and developing a more sustainable Mauritius, the above regulation will also contribute to achieving SDG 12- Sustainable Production and Consumption, through the prevention, reduction, recycling and reuse of waste.

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### *Assistance from international institutions to enhance Waste Management Practices*

The Government of Mauritius has collaborated with international institutions to manage waste and promote the circular economy. For example, the United Nations Development Programme (UNDP, 2023) is currently supporting the country to enhance waste reduction. The UNDP aims to redirect as much as 70% of solid waste away from the nation's overloaded landfills. This aim is feasible, although, at the outset, it seems ambitious. Moreover, the United Nations Environment Programme (UNEP, 2023) aims to develop a roadmap for the circular economy to provide strategic orientation to bring circularity to key economic sectors of the Mauritian economy. The European Union (EU) has also been actively involved in the promotion of circular economy practices in Mauritius (EU, 2023)

### *Barriers and Challenges for efficient and integrated management of waste in SIDS*

SIDS, such as Mauritius, faced several challenges in sustainable waste management, including limited land area for proper disposal of waste, lack of population knowledge, lack of engagement to guarantee extensive recycling and disposal of waste in open dumps and inappropriate/uncontrolled landfills (Mata-Lima et al., 2021). Moreover, a study by Bhuckory et al. (2022) identified the lack of technical and financial means as a significant factor affecting the scope of an economically, environmentally, and socially sustainable solution to waste management in Mauritius. Similarly, Wosnick et al. (2024) emphasized the lack of an Integrated Solid Waste Management System (ISWMS) and inadequate resources as the significant constraints for managing e-waste in the Bahamas. In a similar vein, Assche et al. (2014) identified several challenges in the management of solid waste in Small Tourism Islands, including (i) institutional responsibility, (ii) motivation in participation, (iii) rigidity in policies, (iv) consumption pattern; (v) government adaptability; and (vi) political climate. These challenges deter SIDS from transforming the linear economy to a circular economy (Figure 5 Linear Circular Vs. Figure 6 Circular Economy).

**Figure 5:** Linear Economy



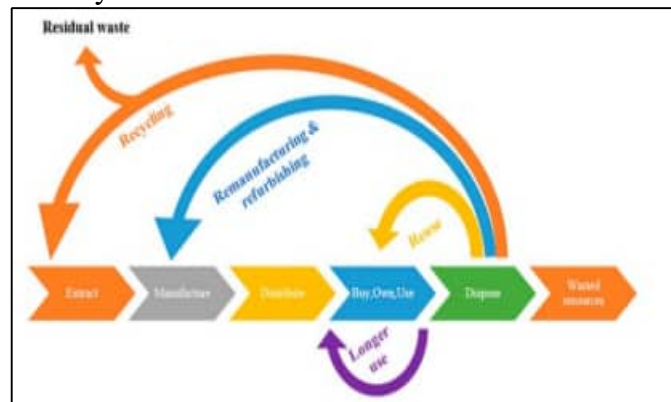
Source: Assche et al., 2014

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**Figure 6:** Circular Economy



Source: Assche et al., 2014

### Discussions and Recommendations

Waste management in Mauritius stands at a significant crossroads. The country has to manage the economic, environmental and public health challenges arising from waste generation through innovative solutions and means. While the regulatory framework for the reduction and management is set in place, it is apparent that sustainable waste management practices are overlooked by both the corporate world and citizens in general. Although the 3Rs concept (Reduce, Reuse and Recycle) is known to the public, strategies to implement them are limited. Several reasons may explain the citizens' and corporations' reluctance to create a circular economy where resources are continually reused. One of the reasons for this could be the differences in values, beliefs, and culture. The cultural context of a given society largely influences the success of a circular economy. For example, the culture of reusing and repairing items is not well anchored in the Mauritian context. Moreover, the education system does not provide enough grounds to shape learners' attitudes towards circular economy practices. On the other hand, being a small country with limited resources may also constrain the adoption and implementation of the circular economy. For example, waste management requires companies to overhaul their existing processes, which requires significant investment in infrastructure, technologies, and re-engineering.

The implementation of IS in Mauritius has already been studied. One of the studies identified the main polluting industries (Mauthoor et al., 2014), namely edible oil refineries, abattoirs and metal scrap recycling plants. In a follow-up study, Mauthoor (2017) proposed how artificial intelligence can be implemented and focused on the recycling of electric arc furnace slag as a concrete aggregate.

Hence, actionable recommendations should be made across various sectors to consolidate the circular economy. These recommendations pertain to the need for (i) segregating the wastes (paper, glass, wood, plastic and metal) generated by the corporations and citizens that recycle and reuse, (ii) investing in waste-to-energy technologies in partnership with the private sector through well-defined vehicles such as Build-Operate and Transfer (BOT), (iii) providing adequate disposal infrastructure such as accessible recycling centers, composting facilities to households and easy access to donation centers where people can drop off their

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items such as clothes, toys and household items for donations and (iv) changing the school curriculum at the grass root level to shape positive cultural attitude towards circular economy practices. Although these recommendations form part of the overall strategic plan for solid waste management (Ministry of Environment, Solid Waste Management and Climate Change, 2022), a strong signal (e.g., through intersectoral linkages) should be sent by the authorities to all the stakeholders to promote the circular economy as well as symbiosis and recycling activities. Furthermore, the local authorities should continue to collaborate closely with international institutions that provide technical and financial assistance and share technology and best practices to promote the circular economy and ensure the well-being of future generations. Moreover, since the waste-to-energy projects are long-term, the expected milestone/outcome must be adequately monitored to ensure the limited resources are effectively and efficiently employed. The government and local authorities should provide funds for research as it has been found that there is a paucity of data on waste generation, collection, and disposal, which may constrain the effectiveness of the waste management process at a regional level. On the political side, waste management should be on the high agenda of any government. As role models, political leaders should demonstrate a high commitment to safeguarding the environment and sustainability. Finally, different mediums (including national television, social media, local press, posters and pamphlets) should be used to undertake a national awareness campaign on the harmful effects of solid waste and waste reduction techniques.

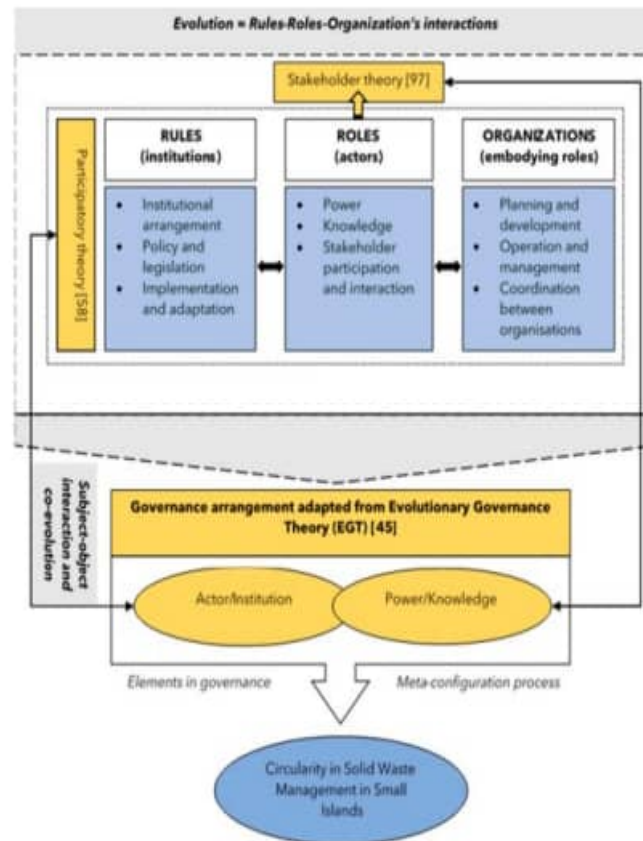
Based on the work of Parmar et al. (2010), Van Assche et al. (2014) proposed a conceptual framework for the governance of solid waste management on small islands (Figure 7). Van Assche et al. (2020) and Fuldauer et al. (2019) further developed this conceptual framework.



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**Figure 7:** Conceptual Framework for the governance of solid waste management on small islands



Source: Van Assche et al., 2014

Drawn from the stakeholder theory (Parmar et al., 2010) and the Evolution Governance Theory (Van Assche et al., 2020), the conceptual framework posts that "*the interaction between the aspects of rules, roles, and organizations gives rise to evolution in governance*" (Van Assche et al., 2014: 20). They recommended three steps to identify gaps in the current governance of solid waste namely:

1. Identify the governance categorization and assess how each dimension affects another,
2. Study the "*configuration between actor/institution and power/knowledge and how it co-evolves (meta-configuration) in the governance dimension of solid waste management on small islands.*"
3. "*observe governance arrangement through the object and subject construction from the meta-configuration.*"

## CONCLUSION

By exchanging resources such as energy, materials or water, industrial symbiosis offers the opportunity to reduce the costs of procuring raw materials and disposing of waste. By

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monetizing by-products or waste that would otherwise be disposed of, companies can tap into new revenue streams, improving their profitability and financial resilience. This approach maximizes resource efficiency and enables companies to make the best use of limited materials, reduce production costs and promote a more sustainable supply chain. Companies that innovate in the reuse of waste can gain a competitive advantage through sustainable business models and improved offerings.

In addition, industrial symbiosis contributes to regional economic growth by fostering cohesive industrial networks, attracting new businesses and increasing demand for local support services. This dynamic can be seen in global examples, notably the Kalundborg Industrial Symbiosis or the Kwinana Industrial Park in Australia, which have delivered significant cost savings and wider economic benefits to participating businesses. These financial benefits not only improve the performance of individual companies, but also strengthen the resilience and sustainability of the regional economy. As a result, industrial symbiosis is an effective model for advancing economic and environmental goals.

Considering that there is a lack of knowledge about the way waste is managed in developing countries (Cárcamo and Peñabaena-Niebles, 2022), this article seeks to contribute to the ongoing debate on the need and possibilities of promoting symbiosis and recycling activities in the Mauritian context. By advocating the practice of industrial symbiosis, this paper has sought to identify the use of available technologies to reduce the amount of waste sent to landfill or stored on site. By uncovering the potential of industrial symbiosis on the island, this paper has explored the potential of industrial symbiosis to contribute to industrial ecology. The conceptual framework proposed by Van Assche et al. (2014) can help Mauritius to find potential industrial symbiosis that can reduce waste and serve as an effective model to realize economic and environmental objectives.

This study is the beginning of a research that investigates the key factors for the establishment of industrial symbioses. Therefore, further research is needed to determine the potential of industrial symbiosis in Mauritius and to identify industrial sectors where industrial symbiosis has the greatest potential. There is also a need to identify the potential funding opportunities for the technology, the establishment of the legal framework and the involvement of stakeholders.

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# COGNITIVE URBAN MAPS AS A BINDING ELEMENT OF LOCAL IDENTITY

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## Abstract

Urban communities are becoming increasingly multicultural and global, presenting a variety of social and urban challenges. In these transitional times, influenced by international trends, population displacement, and disenchantment of history and traditions, local identity becomes significantly important as a counterbalance to urban distress. It represents a vital aspect of urban life by sharing common values and memories, strengthening in this way the collective side of a community. Critical to this shared identity are the defining elements of a given place—the spatial ingredients that render it unique and specific. These defining spatial elements include buildings, natural features, monuments, landmarks, open squares, and many more features that local people account for as important.

This complex pattern of urban elements is distinctive for every place, as each urban history and culture is likewise unique. The cultural imprint of every urban community creates a spatial ecosystem of daily patterns, streetscapes, architectural heritage, local traditions, and various spatial arrangements. This ecosystem of urban space, of the interaction of space and community, represents the foundation of local identity. However, contemporary challenges are affecting this interaction and thus the very foundation of identity elements. Therefore, it is necessary to preserve an anchoring state—a binding element that maintains identity stability while allowing for future change and insightful attachment to the past. This crucial element of continuity is reinforced by a cognitive map, a psychological process that integrates spatial knowledge, personal objectives, and social interaction.

This paper investigates the role of the cognitive mapping process as a binding element of local identity characteristics, highlighting the importance of urban data acquisition acting as a cognitive foundation of place attachment, a sense of belonging, and thus, the basis for local identity.

**Keywords:** Local Identity, Cognitive Maps, Place Attachment, Sense of Belonging.

## 1. Introduction

Urban environments are in a state of constant and complex transformation, facing both environmental and social challenges. Urban communities grapple with adapting to and balancing economic, technological, social, and political innovations (Sassen, 1991; Castells, 1997). Recent crises, such as urban pandemics and increased immigration, have placed

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significant pressure on urban infrastructure and social well-being. These pressures have generated new urban needs, demanding innovative planning strategies.

This paper considers that local identity represents an anchoring element of urban solidarity and resilience. In addition, the concept of identity is perceived through the perspective of cognitive mapping, highlighting an undervalued urban (cognitive) reality. This perspective necessitates a new set of urban tools to manage change and pressure, supporting a concept of urban resilience achieved through 'cognitive anchors' that provide a broader sense of continuity and stability amidst rapid transformation.

This paper argues that local identity serves as such a crucial anchor, embodying shared history, culture, and a sense of belonging. As a defining element of social participation within an urban context, local identity preserves the rich sense of a place (Oldenburg, 1989; Bell & Avner de-Shalit, 2011), thus supporting the concept of place attachment of shared traditions and cultures among urban residents. The focus of this paper is the dimension of environmental cognition, more precisely cognitive mapping, of those spatial elements that reinforce place attachment, sense of belonging and local identity.

Cognitive mapping reflects a process by which individuals understand and form essential knowledge about their environment, shaping preferences, beliefs, attitudes, and daily choices—all integral to urban life. It is crucial to examine the link between cognitive mapping and local identity as a means of strengthening urban social stability and well-being. The cognitive mapping process encompasses both the psychological formation of an urban map and the conditions that enhance the critical elements and connections defining a person's perception of local identity and belonging.

At this stage, the methodology remains theoretical. Future research will compare this theoretical analysis with field knowledge questionnaires and cognitive maps. The field study will focus on medium-sized cities in Greece, followed by similar cities in other European regions. This paper presents the theoretical framework for this research endeavour.

A central hypothesis is that if local identity significantly contributes to the social solidarity and well-being of urban communities, then enhancing the understanding of its nature with cognitive mapping will reveal a new cognitive dimension of urban space, very critical to urban life and planning (Bell & Avner de-Shalit, 2011; Cheshmehzangi, 2020).

## 2. Definitions of Local Identity

Local identity is a concept intrinsically linked to a place, embodying its historical heritage and traditions and representing a blend of cultural and social characteristics (Burke & Stets, 2009). It fosters local communities with both continuity and change within a constant interaction of historical, social, economic, and political processes. It is, however, a concept that varies across different spatial scales (personal, neighbourhood, community, urban, regional, national, etc.), each representing a different side of local identity. It is evident that different spatial scales produce variations in both quantity and quality and generate a diverse understanding of identity (Smith, 1991; Lalli, 1992; Castells, 1997; Hall, 1998). Local identity, by its nature, is complex and multifaceted, often encompassing a mixture of identities, sometimes contradictory, yet fused by common features that form a comprehensive definition of a certain environment (i.e. a neighbourhood of a city).

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Urban identity, on the other hand, exemplifies a group of local identities, marked by both similarities and contradictions, forming a heterogeneous ecosystem. This diversity within the urban environment indicates cultural and social interlinkages, exchanges, and influences. This seemingly vague identity ecosystem is, however, tied to the spatial features and physical elements of the built environment, often used in landmark branding strategies to clearly define a place. These landscapes and living environments foster personal experiences and memories, cultivating a sense of attachment and belonging. However, urban realities are in constant flux, shaped by complex interactions between social and cultural interests, which significantly determine the local context and, consequently, local identity.

This paper focuses on the physical and natural elements of local identity, particularly those that significantly influence cognitive mapping. It concentrates on residents who experience diverse memories, develop feelings and attitudes toward a given place, and thus participate in the ongoing creation of a 'sense of place'. This process of belonging is the result of participation in a local community by sharing common values and memories structuring urban life. This sharing concept, crucial for the formation of local identity, is strongly tied to the spatial characteristics of a place, both the natural and the built environment.

Bill Hillier's space syntax theory provides a valuable framework for understanding how spatial configurations influence social interaction and, consequently, local identity (Hillier & Hanson, 1984; Hillier, 1996). The theory of space syntax analyzes the spatial layout of urban environments, focusing on the relationships between spaces, such as connectivity and integration. According to this theory, urban spaces that are highly integrated and are easily accessible, tend to attract more people and become centres of social interaction. These spaces often play a crucial role in shaping local identity by fostering shared experiences and reinforcing social norms. Space syntax also supports that the layout of streets, squares, and public spaces can either facilitate or hinder the formation of a strong sense of community. For instance, well-connected public spaces may become hubs for local gatherings, reinforcing shared memories and traditions (Hillier, 1996). Opposite to that, fragmented or isolated spaces may contribute to a sense of anonymity and detachment, weakening local identity. As a key assumption, space syntax theory highlights that the spatial configuration of a city is not merely a backdrop for social life but is actively shaping it.

Similar to this perspective is Christian Norberg-Schulz's concept of "genius loci," or the "spirit of place," which adds a phenomenological dimension to the understanding of local identity (Norberg-Schulz, 1979). This theory emphasises that every place has a unique character, an essence that shapes human experience and belonging. It represents the sum of a place's physical attributes, historical layers, and cultural meanings, experienced through sensory perceptions and emotional connections. In this sense, the concept of "genius loci" describes the strong relation between local identity and the processes that involve recognising the unique character of a place.

Within this theoretical framework of local identity, it is essential to clarify at this initial stage the terms used in this work as follows:

a. Local

It is defined not by a specific spatial scale but by the extent to which an individual perceives the spatial boundaries of a given environment, building a sense of belonging

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(cognitive/perceptual recognition). In addition, it delineates the environmental context within which an individual interacts and constructs a cognitive map.

b. Identity

It encompasses identifiable features that describe and represent social groups or a perceived collective context, resulting from processes of distinction, recognition, and reference.

c. Cognitive Context of Local Identity

It emphasises on the cognitive aspects that form a sense of local identity, mainly on the psychological link between the perceptual knowledge acquired from a place, such as cultural, historical, spatial and social elements.

### 3. The defining cognitive dimensions of local identity

Local identity is a fusion of urban space and meaning, thus, within the perspective of environmental cognition, is shaped through individuals' complex processes of data collection and evaluation. Daily interactions with the urban environment provide opportunities for knowledge and significance, representing a continuous process that cultivates a sense of local identity.

Although numerous and complex elements contribute to the understanding of the more general definition and sense of local identity, scholars from various disciplines (Smith, 1991; Lalli, 1992; Castells, 1997; Healey, 1997; Hall, 1998; Burke & Stets, 2009; Bell & Avner de-Shalit, 2011; Cheshmehzangi, 2020; 2021) identify some key factors that describe urban, collective, and local identities, categorised in the following five perspectives (Table 1):

a) The aspect of Sharing (History, Memory and Heritage)

This perspective describes the process of understanding and identifying the common historical and heritage elements of a cultural environment concentrated on the sharing methods and process of a given place. It represents all forms of recognising and evaluating characteristics of the urban environment that act as reminiscences of past experiences and memories, incorporating aspects of:

- Collective Memory (historical events, traditions and cultural practices).
- Structures of reference (landmarks and monuments that serve as tangible reminders of a community's heritage).
- Experiencing Rituals and Traditions (participating in local festivals, ceremonies, and traditions of shared cultural identity).
- Disseminating Narratives & Storytelling (communicating information about the community's historical context).

b) The Social dimension (Links and Community)

This perspective describes the social interactions and relationships that support elements of local identity like the sense of belonging. It is concentrated on social issues and qualities and represents the mechanisms that support aspects of the previously mentioned shared heritage of a community. Key aspects of this perspective include:

- Personal qualities of Family and Kinship (the foundation for belonging, traditions, values, and place attachments).
- The dynamics of Local Networks (the relationships with neighbours, friends, and community members fostering social support and interconnectedness).



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- The encouragement of Civic Engagement (the level of participation in local organizations and cultivating a sense of responsibility).
- c) The Cultural dimension (Expressions and Practices)  
This perspective is concentrated on the cultural ecosystem of a place. It includes distinctive forms and characteristics of local cultures, diversity, traditions, and expressions of identity. Important aspects of this cultural context that define aspects of local identity include:
  - Language and Local Dialects (verbal expressions and dialectic particularities that reinforce unique cultural identity and facilitate characteristic communication).
  - Arts and Crafts (expressions of art, music, dance, and crafts that reflect local cultural values and attributes).
  - Local Gastronomy (traditional cuisine habits and particularities that create a shared sense of taste and identity).
  - Symbolic interactionism (all methods and mechanisms that support mainly cultural elements used as symbolic interpretations of local identity).
- d) The Behavioural Context (Cognitive Values and Norms) This perspective is concentrated on the behavioural context of the urban environment. It includes all aspects that affect the processes and expressions of local behavioural patterns, based on theories of environmental psychology on:
  - Social Norms (this represents the common perception of appropriate behaviours and social expectations).
  - Moral Values (it reflects, for example, the shared beliefs about right and wrong, justice, fairness, etc.).
- e) The Image of a Place (the distinctive elements of the urban environment)  
This perspective focuses on the distinctive elements of the urban environment (especially those that reflect on the imageability of a place). It represents all recognisable and unique characteristics – of sharing, social, cultural and behavioural– that can contribute to identification and attachment. This aspect is crucial for cognitive mapping, representing the psychological connection between individuals and places. Key levels of place attachments and identity include:
  - the Natural Environment (the local landscape and morphology).
  - the Built Environment (the urban design and architectural character of buildings, streetscape, and public spaces).
  - the Neighborhood locality (the cognitive importance and perceptual impact of a spatial proximity environment that supports daily routines and practices).

The defining elements of local identity describe all complex aspects of urban life. Therefore, it is evident that the above five perspectives are coexistent, not in isolation. However, this categorization is mostly useful for theoretical analysis and evaluation, as local identity is a complex and multifaceted concept shaped by daily interactions with the environment. This is a process that leads to shared meanings and place attachments, creating a “sense of place” and a “sense of belonging”, a condition where personal memories and emotional connections bind individuals to their surroundings. This process describes not a

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static set of environmental attributes that affect cognition, but a living and evolving construct shaped by both historical legacies and contemporary experiences.

**Table 1. The defining perspectives and process of local identity.**

| Perspectives                                                         | Process                                                                                                                                                  |
|----------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------|
| Sharing (History, Memory and Heritage)                               | Collective Memory<br>Structures of Reference (Landmarks and Monuments)<br>Experiencing Rituals and Traditions<br>Disseminating Narratives & Storytelling |
| Social (Links and Community)                                         | Personal qualities of Family and Kinship<br>The dynamics of Local Networks<br>The encouragement of Civic Engagement                                      |
| Cultural (Expressions and Practices)                                 | Language and Local Dialects<br>Arts and Crafts<br>Local Gastronomy<br>Symbolic interactionism                                                            |
| Behavioural Context (Cognitive Values and Norms)                     | Social Norms<br>Moral Values                                                                                                                             |
| The Image of a Place (Distinctive elements of the urban environment) | The Natural Environment<br>The Built Environment<br>The Neighborhood locality                                                                            |

#### 4. The cognitive mapping process

Cognitive mapping, as defined by Downs and Stea (1973, p. 6), is “an abstraction covering those cognitive or mental abilities that enable us to collect, organise, store, recall, and manipulate information about the spatial. These abilities change with age (or development) and use (or learning).” This encapsulates a holistic psychological process, from the initial acquisition of spatial information to its interpretation and meaning-making within a living environment, such as a neighbourhood. The primary objective of this process is the adaptation and effective participation in a living environment, incorporating interaction, comprehension, meaning attribution, decision-making, and action. The resulting mental representation of an engaging living (urban) space, reflecting these environmental data and their interpretations, is termed a 'cognitive map' (Figure 1).

This psychological process is also known as *environmental or spatial cognition*, encompassing all cognitive processes related to environmental knowledge (Evans & Pezdek, 1980; Aragonés & Arredondo, 1985; Gifford, 1997). This process forms the basis for individual decisions and choices, relying heavily on visual information (Downs & Stea, 1973).

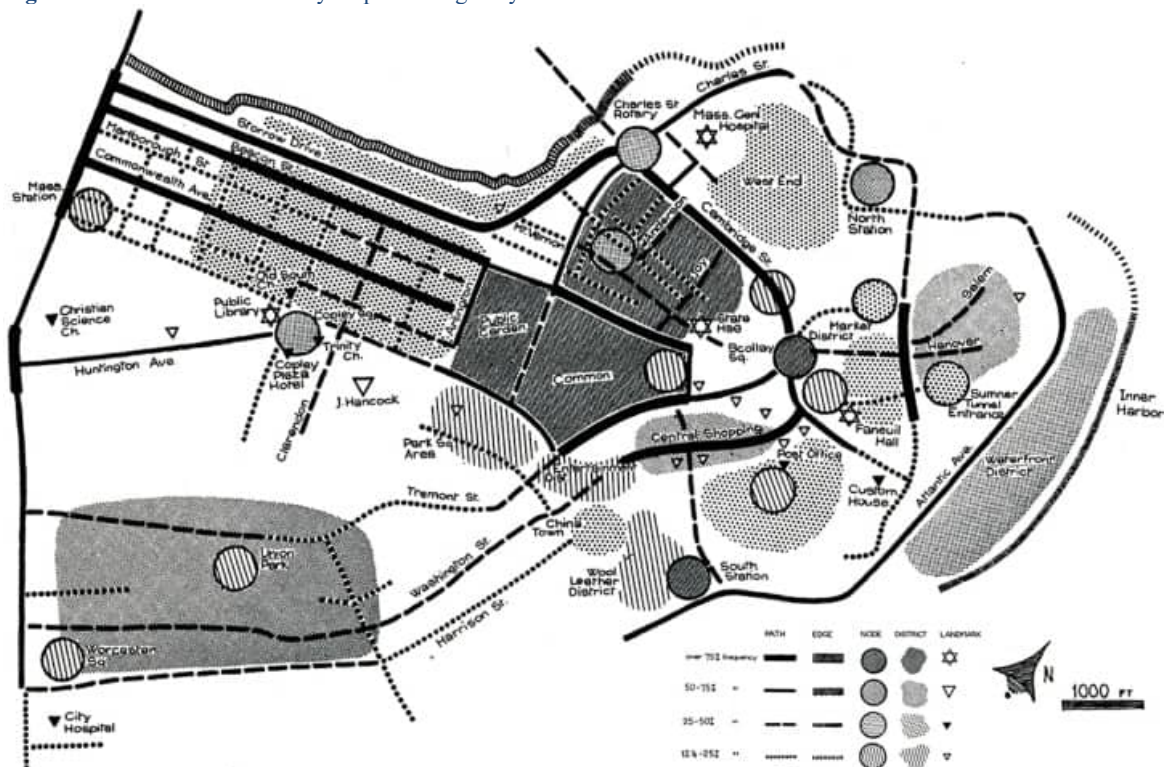
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The visual influence on cognitive processes is significant, as Syngkollitou (1997) notes, the memory of visual information is stored in the mind differently from the memory of other types of information. The human capacity for retaining visual information is encoded distinctly from other sensory forms of environmental data. The superiority of visual memory over, for example, verbal memory, is supported by numerous studies (Lutz & Sheirer, 1974; Nelson, Reed & Walling, 1976; Shepard, 1967). In addition, visual memory is also the mechanism by which mental representations of the physical environment are structured (McAndrew, 1993).

These mental representations, or cognitive maps, offer simplified models of the environment, shaped by perception, abstraction, and attention limitations. Cognitive maps inevitably differ from the actual environment in content and structure, as no representation can fully capture its full potential. Holistic spatial knowledge cannot be achieved through a single cognitive map, as environmental information is too vast and complex (Chase & Chi, 1981). Nonetheless, spatial cognition involves acquiring, organizing, comparing, and recalling environmental information, enabling individuals to solve 'spatial problems' like orientation and wayfinding (Devlin & Bernstein, 1995; 1997). Orientation relies mainly on distinct characteristics of cognitive maps, such as landmarks, urban structures, and navigational reference aids (Downs & Stea, 1977). It's crucial to note that cognitive maps are not geographical maps; they are subjective representations, emphasizing personally significant points.

**Figure 5.** The Boston community map as emerged by verbal interviews.



Source: Lynch, Kevin, *The Image of the City*, Figure 35 and corresponding legend, pp. 145–146, 1960. Copyright Massachusetts Institute of Technology, by permission of The MIT Press.

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A cognitive map represents an environment as perceived by an individual (Matlin, 1989), often presenting similarities among those in the same environment due to place familiarity. Cognitive maps integrate information from personal experiences and other sources, such as social interactions (Evans & Pezdek, 1980; Spoehr & Lehmkuhle, 1982). As Syngkollitou (1997, p. 8) states, “We form various types of cities in our minds...the mental representation of the environment may ultimately consist not only of a spatial map but also of various social and symbolic meanings”.

While personal cognitive characteristics influence cognitive maps, a condition termed *cognitive symmetry* or *symmorph* (Royer, 1981; Ishida & Kotovsky, 1995; Pecchinenda, 2022) describes the human tendency towards common or similar patterns of human cognitive processes and behaviours. These common patterns, however, may present significant differences according to:

- Simplifications, cognitive shortcuts of complex and numerous environmental data.
- Cognitive Bias, oversimplifications or distortions of information to fit expectations.
- Communication Errors, on information interpretation and meaning.

In addition to cognitive symmetry, several other factors significantly influence the quality of the cognitive process, consequently affecting the perceptual and evaluative outcomes of spatial cognition. Scholars widely agree that these factors of cognitive importance include (Downs & Stea, 1977; Golledge & Stimson, 1997; Syngkollitou, 1997; Kalergis, 2012; Zahra, 2017):

### i. Age

Age significantly influences the process of spatial cognition (Piaget, 1964; Everitt & Cadwallader, 1972; Allen & Hogeland, 1978; Bryant, 1982; Devlin & Bernstein, 1997; Cabrera et al., 2020; Lurie, Peled & Rosenblum, 2024). For example, in young people, cognitive development typically progresses through a perceptual sequence, moving from an egocentric perspective to a projective and partially abstract understanding of space. Conversely, in elderly individuals, despite potential limitations in mobility or sensory skills, environmental memories tend to be more personalized and specific compared to those of younger individuals (Syngkollitou, 1997, p. 89). This suggests that while younger individuals develop broader spatial frameworks, older adults focus on detailed, personally meaningful experiences within their environment (Christensen, Johnson & Swanson, 2014).

### ii. Familiarity and Legibility

Familiarity, derived from frequent interaction with a spatial environment, significantly enhances the completeness and organization of an individual's cognitive map. This principle underscores the importance of legibility or the ease with which a space can be recognized and understood. As Kevin Lynch (1960) highlighted, the recognizability of a space is a crucial component of familiarity. When individuals are well-acquainted with an environment, they develop a more nuanced and detailed mental representation, enabling them to navigate and interact with it more effectively. This familiarity not only aids in spatial orientation but also fosters a sense of comfort and attachment to a place (Borrie & Roggenbuck, 2001; Brown, Perkins & Brown, 2003; Lewicka, 2009; Alinam, 2014).

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### iii. Cognitive Distortions/Errors

Cognitive distortions, or errors, play a significant role in shaping mental representations of space (Alinam, 2014). These errors encompass several categories, including omission, distortion, and augmentation (Downs & Stea, 1973), as well as the perceived simplicity or complexity of a spatial context (Syngkollitou, 1997). Omission occurs when individuals fail to perceive or recall certain environmental elements, either intentionally or unintentionally. Distortion involves misrepresenting the physical characteristics of a space (Briggs, 1980), often influenced by strong subjectivity or exaggeration. Augmentation refers to the addition of non-existent elements to a mental representation (Syngkollitou, 1997, p. 92). The perception of simplicity or complexity is subjective; moderate complexity tends to be preferred, while high complexity can lead to confusion and anxiety (Wohlwill, 1968; Berlyne, 1971). Conversely, the low complexity of a spatial environment may fail to engage attention. Beyond these errors, gaps in spatial knowledge are common, such as asymmetric distance estimates (Sadalla & Staplin, 1980) and distortions in distance perception (Briggs, 1980). It is widely acknowledged that human spatial knowledge is often incomplete and schematic, particularly in unfamiliar environments. Notably, familiar or closer distances are often perceived as greater than they are, while unfamiliar or distant spaces are perceived as closer (Kosmopoulos, 1994). Consequently, spatial knowledge becomes more detailed and robust in familiar environmental settings.

### iv. Gender

The significance of gender differences in spatial cognitive abilities remains a subject of ongoing research, though conclusive interpretations are hindered by inconsistent findings (Linn & Petersen, 1985; Voyer, Voyer, & Bryden, 1995; Knez, 2005). While some studies suggest that men exhibit more effective performance in certain spatial tasks, others report no significant differences or even instances of female advantage. Specifically, men are often observed to excel in map reading and spatial manipulation tasks, such as maze learning and spatial tracking (Allen & Hogeland, 1978; McGee, 1979). Similar patterns are noted in navigation accuracy and error rates (Bryant, 1982; Devlin & Bernstein, 1995, 1997). However, it is important to acknowledge the variability in these results and the ongoing debate within the field.

### v. Social Homogeneity and Neighborhood Continuity

Social homogeneity, particularly at the neighbourhood level (Lee, 1968), acts as a significant intervening variable between experience and place knowledge, thereby influencing environmental cognition. Neighbourhoods are multifaceted, encompassing behavioural, social, cultural, and economic spatial contexts (Lurie et al., 2024). The concept of neighbourhood and local activity includes factors such as residents' time spent in the area and their frequency of participation in local recreational facilities. Additionally, the proximity of friends, relatives, and other social relationships serves as an indicator of the residents' social environment. Cultural cohesion within a neighbourhood is often directly linked to social homogeneity (Smith, 1985) and satisfaction (Hur & Morrow-Jones, 2008). Moreover, Lee (1968; 1978), analysed social and spatial aspects at the neighbourhood level into a 'socio-spatial schema' and according to that categorized three neighbourhood types:



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- (a) the *social acquaintance neighbourhood*, defined by the physical extent of social interaction;
- (b) the *homogeneous neighbourhood*, characterized by relatively low social interaction and a heightened role for cognitive factors; and
- (c) the *unit neighbourhood*, which encompasses elements like retail stores, various organisations, and urban infrastructure. Ultimately, the structure and characteristics of the social environment exert a substantial influence on environmental cognition by affecting the degree of individual social participation.

The above five key factors of cognitive importance represent only some fundamental elements of cognitive influences; however, numerous other psychological determinants can affect both the process and outcomes of cognitive mapping (Table 2. Factors according to Alinam, 2014, p. 139). While cognitive mapping is not exclusive to urban settings, due to the intensity of urban life and its impact on individual experiences, urban environments are the most representative places for such a process. This explains the tendency for individuals to prioritize prominent urban features such as monuments, symbolic structures, and road networks when constructing mental representations of their environment.

**Table 2. Studies on the individual factors affecting cognitive map.**

| Factors affecting cognitive mapping | References                                                                                        |
|-------------------------------------|---------------------------------------------------------------------------------------------------|
| Gender                              | Orleans and Schmidt, 1972<br>Erikson, 1964<br>Appleyard, 1970<br>Everitt and Cadwallader, 1972    |
| Age                                 | Porteous, 1977<br>Lewicka, 2009<br>Ng et al., 2005<br>Pretty et al., 2003<br>Lovejoy et al., 2010 |
| Occupational status                 | Goodchild, 1974                                                                                   |
| Educational level                   | Mesch and Manor, 1998<br>Porteous, 1977<br>Hur and Morrow Jones, 2008                             |
| Housing ownership status            | Lewicka, 2009<br>Brown et al., 2003                                                               |



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|                     |                                                                                      |
|---------------------|--------------------------------------------------------------------------------------|
| Length of residence | Nielsen et al., 2010<br>Knez, 2005<br>Borrie and Roggenbuck, 2001<br>Appleyard, 1970 |
| Transport mode      | Goodchild, 1974<br>Orleans, 1973<br>Michelson, 1970                                  |
| Duration of walking | Lund, 2002<br>Mesh and Manor, 1998                                                   |

Source: Alinam, 2014, p.139.

### 5. Urban elements of cognitive mapping importance

The resulting process of a cognitive map, besides any individual cognitive skills, depends also upon key characteristics of the urban environment (Samaras, Triantafyllidi & Kalergis, 2025). These environmental parameters reflect the qualities of the cognitive inputs and incentives, a process that is called “cognitive stimulation” (Cabrera et al., 2020; Lurie et al., 2024). Although it is increasingly recognized as a crucial aspect of environmental experience linked to children’s neurocognitive development (Hackman et al., 2010; Christensen et al., 2014; Rosen et al., 2019), cognitive stimulation and mapping are strongly associated with the characteristics of the urban space, acting as environmental stimuli. This link between cognitive stimulation and mapping is multifaceted and relies upon enhancing various cognitive abilities such as memory, attention, and spatial reasoning that indirectly strengthen cognitive mapping skills. More precisely, those cognitive abilities include (Piaget, 1964; Downs & Stea, 1973;1977; Chase & Chi, 1981; Aragones & Arredondo, 1985; Christensen, Johnson & Swanson, 2014; Cabrera, Navarro & González, 2020):

- Enhanced Spatial Memory  
Cognitive stimulation activities, particularly those involving spatial reasoning, may improve spatial memory and thus contribute to more accurate and detailed cognitive maps.
- Improved Attention and Focus  
Activities that enhance attention and focus can assist individuals in developing skills such as observation and the encoding of environmental cues. This heightened attention to detail results in more accurate and comprehensive cognitive maps.
- Enhanced Working Memory  
Working memory is crucial for retaining and manipulating information, such as the sequence of turns necessary to navigate a route. Cognitive stimulation activities that enhance working memory may improve the ability to mentally prepare and update cognitive maps as required.
- Increased Engagement with the Environment  
By encouraging exploration and interaction with the environment, many cognitive

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stimulation activities foster a deeper understanding of the spatial relationships between places and landmarks, thus enriching cognitive maps.

In addition to the above cognitive abilities of an individual, the process of a cognitive map also depends on these significant elements of the urban environment. Although these urban elements acting as environmental cues and stimuli are endless, some basic characteristics contribute to the recognition of the urban environment and, consequently, to the formation of cognitive maps. These basic characteristics, recognised by numerous scholars (Gulick, 1963; Appleyard, 1970; Evans et al., 1981; Aragonés & Arrendondo, 1985), as originally outlined by Lynch (1960: 46-90) are as follows:

a) Paths

These are channels along which an observer customarily, actually, or potentially is in motion, like streets, sidewalks, canals, railroads, etc.

b) Edges

These are the linear (separating or defining) elements not used or considered as paths by an observer, like shores, railines, edge walls, and sudden changes in the texture of a surface.

c) Districts

These are urban areas perceived as presenting shared identity features, a recognisable character like a unique physical quality (skyscrapers, warehouses), use (residential, industrial), or symbolic meaning.

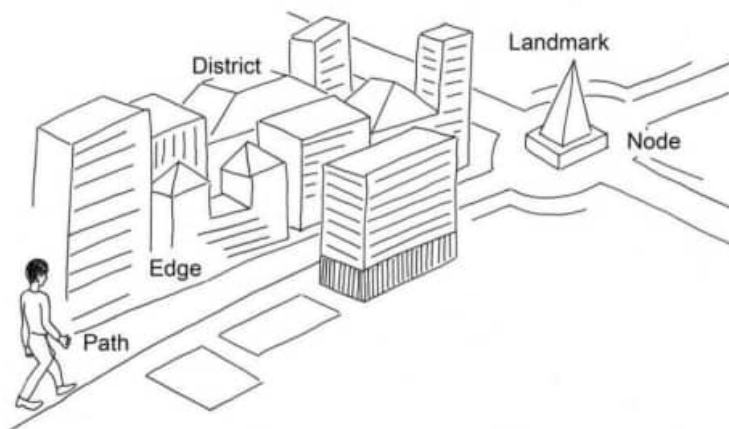
d) Nodes

Urban loci serve as strategic reference points and foci of intensive observer attention. These may constitute concentrations of activity, such as transportation nodes or public plazas, or points signifying transitions within the urban fabric.

e) Landmarks

These are urban points of symbolic reference, non-directional and may be considered as isolated objects, like architectural buildings, heritage monuments, an archaeological site, large-scale or symbolic signs, contemporary stores, physical features like mountains, etc. Landmarks stand out for some meaningful reason and are easily visible and distinctive from a distance.

**Figure 6.**Elements of the City, adapted from Lynch (1960).



Source: Jack, 2021, p.71.

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Lynch's (1960) categorization of the basic elements of urban space recognition (Figure 2) is supported by numerous studies (Magana, 1978; Aragones & Arredondo, 1985) and constitutes important components of a cognitive map (Gifford, 1997). In addition, Syngkollitou (1997, p. 99) offers an interesting distinction of recognition components based on the form of spatial knowledge, into:

- Route knowledge of the direct experience of navigation.
- Survey knowledge of more representational aspects, such as the relationships between different locations.

Regardless of the nature of recognizable urban elements that present a significance on environmental cognition, the formation of a cognitive map, with its associated characteristics, significantly influences the processes of shaping spatial behaviour (Weitzer, 1980). Spatial behaviour encompasses an individual's lifestyle, environmental familiarity, social class, and social engagement. An individual's lifestyle influences their experience in specific urban areas, leading to increased familiarity and perceived importance of those areas in their daily life. Greater familiarity with a spatial context, such as one's residential area, facilitates better spatial adaptation compared to individuals with less familiarity (Evans, 1980). Social class is positively associated with the breadth and functionality of cognitive maps (Syngkollitou, 1997), largely due to economic constraints that limit the spatial mobility of less affluent individuals, thereby restricting their environmental engagement (Michelson, 1976; Holahan, 1982; Syngkollitou, 1997). Furthermore, social engagement, which concerns the social relationships within a space, such as a neighbourhood, may determine the type and extent of social activities (Lee, 1968).

It is important to mention that the primary motivation for the formation of a cognitive map is orientation, an action-based and initially egocentric process (Piaget, 1960). During childhood, orientation is achieved through patterns determined by the human body and movement in space (Gregg, 1939; Shemyakin, 1962; Howard & Templeton, 1966). Piaget's (1960) study of preschool children's egocentric reference systems highlights the crucial role of cognitive processes in environmental understanding. This study observed that spatial points were not stable in their memories, preventing them from forming a comprehensive environmental representation. Consequently, Piaget concluded that during preschool age, which lays the foundation for further cognitive development, cognitive representations and perceptions are typological. Shemyakin (1962) distinguishes this evolution of environmental representation into two types (Kosmopoulos, 2000, p.185):

- Path maps, a representation through mental “tracing” of a path in space.
- Morphological maps, a representation of the general form or spatial arrangement of objects.

Further studies by Piaget (1963; 1972; 1974) confirm the evolutionary development of an individual's ability to visualize the environment. These studies conclude that spatial perception is neither innate nor learned through direct instruction, but rather is shaped by the individual from childhood through their interaction with the environment.

The terms “cognitive” or “environmental image” emphasize the concept of the cognitive map, which is essential for the formation of concepts that enable proper environmental adaptation. This includes, as already explained, the series of psychological processes through which an individual receives, encodes, and decodes information about the locations and properties of urban experiences within their everyday spatial environment (Downs & Stea,

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1973). As previously mentioned, the term “map” is used metaphorically, suggesting that an individual behaves as if a map exists. While mental maps do not possess the structural characteristics of physical maps, they undergo various transformations. Canter (1977) identifies four distinct categories of transformations of a physical map by an individual (Kosmopoulos, 2000, p. 187):

- a. Orientation (creation of new directions)
- b. Reduction (smaller in extent than the real one)
- c. Projection (formation of a panoramic perspective - bird’s eye view)
- d. Symbolism (symbolic representations of reality)

Regarding the content of a cognitive map, essential for everyday spatial behaviour, it includes two general categories (Kaplan, 1972; Kosmopoulos, 2000, pp. 189-190):

- Information about urban space (e.g., distances, directions) addressing the need to understand one's position relative to other elements within that space.
- Information about the properties or relationships of space, encompassing characteristic elements of both descriptive and evaluative content.

Based on this content classification of spatial data and their associations, the process of cognitive mapping is inherently dependent upon the sense and understanding of a place's local identity. Recognising the distinct elements of a place and their meaningful cultural and social associations, local identity is closely intertwined with daily cognitive mapping. Local identity encompasses a collection of these maps, supporting more complex perceptions and psychological processes such as behavioural attitudes, environmental evaluations, and routines. In this context, cognitive maps serve as the binding elements of a complex and evolving psychological process of daily urban interaction. Although the urban environment presents numerous features and elements of local identity, those that affect cognitive mapping play a significant role in this binding relation of spatial recognition, mapping and sense of local identity.

### 6. Identity Principles of Cognitive Importance

The key principle of Lynch’s theory, established in the 1960s and followed by other scholars to this day (Gehl, 1971; Whyte, 1980), regarding the element of recognizing an urban identity is *distinctiveness*—the ability to recognize a place, including all that makes it unique and memorable. This key principle, according to Lynch, depends primarily on the features of an urban environment, specifically those features that form an image, a principle termed as “imageability.” Imageability describes the quality in the physical environment that allows it to be easily and distinctly perceived and recalled. In this sense, Lynch and other scholars (Gehl, 1971; 2004; 2010) agree that the physical form of a city contributes to its unique identity and influences how this identity is perceived and experienced by its inhabitants.

Any process of cognitive mapping is dependent on these qualities of the built environment. Beyond any individual cognitive skill, cultural and social context, the spatial condition of the urban environment provides a series of cognitive incentives for engagement and interaction. These incentives depend on urban features as previously described; however, the level of their encouraging or discouraging motivation for developing cognitive maps is

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relevant to basic principles that forge local identity (cognitive spatial inclusivity<sup>140</sup>). These principles rely primarily on the level of individual engagement, which in turn initiates social interaction and thus supports elements of local identity to be experienced and identified. Emphasising the spatial parameters that assist environment cognition and interaction, the key principles of cognitive importance are as follows:

1. Legibility

This principle encompasses spatial parameters that enhance environmental comprehension, such as Lynch's (1960) elements of paths, districts, landmarks, edges, and nodes. It also includes broader qualities of legibility like urban structure, form, and symbolism, as well as issues of scale and connotation—a range of factors necessary for processing environmental data for cognitive use.

2. Imageability

This principle describes the ability of urban elements to contribute to the creation of mental representations of the city (Lynch, 1960). It includes aspects of form, scale, and architectural and cultural characteristics, with a focus on aesthetic qualities.

3. Plurality & Mystery

This principle refers to the rich content of an environment that encourages engagement and participation. It focuses on the incentives and perceived benefits of an environmental context that stimulates an individual's interest, presenting possibilities and opportunities (the *open work* by Eco, 1989; the *enigmatic signifier* by Jencks, 2005).

4. Spatial Description

Describing a space almost inevitably leads to an environmental assessment. However, a spatial context can be described in various ways and at multiple levels, rendering environmental descriptions relevant in terms of both the descriptive process and the individual's ability to perceive the description. Environmental or spatial description is a fundamental method of knowledge acquisition, with categorization as a key element. Categorization influences both the perception process that underpins description and the social communication process that facilitates information transfer within the framework of each category. Typically, categorization is subconscious, for example, categorizing a room involves objective elements like furniture and subjective characteristics like the view. Descriptions can range from lengthy and detailed to brief, whereas the elements and characteristics included depend largely on the description's purpose. Urban planning descriptions typically encompass land uses, urban infrastructure, road network characteristics, built environment elements, and so on. This broad description necessitates categorization to better assess the spatial context's scale. Regardless of scale, categorization involves numerous physical environmental characteristics, generally classified into two types (Syngkollitou, 1997, p. 71):

- of content, involving grouping similarities in classes or types of characteristics, varying with each approach (e.g., the built environment)

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<sup>140</sup> The term *cognitive spatial inclusivity* reflects a growing awareness of how spatial environments are experienced and understood by diverse populations, particularly those with varying cognitive abilities. It builds upon the concepts of spatial cognition and inclusivity, bringing them together to address the ways in which environments can either support or hinder cognitive accessibility.

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- of spatial configuration, a categorization that compares the structural arrangement of elements within a spatial context, based on two main criteria: the possibility of “inclusion” (participation) versus spatial “exclusion” (limitation) (Syngkollitou, 1997, p. 72).
- 5. Environmental Accessibility  
This refers to all means of accessing a spatial environment and context. The method and quality of access, both “direct” (unassisted) and “indirect”, influence the degree and level of information reception, thereby affecting the overall cognitive process. Spatial barriers that impede equitable access to an environment weaken the psychological connection with that context and discourage the formation of cognitive data.
- 6. Sense of Belonging and the Social Context  
The development of social relationships within a behavioural context depends on the environment's perceived “personality” and social identity. The ability to foster social relationships is a crucial element of satisfaction. Furthermore, the flexibility and opportunities offered by a context significantly contribute to its positive assessment. Flexibility enables the development of diverse activities, fostering a sense of freedom and pleasure (Maslow, 1954; McClelland, 1987; Deci & Ryan, 1991; Baumeister & Leary, 1995). Additionally, the presence of boundaries within a context influences the sense of pleasure. Boundaries enable control over social involvement, protect access, and enhance security from potential external “threats”, thereby reinforcing the context's identity and distinctiveness from its surroundings.
- 7. Symbolic Shock - Effects  
Large-scale transformations to an urban environment can induce a shock to the cognitive process. For example, new landmarks that alter wayfinding and orientation, thus affect daily decisions, incentives, and opportunities may dramatically change a person's willingness to participate, or conversely, generate new meanings that are crucial for a revised understanding of that urban environment.
- 8. Transportation Qualities and Modes  
Urban transportation patterns and familiarity with their use contribute to cognitive mapping. This is due to the previously mentioned knowledge of both (a) route knowledge, which encompasses the geographical aspects of experience, such as directions, locations, and connections, and (b) survey knowledge, which includes qualitative data and the meanings derived from the environment and specific locations.

All the above principles that present cognitive importance, thus environmental knowledge and evaluation, are strongly related to a specific place. Traditionally, local identity is rooted in shared history and cultural practices, serving as a cornerstone of social cohesion and cultural continuity. Nowadays, the concept of local identity faces profound challenges mainly as a result of globalization, multiculturalism and the disenchantment of culture (Josephson-Storm, 2017). The rise of multiculturalism, while advocating for inclusivity and diversity, raises questions about the preservation of distinct features that define locality.

Besides many challenges that may affect local identity, the most crucial of all is the concept of *authenticity*. This concern describes the concerns of diverse cultural practices that may transform or mimic the “pure” or “original” character of a locality. As communities become increasingly heterogeneous, traditional customs, languages, and social norms may be



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challenged or even displaced by new cultural expressions (Tummala-Narra, 2007; Fields, 2010). This can lead to a sense of displacement among long-standing residents, who may feel that their familiar cultural landscape is being irrevocably altered. The proliferation of hybrid cultural forms, while enriching the overall context of society, can also be perceived as a threat to the distinctiveness of local traditions. This perceived erosion of authentic cultural markers can fuel anxieties about the loss of shared history and collective memory, leading to a sense of cultural fragmentation and a weakening of the bonds that traditionally held communities together.

Furthermore, the emphasis on inclusivity and diversity within multicultural frameworks can inadvertently lead to a flattening of cultural differences (Ritzer, 2018), where the unique characteristics of local traditions are subsumed under a broader, more generic understanding of cultural identity. The pressure to conform to broader societal norms of tolerance and acceptance can also lead to self-censorship within local communities, where certain cultural practices or beliefs are suppressed or downplayed to avoid conflict or controversy. This can result in a distorted or incomplete representation of local identity, further contributing to the perception that multiculturalism undermines the authenticity of cultural expression.

The perceived loss of authenticity within local identity, as a consequence of multiculturalism, may significantly affect the processes of cognitive mapping. Traditionally, these maps are constructed through shared experiences within a relatively homogeneous cultural context, reinforcing a sense of collective identity and place. However, the introduction of diverse cultural elements through multiculturalism disrupts these established cognitive maps. The familiar landmarks, social cues, and cultural narratives that once provided a clear sense of orientation and belonging are now overlaid with new, often unfamiliar, information. This can lead to a sense of cognitive dissonance, as individuals struggle to reconcile their existing mental representations with the changing cultural landscape. Therefore the perceived loss of authenticity is not only a cultural issue but also a cognitive one, reflecting the challenges individuals face in remapping their mental landscapes in response to the dynamic interplay of local and global cultural forces.

### **7. The binding element of cognitive mapping and local identity**

The strong relationship between cognitive mapping and local identity represents a dynamic process that forges a deep connection between an individual's mental representation of space and their sense of belonging to that local environment. This bond of cognitive mapping and local identity is a continuous and evolving interaction between environmental cognition and shared urban experiences.

At its core, cognitive mapping provides the spatial framework upon which local identity unfolds. It is a process where shared experiences and a common understanding of a place blend based on key mechanisms that recognise, evaluate and reproduce elements of local identity. This process of blending and sharing of identity attributes is supported by key mechanisms, such as:

#### **a) Narratives and Storytelling**

Cognitive maps are not isolated constructs; they are influenced by social interactions and cultural narratives. When individuals share stories about their city, they contribute to a

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collective understanding of its spatial layout and history. These shared narratives reinforce the significance of specific landmarks and spaces, transforming them into symbols of local identity. This bonding element of mapping and identity relies on the previously mentioned principles of Legibility, Imageability, Plurality and Mystery, all of which enhance the content of Spatial Description.

b) Place Attachment and Emotional Associations

Cognitive maps are imbued with emotional significance. Places with a high degree of familiarity, comfort, and a sense of belonging stimulate emotional attachments to a place and reinforce a sense of local identity. Cognitive mapping, therefore, does not present only a cognitive side but also an emotional one, where personal experiences and feelings shape mental representations of a given space.

c) Cognitive Symmetry and Symmorph

This mechanism relies on the tendency of people to organize spatial information consistently and coherently, facilitating communication and shared understanding. This necessary shared understanding of the urban environment strengthens social interaction and reinforces local identity as it becomes the common cognitive language of collective understanding and experience.

In essence, the binding element of cognitive mapping and local identity is a dynamic process that integrates environmental cognition, social interaction, and emotional attachment. Cognitive mapping is a process through which individuals understand and develop essential knowledge about their environment, thereby constructing a set of preferences, beliefs, attitudes, and daily choices—all integral aspects of urban life. The cognitive mapping process encompasses not only the psychological mechanisms involved in forming an urban map but also the conditions that enhance the critical elements and linkages defining a sense of local identity. In this context, a cognitive map serves as the unifying element of environmental characteristics that support the perception of local identity. It represents a dynamic interaction between people and their spatial environment, driven by the need for spatial knowledge, participation, and search for meaning.

## 8. Conclusions

In conclusion, this theoretical analysis highlighted the multifaceted relationship between two processes in parallel: cognitive mapping and perceptions of local identity. It demonstrated that cognitive maps are not merely passive representations of urban spaces, but active tools through which individuals construct their understanding of place and their sense of belonging. This relationship is crucial as urban environments become increasingly complex and face rapid change. Understanding this link between cognitive mapping and local identity may provide significant information to urban planning and design.

By examining the psychological processes involved in acquiring, storing, and recalling spatial information, that is to understand the role of cognitive maps in daily urban life, it is like unfolding the structure of perceiving the elements of the identity of a place. In a world characterized by multiculturalism, population displacement, and rapid technological advancements, the ability to maintain a stable sense of local identity is crucial for social cohesion and well-being. Cognitive maps may provide a framework for navigating these

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changes, allowing individuals to adapt while preserving their connection to the past and their sense of belonging.

Therefore, understanding how individuals construct and use cognitive maps is essential for urban planners and policymakers. By recognizing the interaction between personal cognition and the spatial ingredients of a city, strategies can be developed to enhance legibility, promote social interaction, and foster a sense of shared history and culture. Future research will further illuminate these connections by providing empirical evidence of how cognitive mapping processes contribute to the construction of local identity in specific urban contexts (case-study cities of Volos and Kavala). This research will yield practical insights into how urban planning can be tailored to strengthen social bonds, enhance place attachment, and ultimately, improve the quality of urban life. By prioritizing the cognitive dimension of urban experience, it can create more inclusive, resilient, and meaningful cities for all.

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### ISSUES OF DEATH AND ECOLOGY: RECONSIDERING THE ROLE OF FUTURE CEMETERIES IN THE CITY

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#### Abstract

Burial grounds are an integral part of every social formation and social ritual. They reflect the peculiarity of cities over time and narrate the evolution of society's attitudes towards death, since they in turn constitute 'cities' of limited size. Over the centuries from scattered burial grounds to modern organized cemeteries, burial grounds constitute vital urban cells of multiple properties. These are important free urban spaces, open to the public of the city that go beyond religious rituals and can be treated as monumental 'gaps' in which its past is inscribed. From the medieval spaces that were social and crowded spaces, a displacement of the cemeteries from the core of the city is established, with the result that they function as 'organized spaces' on its borders, leaving behind the monumental burials as 'urban fragments'. Therefore, the purpose of the paper is to explore philosophical and cultural views on death from the Middle Ages to the modern era and the influence they have had on the design of modern burial grounds. The paper will focus on the emergent urban dynamics of cemeteries, studying issues of urban integration and spatial composition in the context of a climate of gentrification and a lack of open public spaces. The above problem can be understood in the light of 'Landscape Urbanism'. According to 'Landscape Urbanism', the landscape is defined as the prism through which the modern city is interpreted and at the same time the mean through which it is shaped. It is essentially an attempt to decode the urban situation in landscape terms and manage it as an ecosystem, which is studied and planned on the basis of a spatio-temporal ecology. Through the contemporary production processes of the space, the vanguard of landscape architecture design expresses the view of a 'new urban nature' which can be identified in the modern burial grounds. In addition, both incineration and conventional burial have some adverse environmental effects, with the result that some cities are already implementing innovative design strategies aimed at urban resilience. Therefore, the re-personification of the spatial issue of death projects the future form of specific spaces through their change, shrinking and even disappearance. In general, innovative design approaches to burial sites are emerging through modern technology and architecture under the gaze of the continuous ecological needs of the space. Beyond the theoretical part, the presentation focuses on two personal design research projects that examine the above issues. The first project focuses on the ways in which the question of burial is reintegrated into the urban fabric and the daily life of the inhabitants, while the second on the process by which the dead body ceases to cause disgust and returns to the city in a 'new form', identifying public space with memory.

**Key words:** burial sites, urban voids, death, integration, landscape.

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### WITH THE GAZE OF PLACE - MULTIFUNCTIONAL COMPLEX IN DORIDA

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#### Abstract

This thesis concerns the creation of a multi-functional complex in the municipality of Dorida, in the prefecture of Fokida. The plot on which the intervention is taking place is located at the entrance to the settlement of Koniakos, a village located on the eastern slope of Vardousia. The landscape, the traditional architecture of the place, the traditional buildings and settlements combined with the folklore of the place led to architectural gestures that respect the heritage and the natural environment. Consequently, the traditional elements of the area are transcribed in a modern way defining a renewed local character in the area. More specifically, the complex consists of an amphitheater with a capacity of 200 people which will be a place for cultural events, conferences, etc., a refreshment room, a folklore library and a long-term residential zone. The steep slope of the ground helps to compose functions and volumes by creating platforms and bleachers for easier passage and circulation inside the complex. Therefore, the complex of functions tries to transcribe the tradition of the place in a material and immaterial way thus avoiding copying and standardization.

**Key words:** *traditional architecture, architecture, tradition, place*

#### 1. Area Analysis

The focus and topic of this thesis were chosen due to my deep connection with this place. My ancestral ties, combined with my academic journey and the knowledge I have acquired during my studies, have sparked several questions.

My main concern was how I could intervene in these environments with historical and documented traditions without resorting to mere imitation. Respecting the landscape, the goal is to create ideal conditions for re-inhabitation and to establish the prerequisites for a return to the land and its roots.

The study area is located in Central Greece, specifically in the regional unit of Phocis. It is divided into two municipal units: the Municipality of Dorida in the western part of the region and the Municipality of Delphi in the eastern part. Phocis covers an area of 2,120 sq. km and, according to the 2011 demographic data, has a population of 40,343 inhabitants. The Municipality of Delphi occupies nearly half of the region, covering 1,122 sq. km, with a population of 26,716. In contrast, the Municipality of Dorida spans 970 sq. km and has 13,676 inhabitants—roughly half the population of Delphi.

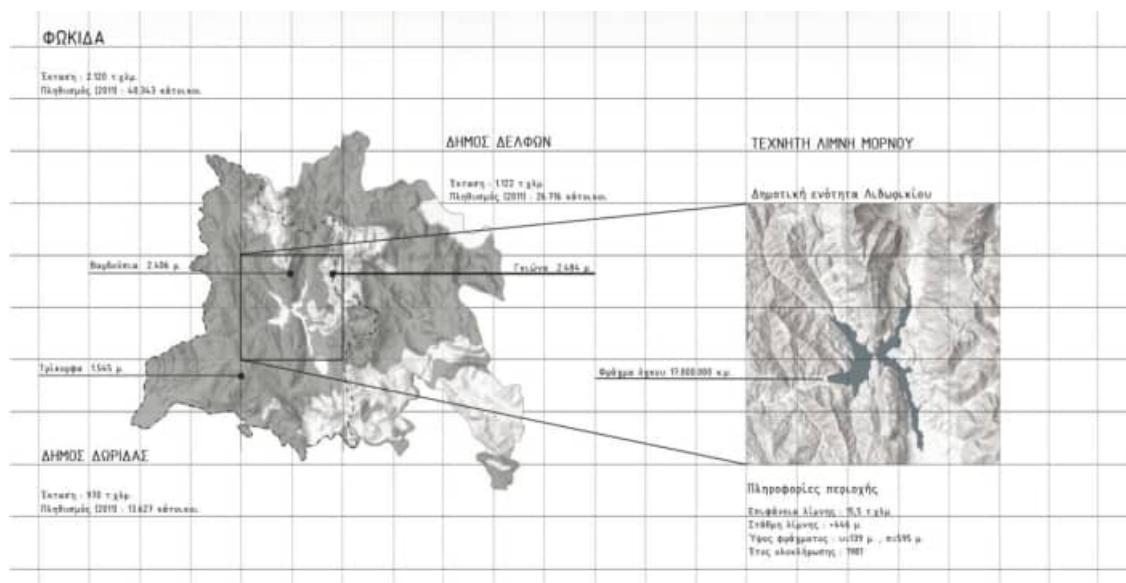
Dorida is predominantly mountainous, consisting of three major mountain ranges: Giona (altitude: 2,484m), Vardousia (altitude: 2,406m), and Trikorfa (altitude: 1,545m). The natural environment exhibits a dry Mediterranean climate, characterized by arid rock

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formations and low-lying shrubs in Giona, pine, fir, and wild cypress trees at altitudes of 600-1,800m, and a continental high-altitude beech forest throughout the Vardousia range. The northern part of the municipality is rocky, while in the central and southern regions, one finds the artificial Lake Mornos, which supplies water to Athens. Further south, the terrain transitions to lower elevations with valleys, ultimately reaching the coastline along the Corinthian Gulf.

The **Mornos artificial lake** is located at the center of the municipality, between the Giona and Vardousia mountains. Construction began in 1979 to address Athens’ water supply issues. The lake covers an area of 15.5 sq. km, with a dam holding back 17 million cubic meters of water. The project was completed in 1981.



Picture 1: Fokida, Greece

## 2. Access to intervention area

The intervention area is centrally located within the municipality, specifically in the settlement of **Koniakos**, which sits at an **altitude of 1,000 meters**.

To travel from **Athens** to Koniakos, visitors can choose between two main routes:

1. **The mountainous route via Amfikleia, Bralos, and Oiti**
2. **The more common route via Livadia, Amfissa, and Lidoriki**

The **second route** is the **preferred option**, as it takes approximately **four hours** and offers better road conditions, avoiding the **winding, mountainous roads** of the first route.

For visitors traveling from **western Greece**, access is provided via:

- ✓ The **Rio-Antirrio Bridge** or through **Nafpaktos**, crossing the Corinthian Gulf to **Eratini**, where the ascent into the **mountainous part** of the municipality begins.
- ✓ **Local Transportation**

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- ✓ The **secondary road network** serves local travel between settlements, while **provincial roads** offer shorter routes and access to more remote areas.
- ✓ For those without a private vehicle, the **KTEL intercity bus service** is the next available option. However, due to the village’s remote location, **multiple transfers** are required, making public transport **less convenient**.
- ✓ The **nearest railway station** is located in **Bralos**, but no rail network extends beyond that point.
- ✓ A **maritime transport network** is also available, primarily serving **local residents and tourism activities**.



Picture 2: Access in Fokida

### 3. Points of interest

Phocis, and especially the **municipality of Dorida**, remains a relatively undiscovered destination that has not been widely promoted. As a result, the **points of interest** within the region have been identified in relation to its settlements.

Visitors to the area can explore **parks and forests**, such as the **thematic park of Pavliani** and the **Mining Park on the slopes of Mount Giona**. They can also discover **archaeological sites**, with **Delphi** being the most significant, or venture into **hidden spots with waterfalls and natural springs**.

A major attraction is the **mountain ranges of Giona and Vardousia**, where experienced mountaineering and hiking groups have developed **hiking trails**. Notably, these trails are connected to the **settlement of Koniakos**, which is located on the **slopes of the Vardousia mountains**.

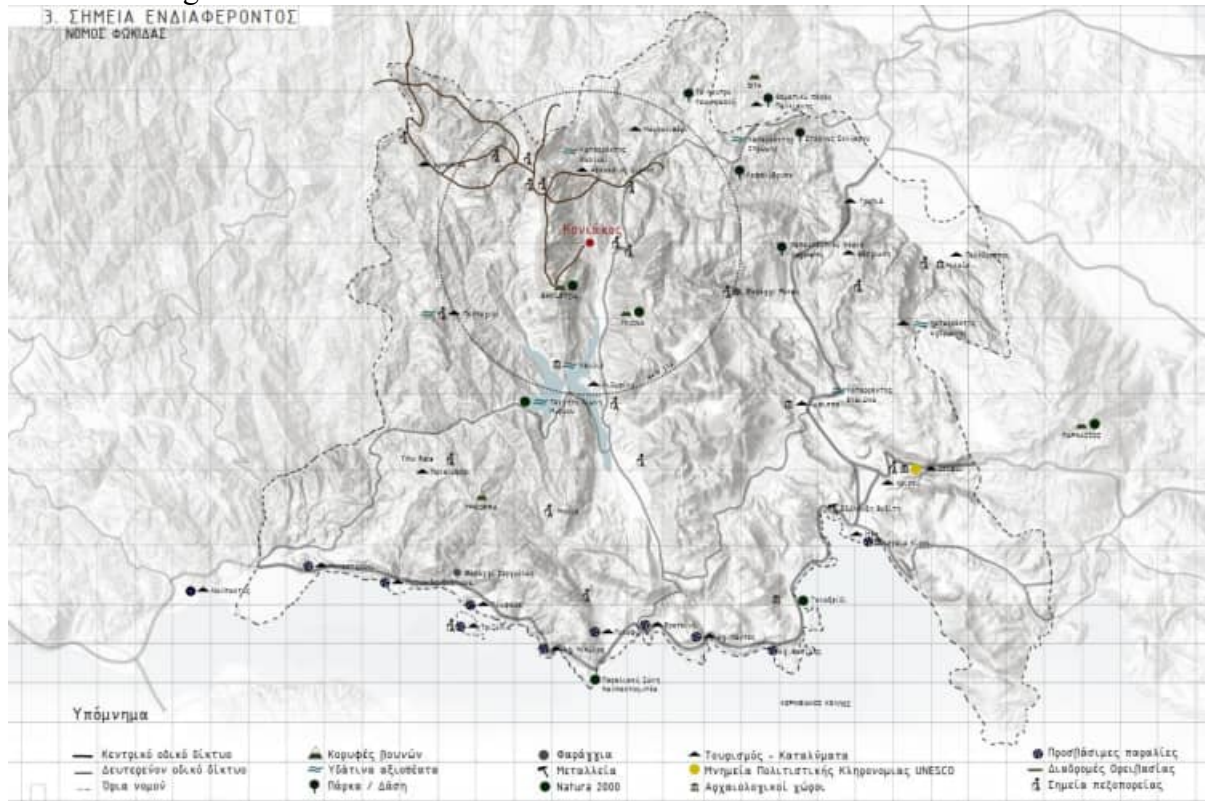


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The **diverse natural landscape** makes the region suitable for both **winter and summer activities**. The **northern part** reaches an altitude of **2,500 meters**, while the **southern part** is bordered by the **Corinthian Gulf**, offering a mix of mountain and coastal experiences.

Despite the variety of activities available, central **mountainous Dorida**, including **Koniakos**, remains a **non-touristic area**, characterized by **its traditions and its people**, rather than large-scale tourism.



Picture 3: Fokida, points of interest and tourism

### 4. Peripheral area: Analysis of road network

Focusing on the Dorida region, the relationship between settlements becomes more evident. These settlements are generally located at an altitude of approximately 850 meters and are strategically oriented to overlook the Mornos Lake and the lower-altitude areas where the tributaries of the Mornos River flow. Their locations were historically chosen for livelihood purposes, as access to water was essential for cultivation, livestock farming, and daily consumption. This is evident in the proximity of settlements to water sources. Notably, Mornos Lake is a man-made intervention that was created much later and did not influence the original development and planning of these settlements.

Regarding the road network, it follows a winding pattern to ease the ascent to the settlements due to the steep terrain. As a result, while the geographical distances between settlements are relatively short, travel times are longer due to the elevation changes. The sharp altitude

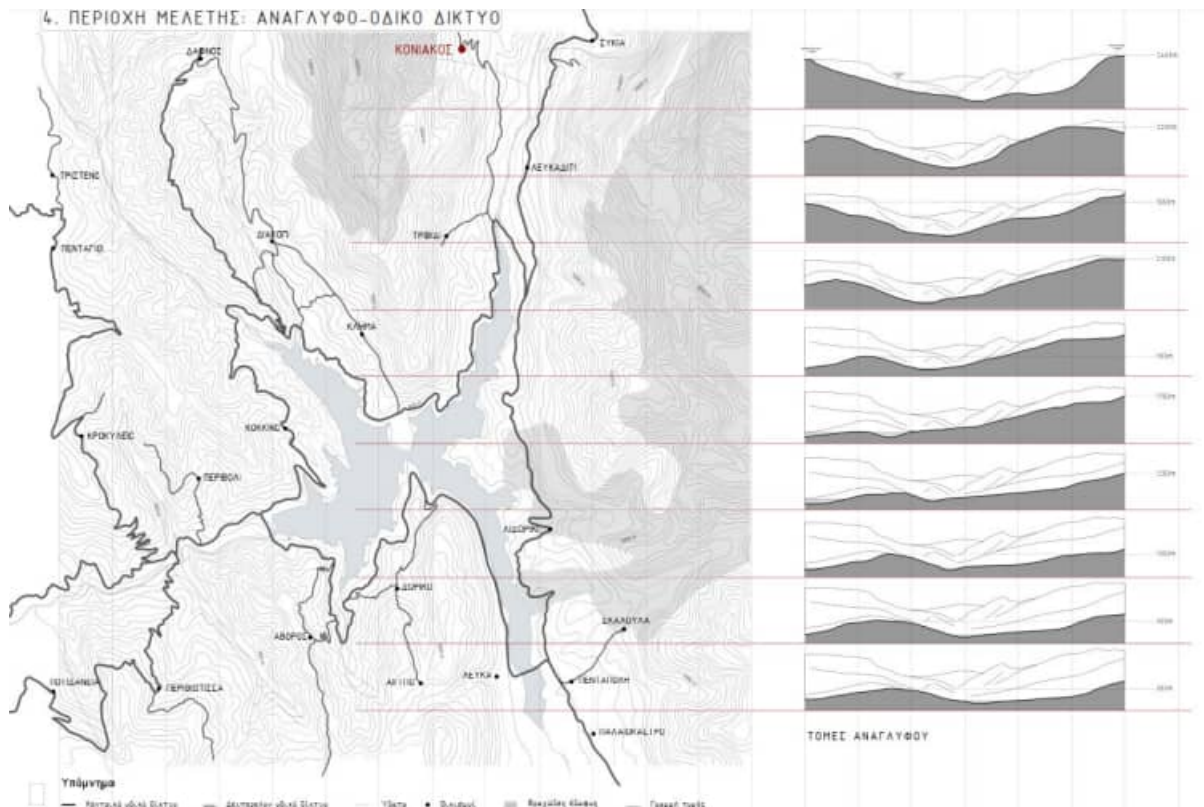
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variations, combined with the presence of the river and the lake, establish a spatial relationship between settlements and their counterparts on the opposite side—a key factor to consider in any intervention within the settlement.

The cross-sectional studies illustrate how the elevation gradually decreases as one moves southward within the municipality, from the settlement towards the lake.



Picture 4: Municipal of Dorida, landscape sections

### 5. Analysis of the spatial characteristics of settlements and building structures

Based on my heritage and personal experience, all aspects of the local tradition were explored, with traditional settlements being part of this. After an **in situ** survey of the area, some typologies were identified in relation to the ways in which the settlements developed. It was observed that there are settlements that develop in two groups, linearly, on peaks as one group, concentrically, and orthogonally. Additionally, the locations where the settlements developed were investigated. It was found that the settlements are either on mountain slopes, on mountain peaks, in gorges, or in valleys.

In addition to the settlements, the traditional buildings of the area were examined, with a focus on the typical **Doric two-story house**. This structure consisted of a **lower floor**, which served auxiliary purposes such as storage and the keeping of animals, and an **upper floor**, the main living space of the family. Key characteristics included the 4:3 ratio openings around the



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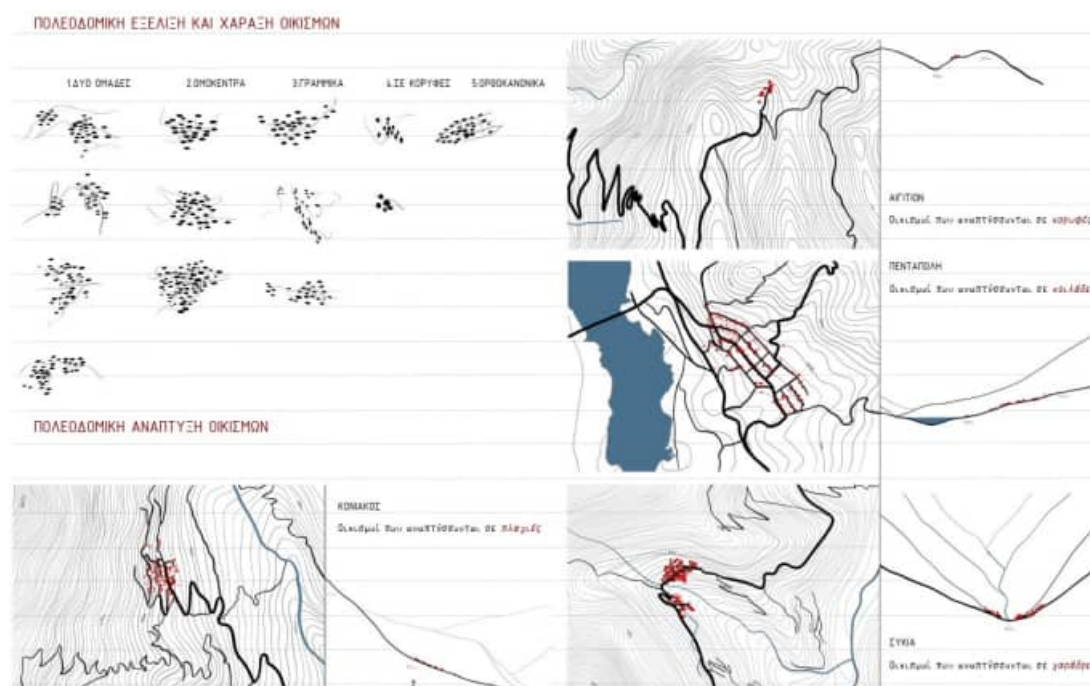
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structure, except on the northern side. The **external stone staircase** led to the entrance of the house, which included a **balcony** and a **courtyard** that was part of the dwelling. The main building materials were **stone masonry** with clay and mud, **wooden joinery** with wooden beams and lintels, **oak frames**, **beams** (used to support the floor), and the construction of the **four-pitched roof**.

Alongside these buildings and settlements, which, in combination with the landscape, are part of the tradition, there is also **folklore**. This includes objects from everyday life, clothing items, cookware, and production tools. In other words, small but highly significant pieces of daily life at that time.

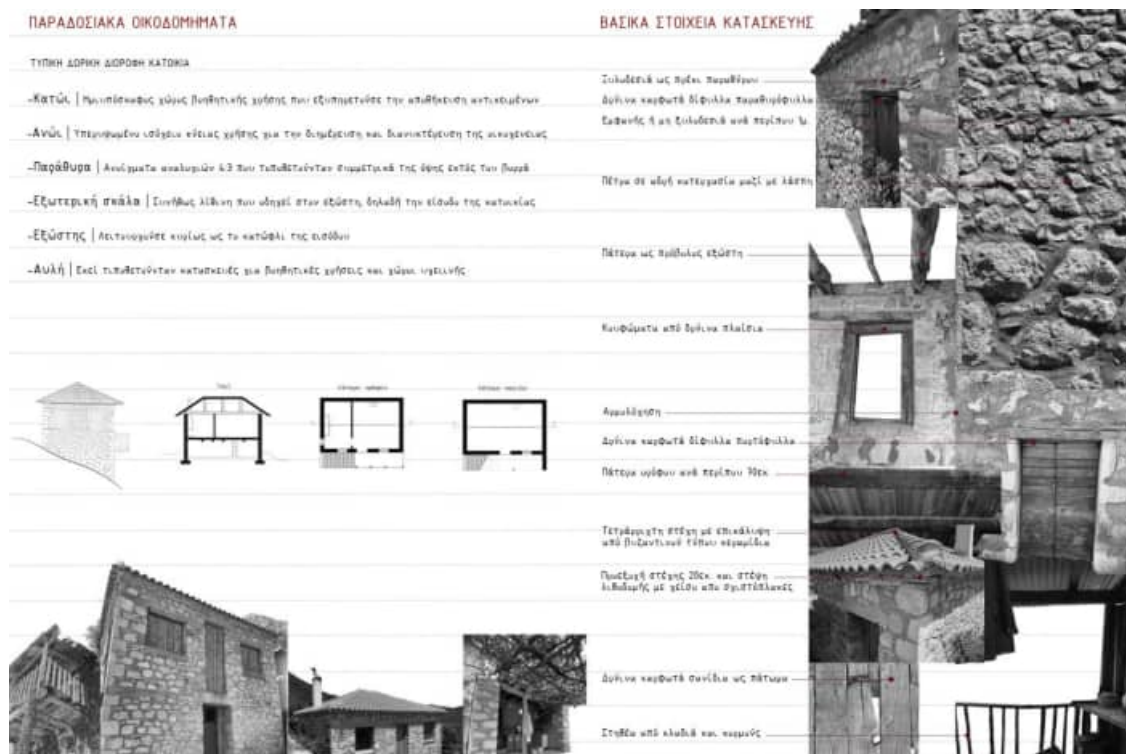
Tradition, however, consists of both **material** and **immaterial** elements. These include **song, dance, music**, and **theater**. **Koniakos** is the place where the **folk songs of Dorida** were collected, making it the element that most defines the settlement. These songs capture the customs, traditions, joys, sorrows, and struggles of everyday life. Together with the melody, they reveal **popular emotions**.



Picture 5: Settlements in Dorida

## PROCEEDINGS

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Picture 6: Traditional architecture characteristics

### 6. Intervention area

**Koniakos** is located on the eastern slopes of the Vardousia Mountains at an altitude of 1000 meters. It is a settlement that develops concentrically, with its central core being the **village square**, which creates relationships with the opposite mountain, **Giona**, at all levels.

The **road network** is divided into **four axes** due to the steep terrain and the amphitheater-like position of the settlement. Within the settlement, movement is mainly done through **paths**.

The site for the intervention is located at the **entrance** to the village. This area used to be the **courtyard of the village school**, which has remained inactive for about 50 years.

The settlement is primarily composed of **typical Doric houses**, as well as public buildings such as the **cafeteria in the village square**, the **church**, and the **former school**, which aims to revitalize the complex with **a range of functions**.

## 7. Central idea

The **central idea** of the proposal was to make the best use of the **elevation difference** on the site and preserve the **passages**. In order to facilitate better circulation, the volumes of the building are **dispersed**, creating an additional passage.

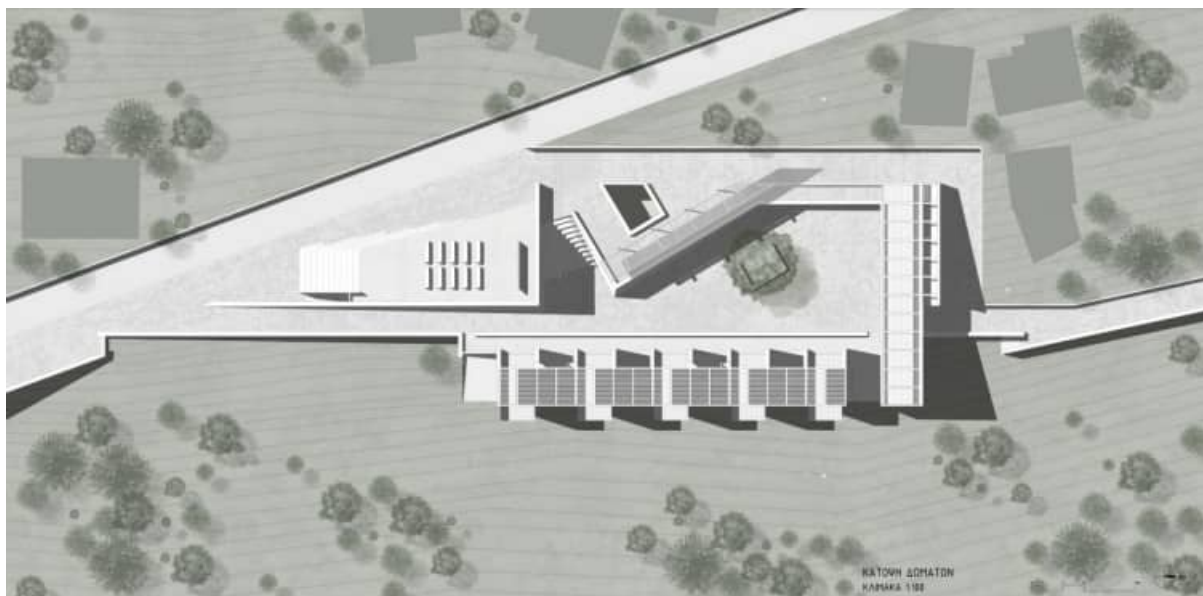
The second **disruption** comes from the creation of an **embrace**, or a **terrace** on a scale that symbolizes a second core of the settlement. By distinguishing the functions of each volume, a zone is created that preserves the **passages**, **free circulation**, the **square**, and a lower zone with new **viewpoints** and **movement paths**.

The **free movement** and the arrangement of volumes, combined with the passages and terraces of different scales, connect public and private functions with a slight **setback**, creating **secondary circulation**.

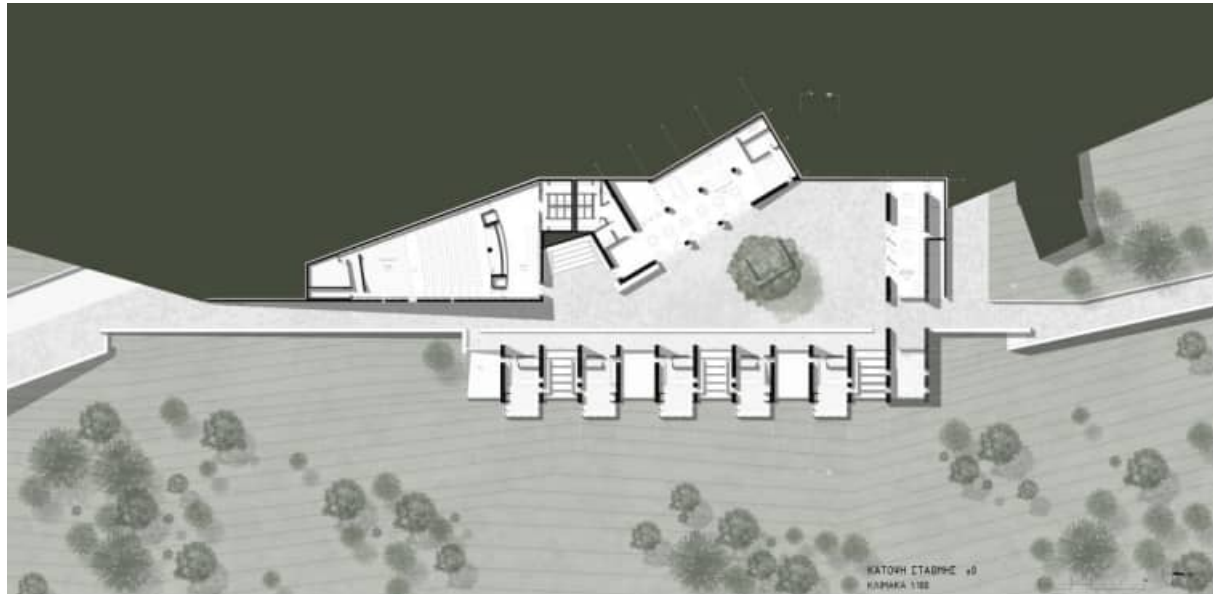
## 8. The idea

- a. A **void space** is created, with the focal point being the **square** at scale, the **passages**, and the smaller **terraces**.
- b. The **freedom of movement** dominates the entire composition, creating connections with the **road network** and the **slopes**.
- c. The **inner square** was kept enclosed, and because I was interested in the **typology**, specifically the typical **Doric house**, I created these **prisms**.
- d. By creating a second **movement zone**, the public and private spaces are smoothly separated, without restricting **free movement**.
- e. The **roofs** take on functions and movements, allowing for **observation** and **relationships** with the opposite side at every point in the composition, meaning **transparency** dominates

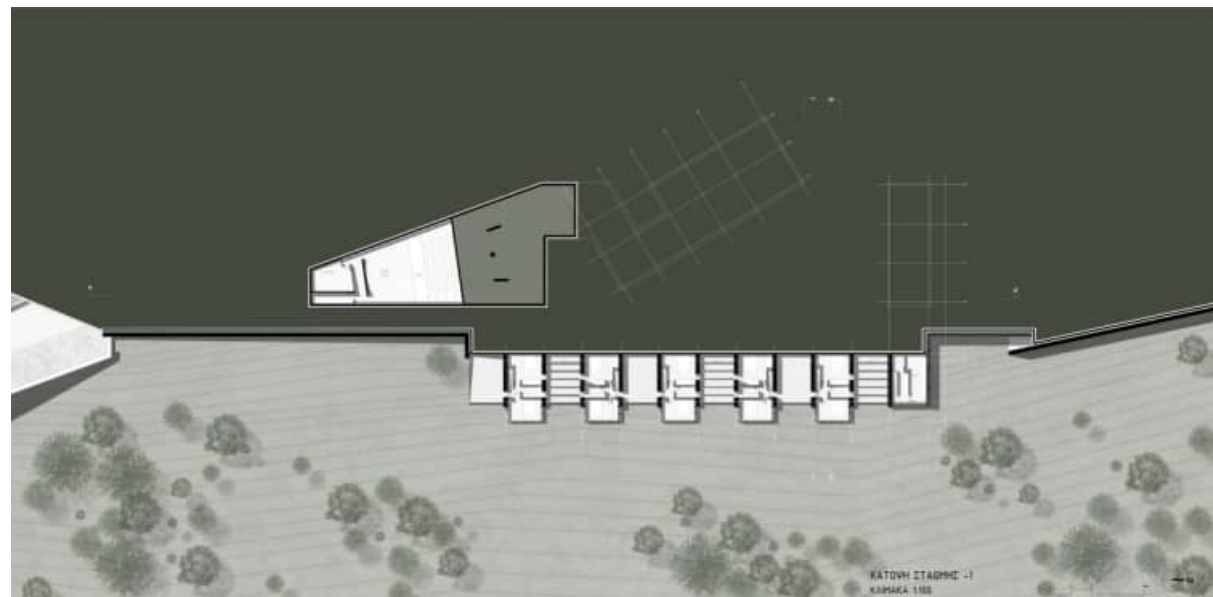
## 9. Architectural drawings



Picture 7: Top view



Picture 8: 0 level plan



Picture 9: -1 level plan



TOPO A-A  
KARAKA 1/50



Picture 10: Section a-a



TOPO B-B  
KARAKA 1/50



Picture 11: Section b-b



ANATOLIAN DIN  
KARAKA 1/50



Picture 12: Front view



## **10. Photorealistic renderings**



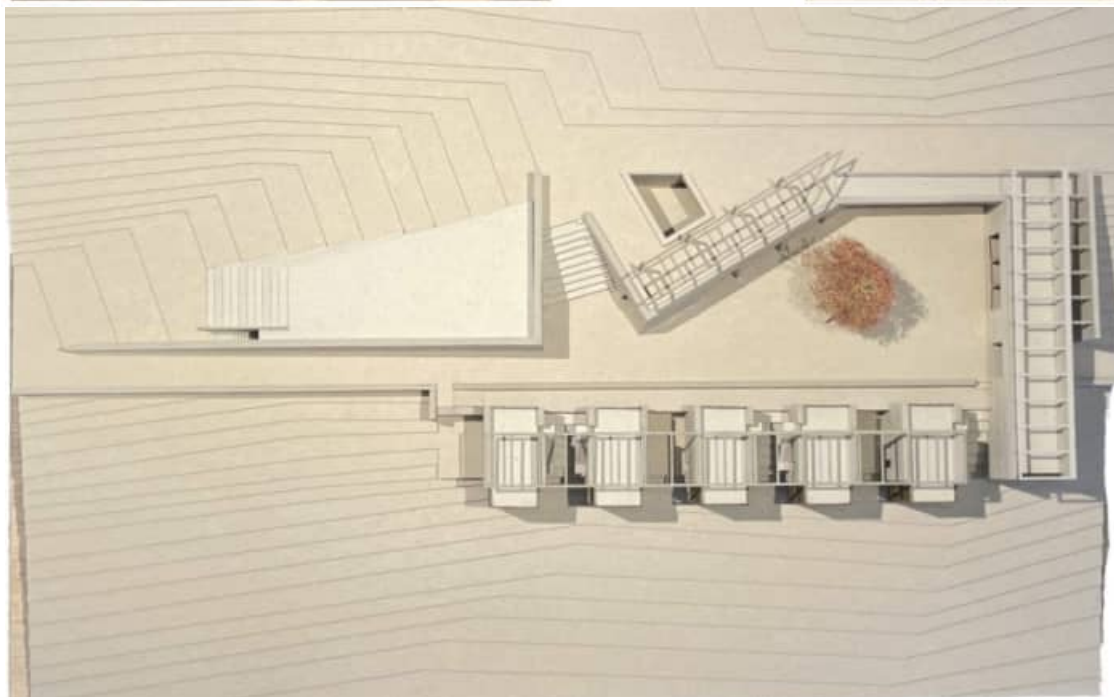
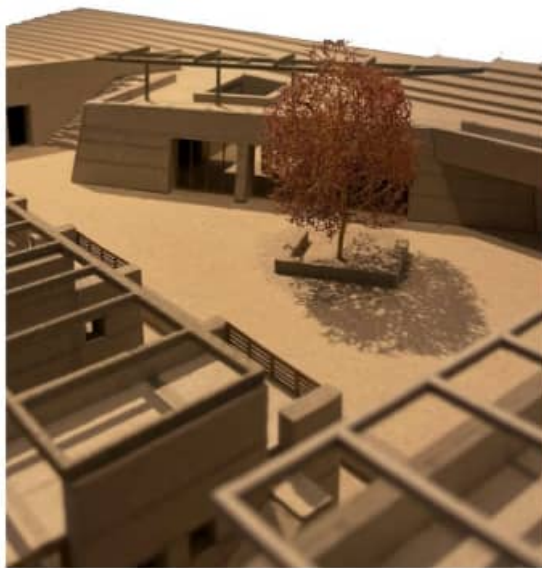
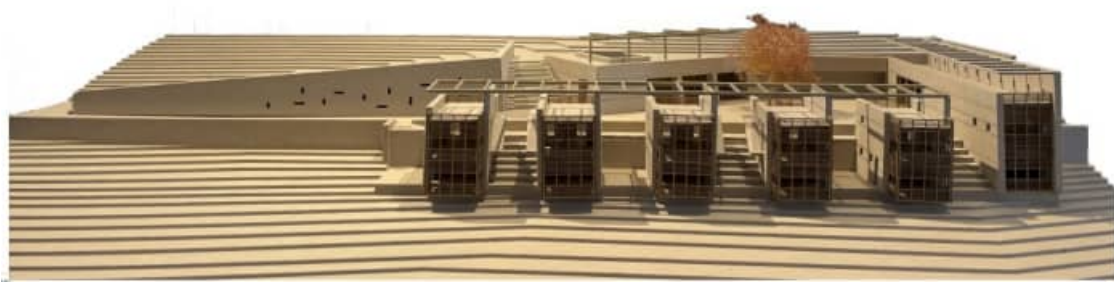
Picture 13: Front view



Picture 14: East view



## 11. Model



## **Conclusion**

Following research conducted as part of my study, it was observed that the characteristics of local tradition and architecture form the core of the evolution of today's heritage. Therefore, taking these principles into account, the composition reveals a design that integrates elements from local tradition with forms of contemporary architecture. Respecting both the place and the landscape, this proposal harmoniously unites the old and the new.

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## **MOVING FROM LOCALITY TO LOCABILITY TOWARDS SUSTAINABLE PLACE BRANDING**

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### **Abstract**

The notion of *locability* is presented as an essential framework supporting sustainable place branding. Locability, the unique set of attributes of a place that makes it easily identified, visited, and ultimately experienced, encompasses physical infrastructure, digital connectivity, and cultural identity. Being a fluid concept, locability lies beyond the fixed conception of locality, by considering essentially functional and communicational qualities that endow a place with the ability to engage meaningfully with residents, visitors, and all stakeholders involved for the benefit of economic development, community well-being and sustainability.

In its next step, this study examines locability as a tool that aligns place branding with the principles of sustainable development, linking to the goals of the SDGs set up by the United Nations. Locability is the golden thread that connects the identity of a place to its sustainability initiatives. It fosters improved access to resources promoting equity and facilitating inclusion and social cohesion. Engaging with these themes and drawing on both theoretical insights and case studies, the paper shows how locability-based strategies can endorse and underpin environmental stewardship, economic resilience, and cultural preservation. This study contributes to the discourse on sustainable urban and regional development by highlighting the innovative role of communication and co-creation within the context of place branding.

**Keywords:** sustainable development, strategic communication, locality, locability, place brand management, experience

## **ANCIENT HARBOR OF LECHAION: REDEFINING THE PLACE**

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### **Abstract**

Lechaion, the western port of ancient Corinth is characterized as one of the most important ports of ancient times for the Mediterranean history.

Nevertheless, the fact that in its present state, the ancient port of Lechaion comprises of a fenced space, to which the public doesn't have access, introduces the question whether it can become a "place" today, i.e. part of the social and cultural life of the city, but also an international archaeological destination, part of the network of important archaeological sites of the wider area of Corinth.

This paper aims to promote a project-oriented approach to context interpretation, place intervention and translation of its identity into an architectural proposal. Through an extensive analytical procedure, it intends to provide some initial answers to the question stated above, via a case study focused on the archaeological site of Lechaion Ancient Harbor which is, at the same time, an important water landscape ecosystem, which in now days act as a biotope.

In order to answer the question, it was considered important to search for the principles that constituted the ancient port as a "place" in the past.

Listening to the landscape, understanding the way in which it was formed and giving value to the life that appropriates it in the present are the pillars of an architecture that can regenerate a place, redefine it in the present for the future, while carrying its spirit, what makes it unique compared to any other place in the world.

This kind of approach can establish a methodological tool, as a link between the fields of architecture, nature and archaeology, which in more ways than one has a lot in common.

In a time of increased awareness on issues of sustainability and heritage, the preservation of architectural landmarks of historical significance is of major importance.

**Keywords:** Lechaion harbor, Ancient Corinth heritage, environment, place integration, Genius Loci, place identity, sensitive architecture

## A SPATIAL ANALYSIS OF URBAN POVERTY: THE CASE OF KUSTEPE NEIGHBORHOOD

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### Abstract

The term "space," although generally meaning "place," conceptually refers to a phenomenon that can continuously reproduce itself through actions. Hence, space inherently encompasses a network of social relations, ideology, collective memory, belonging, identity, and similar concepts. In urban planning, "space" is predominantly discussed in the context of "public space" and "public realm." When linked with the concept of "resilience," studies on "urban resilience" tend to focus on physical spaces, particularly with an emphasis on seismicity and disaster.

The Kuştepe neighborhood, located within the Şişli district, one of the primary service centers on the western side of the Istanbul Metropolitan Area, has become home to low-income households relocated from different sub-regions due to squatter demolitions and affected by national migration waves over time. Residents in the neighborhood face inadequate housing conditions, limited access to social services, economic opportunities, and insufficient physical infrastructure.

Kuştepe serves as a significant study area for understanding how urban poverty takes shape spatially and how impoverished neighborhoods cope with socio-economic exclusion. The lack of economic opportunities in the area, coupled with daily practices adopted or embraced by the residents, has led them to utilize shared spaces (streets, parks, neighborhood squares) more intensively. These spaces serve as public realms where social relationships develop, and collective solutions to common issues are crafted. In Kuştepe, where public spaces have gained the characteristic of common spaces, the urban poor have strengthened their social resilience against the negative impacts of urban poverty by building a sustainable system through their own organizational structures (such as regional ties, neighborly relations, and shared economic activities), despite their vulnerabilities.

This research aims to shed light on the challenges faced in a poor neighborhood lacking technical and social infrastructure, where initially socially excluded residents have transitioned towards a preferred collective existence. It explores the factors contributing to this resilience and the problems arising from it. The study also seeks to understand the sustainable system built by the urban poor in Kuştepe, as well as to propose neighborhood-scale sustainable development suggestions based on the local dynamics of Kuştepe, aiming to preserve existing values and improve the quality of life.

**Key words:** Urban Poverty, Social Resilience, Sustainability, Public Space, Commons, Neighborhood



Session:

**“Tourism, Culture and Sustainable Development of  
Places”**

## SUSTAINABILITY AND CULTURAL HERITAGE: AXIOM OR OXYMORON?

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### Abstract

Sustainability has become a global priority among the environmental, social and economic challenges facing us urban planners in the coming decades.

The perspective of culture and the cultural heritage's role in triggering sustainable policies is one that, more than any other, requires an informed, integrated and interscalar approach. Yet, we still encounter many difficulties in associating the two terms within effective and lasting policies and strategies. We are still too often associated with a constrained view of cultural heritage that reconciles poorly with sustainability and development.

If, instead, we address the issue of sustainability from the perspective of a complex and conscious process of building a social and cultural identity, then cultural heritage becomes a fundamental component in the definition of valorisation and development strategies that relate heritage itself and communities to the territory and its inevitable physical and functional transformations.

From this viewpoint, sustainability and cultural heritage can represent a deductive and reinforcing axiom of the same principle. Culture is thus asserted as a tool not only for economic development, but above all for promoting dialogue, respect for diversity, social inclusion and consequently cohesion in response to the need to ‘strengthen efforts to protect and preserve the world's cultural and natural heritage’.

In urban territories in constant transformation, cultural heritage becomes the element of continuity between the past and the future: it represents continuity to the past, and at the same time, the identity heritage to be passed on to future generations, in a perspective in which transformation becomes continuous evolution.

The contribution intends to explore this theme through the presentation of sustainable and inclusive experiences of regeneration and reuse of cultural heritage in Italy. These include the cases of Rome (Integrated Park of the Aurelian Walls), Bologna (City of Water) and Padua (Park of the Walls).

**Key words:** Cultural Sustainability, Cultural Heritage, Urban Regeneration.

### 1. Introduction: Sustainability and Cultural Heritage

Sustainability has become a global priority among the environmental, social and economic challenges posed to society and, specifically, to us urban planners, increasingly declined from the perspective of enhancing the cultural heritage and, more generally, the Genius Loci of the territory. Yet, we still encounter many difficulties in associating the two terms within effective and lasting policies and strategies. We are still too often associated with a narrow view of cultural heritage that is ill-suited to sustainability and development.

Too often sustainability and cultural heritage represent an oxymoron. Instead, it is necessary today to approach the issue from the perspective of activating policies and

strategies framed in an overall integrated and interscalar approach. Working on sustainability, according to a broader sense of the term, means moving from traditional models of development to new responsible models, based on “respecting the future” according to an environmental, economic and social dimension.

Sustainability implies “a constant and preferably increasing well-being and the prospect of leaving future generations a quality of life that is not inferior to the present one” toward the construction of a social and cultural identity, starting from the assumption “that there can be no authentic and lasting conservation that does not involve innovative tension, at least in making sense of things again” (Gambino, 2011, p.23).

Our country is now facing crises (energy, climate, health) that have produced negative effects also in the perspective of protection, enhancement and management of cultural heritage and landscape. The aim is to highlight the interdependence and interdisciplinarity between cultural heritage, environment, landscape and technologies for sustainable development, a vision in which culture, its character of memory and permanence, assumes a unifying role that links the past to the present toward a possible future. A vision in which culture, its character of memory and permanence, assumes a unifying role that links the past to the present toward a future.

Addressing the issue of sustainability from the point of view of a complex and conscious process of building a social and cultural identity means assuming cultural heritage as a fundamental component in the definition of strategies of valorization and development that connect heritage itself and communities with the territory and its inevitable physical and functional transformations.

In fact, sustainability is one of the five pillars of the Cultural Heritage Framework for Action, which highlights its potential to strengthen social capital, stimulate economic growth and ensure environmental sustainability. Culture and cultural heritage can contribute to the achievement of inclusive and sustainable development. (EU, 2021). The framework includes three sets of actions to:

- regenerate cities and regions through cultural heritage
- promote the adaptive reuse of heritage buildings
- balance access to cultural heritage with sustainable cultural tourism and natural heritage.

From this perspective, cultural heritage becomes a key component in defining enhancement and development strategies that relate heritage itself and communities to the land and its inevitable physical and functional transformations.

Rethinking cultural heritage by placing the principle of sustainable development at the center of functions helps to guide choices and take conscious actions from a long-term planning perspective. In urban contexts in constant transformation, cultural heritage becomes the element of continuity between past and future, in a perspective in which transformation becomes continuous evolution. Sustainability and cultural heritage can represent a deductive and reinforcing axiom of the same principle. Culture thus asserts itself as a tool not only for economic development, but above all for promoting dialogue, respect for diversity, social inclusion and thus cohesion, in response to the need to “strengthen efforts to protect and preserve the world's cultural and natural heritage” (UNESCO, 1972).

## **2. Land care and sustainability of cultural heritage**

The pandemic experience of the last few years has amplified the potential effects of the systemic fragilities of our urban realities weighing heavily on cultural heritage management practices and marking an unprecedented setback for the sector related to curation. This resulted in a scenario of uncertainty with respect to the modalities and degree of resumption

of activities that is only recently becoming clearer thanks in part to the numerous emergency measures put in place that have brought the issue of curation to the center of the debate.

Land curation takes the form of a set of practices and policies aimed at preserving and enhancing the natural and cultural resources of a given spatial context, recognizing cultural heritage as a foundational element of territorial identity and a key factor for sustainable development. This approach emphasizes the need for heritage management that goes beyond the mere preservation of individual assets to embrace a broader vision that includes landscape protection, promotion of sustainable practices, responsible resource management, and mitigation of climate change impacts.

*The question then arises: in terms of urban planning, how can cultural places, often linked to a conservation rather than a transformative approach, respond to the challenges posed by regeneration and sustainability in the contemporary city?*

Sustainability has become a key principle in cultural heritage management, as evidenced by recent studies exploring the interconnections between conservation, economic development and social welfare. A sustainable approach involves protecting heritage for future generations while ensuring that its enhancement contributes to the economic and social development of local communities. With this in mind, it is imperative to think of culture as the fundamental pillar of the entire process of developing a social identity and building knowledge. The concept of cultural sustainability is often associated with social sustainability.

It connects heritage and communities: the degree of development of a given society and the associated quality of life are based on the ability to preserve and repurpose cultural capital, understood as the set of beliefs, values, behaviors and meanings intrinsic to social individuals. This conception places at the center of sustainable development the respect, preservation and enhancement of cultural heritage: culture, therefore, figures as the engine for more authentic and comprehensive development, the tool for smart and inclusive or, better, sustainable growth.

We cannot therefore simply limit ourselves to asset preservation, but must think in terms of inclusion, promotion of cultural diversity, and integration of cultural heritage into social and economic development in an equitable and inclusive manner. A sustainable approach recognizes the interconnectedness of culture, environment and society, aiming for a balance that respects the cultural identity of communities and the planet's resources. This implies the need for participatory cultural policies that actively involve local communities in the definition and implementation of heritage management strategies, conscious of its impact on the social and environmental fabric.

On the other hand, the regeneration of cultural heritage is a complex and multidisciplinary process that, starting from the revitalization and enhancement of existing cultural assets (tangible and intangible) contextualizes them in their territorial, social, economic and environmental context: an investment in the future, capable of generating social, economic and cultural benefits for communities and for generations to come.

### **3. Cultural heritage and regeneration: good practices to compare**

Cultural heritage represents a fundamental element of the identity, rootedness and image of a territory, a valuable asset that plays a particularly important role in the lives of citizens: a tool for the promotion of the territory itself that allows for the activation of paths of knowledge and enhancement and, at the same time, to attract interest, investment and diversify forms of use.

For this to happen, it is necessary to build a network of relationships, both material and immaterial, between subjects of different natures and initiate a shared process between public administration, investors, associations, neighborhood networks, and private operators (Ricci,

2021). Culture constitutes the strategic and structural factor of initiating and managing transformations by “governing” the processes themselves in such a way as to activate flows of knowledge, experience and new relationships. Cultural heritage then assumes the role of invariant: naturalistic and anthropic, landscape and historical documentary permanence, it becomes a structuring and structural feature to configure innovative arrangements and relations between cities and the permanences themselves, in architectural but also social terms, reconfiguring inhomogeneous and fragmented areas to implement a broader regeneration of the urban form (Ricci, 2018).

Permanences, from marginal elements, become transversal threshold places in urban environments where to build policies and transformation projects shared between public and private stakeholders, institutions and citizens and, in particular, play a leading role based on awareness of the collective needs and symbolic value of cultural heritage (INU, 2012).

Among the many signs still present in our urban contexts, wall fortifications represent, where they still exist, a testimony to the history and urban evolution of a city. They are not simply defensive vestiges, but structures integrated into the contemporary city fabric, sometimes as evocative fragments, other times transformed into scenic routes, offering a privileged glimpse into the past while posing complex challenges of management and preservation in a dynamic urban context (Harvey, 1990).

The relationship between walls and urban contexts is an ongoing dialogue between past and present: if walls shaped past cities, and contemporary cities continue to interact with their vestiges, adapting them, enhancing them or, in some cases, erasing them, in a dynamic process that reflects the evolution of societies and their needs (Holston, 2008) .

In Rome the **Integrated Linear Park of the Walls** represents an interesting case for the possibilities of reconfiguration and refunctionalization that can be created by transforming the walls, still the margins of the historic center, into an onclus of public spaces of hinge and interrelation.

The Aurelian Walls, built in 270-275 A.D. by Emperor Aurelian and raised by Honorius in the early fifth century A.D., constitute the most extensive and best-preserved fortification in the classical world: They stretched for about 19 km around the ancient city (about 13 km remain intact and passable) interrupted by gates flanked by semicircular towers at the consular roads.

Rome's new PRG (approved in 2008) has recognized the Aurelian Walls as one of five strategic planning areas: structuring “signs” (natural or man-made, fully or partially preserved) to which the Plan assigns a strategic role” for the purpose of upgrading the entire urban context.

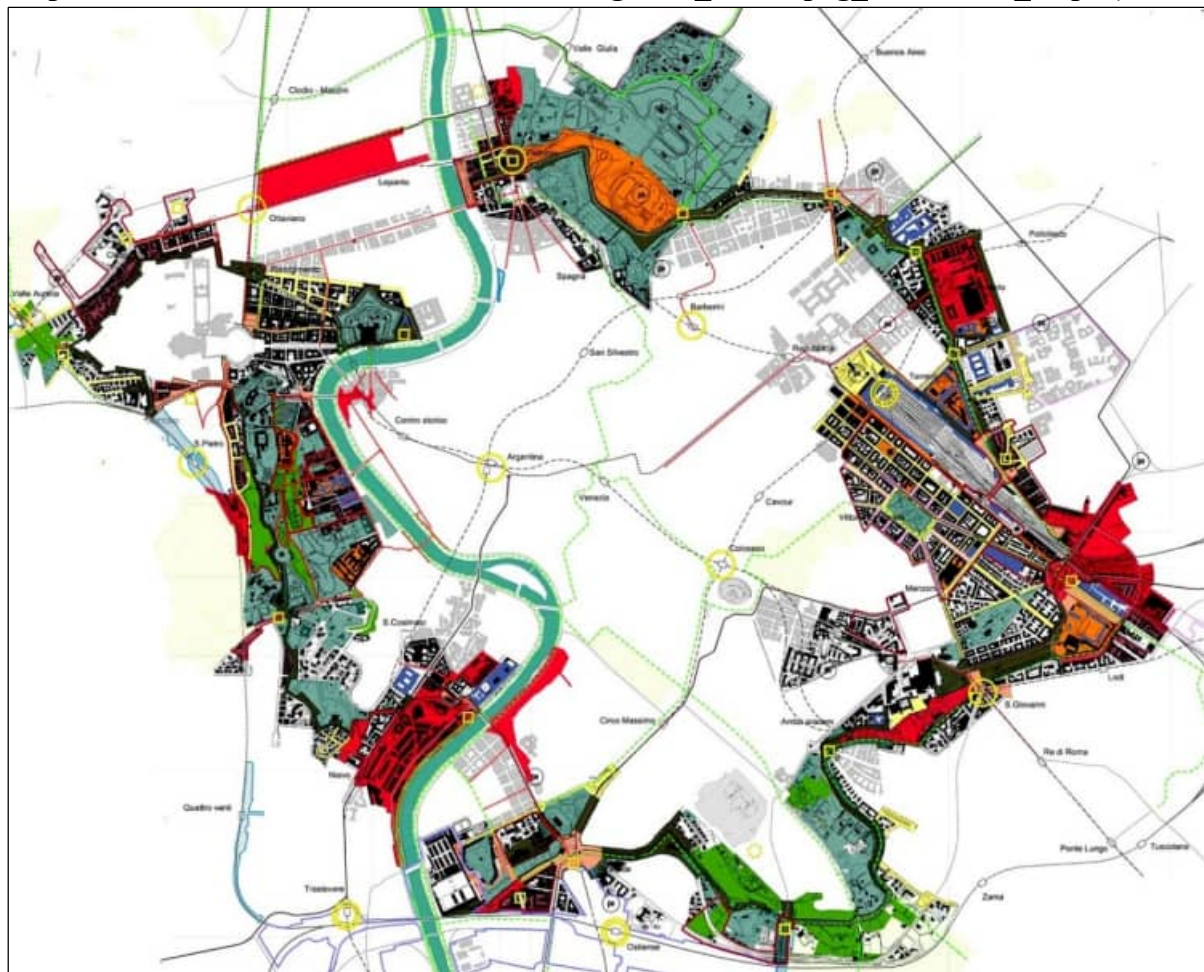
Today, the city walls represent a unique heritage, an identifying sign of the city that, however, apart from a few single episodes, has not found integration with the consolidated urban system and is often not recognized as a resource or added value but as a limit, an often insurmountable obstacle, in the weaving of relations of the contemporary city (Falini, 2009). A “large urban structure, capable of constituting a load-bearing framework capable of reinterpreting the historic city itself in the systems of relations between it and the emerging urban configurations,” (Municipality of Rome, 2003) which requires an overall strategic project of restoration and enhancement, in continuity and coherence with the structuring character attributed to the construction of the overall Historic-Environmental System.

The strategic planning scope of the PRG (Falini,Terranova,2001), prefigure the construction of an integrated Linear Park consisting of the “artifact” of the walls and the spaces of its encroachment (open spaces, green areas, services, etc.) that articles the walkability of the entire city wall and the re-functionalization of the walls and related volume for cultural and service activities. A true public works project according to a flexible perimeter but characterized by identity and continuity and a udea of overall unity.

The Park Project has been carried out in phases from the perspective of “planning by doing” (Morassut, Ricci, 2018), understood as an approach characterized by experimentation and processuality, aimed at bringing extraordinary procedures back into the Plan's contexts of reference: parts already defined are the Gardens along Via Carlo Felice, and the area between Porta Metronia and Porta Latina (inaugurated in 2009), Porta San Paolo - Via Giotto - Via Guerrieri (2013). Areas still to be redeveloped, however, are those at Via delle Fornaci, Porta San Paolo and Porta Maggiore - San Lorenzo (Terranova, 2001). The realizations, of the single parts of the Park have highlighted its enormous potential in terms of preservation of historical manufacts, environmental regeneration and revitalization of urban contexts.

The Walls become the backbone of an urban and metropolitan level redevelopment project “capable of reinterpreting the historic city itself in the systems of relationships between it and the emerging configurations” (Falini, Terranova 2001, 114). A multifunctional linear urban park is being configured that integrates pedestrian and bicycle routes in a unique context witnessing and active memory of the city's history. At the same time, the continuation of the Project opens up significant scenarios for the accomplishment of an ecological ring road corridor according to an idea of a “*planning conscious of the history of the places and attentive to the values of the contexts*” (Municipality of Rome, 2003).

**Map 1. Strategic Planning Walls Ambit, (Elaboration I6.2 Objectives, scale 1:10,000, [http://www.urbanistica.comune.roma.it/images/uo\\_urban/prg\\_adottato/i6\\_02.pdf](http://www.urbanistica.comune.roma.it/images/uo_urban/prg_adottato/i6_02.pdf))**



The case of the **Walls a and Water Park of Padua**. proposes a different approach to the Project that sees in a shared and participatory path the way toward the construction of a new



arrangement of places focused on public space and the promotion of innovative uses compatible with the historical-cultural value of the permanences .

The city walls of Padua represent an important testimony of military engineering of the 16th century, the first one built to defend a large plain city: a complex system composed of the perimeter wall (11 kilometers in extent, nineteen bastions and six surviving gates of the original eight), historic canals roads and military areas inside and outside the walls for a total of about 1,100,000 sq. m. 500,000 sq. M (Municipality of Padova, 2006).

By the end of the 19th century, having now lost all military function, the walls, ceded by the state property to the Municipality of Padua, began to become an obstacle to urban growth and circulation, and the first of about fifteen breaches began to open, sections of the walls were razed to make avenues (along the Piovego towards the Portello, in Via S. Pius X), other sections of walls and bastions accommodate public gardens (Savonarola, Arena and Codalunga bastions, with large sections of walls adjacent to them, as well as next to the S. Croce bastion).

Luigi Piccinato in the PRG of 1954 had grasped the importance of the walls and the river-canal system linked to them as an exceptional resource (Franzin, 2004), and had hypothesized the design a green ring along the esplanade that surrounded the Centro Storico, which, however, was never realized due to strong settlement pressures. It was not until the mid-1980s that the idea arose that the 16th-century walls constituted an enormous resource to be enhanced.

In the long path to the establishment of the Park of Walls and Waters, the Comitato Mura played a fundamental role an association founded in 1977 on the initiative of a group of scholars, preservation bodies and simple enthusiasts, with the aim of studying, spreading knowledge, safeguarding and enhancing the city walls of Padua. The Walls Park project, has been carried on since 1986 by the Walls Committee through a project path shared with associations, IUAV and with the support of the Region, Province and Municipality.

The basic idea starts from considering the rampart belt as a unique system, overcoming the logic of restoration for the purposes of pure conservation. The Project defines a complex system of interrelation between the different values inherent in the nature of the park itself (historical-cultural, architectural, landscape, naturalistic, artistic) by articulating differentiated levels of offerings (public spaces, functions, etc.)

In 2016, again on the initiative of the Walls Committee within the framework of the Culturalmente Call for Proposals, the experimentation of a non-museum museum of the walls, consisting of Narrative Environmental Installations, and educational stations, was carried out, providing diversified and interactive modes of enjoyment (Fadini, 2016). From the reinforcement of this first project, in 2021, the MURAVIVE initiative, a multimedia narrative museum in permanent form, was born. MURAVIVE is both a multimedia museum that places the musas themselves at the center of the narrative through different modalities and technologies, and a diffuse museum, articulated in several "stations" - seven once the project is completed - housed in gates and bastions, distributed along the entire bastion walls.

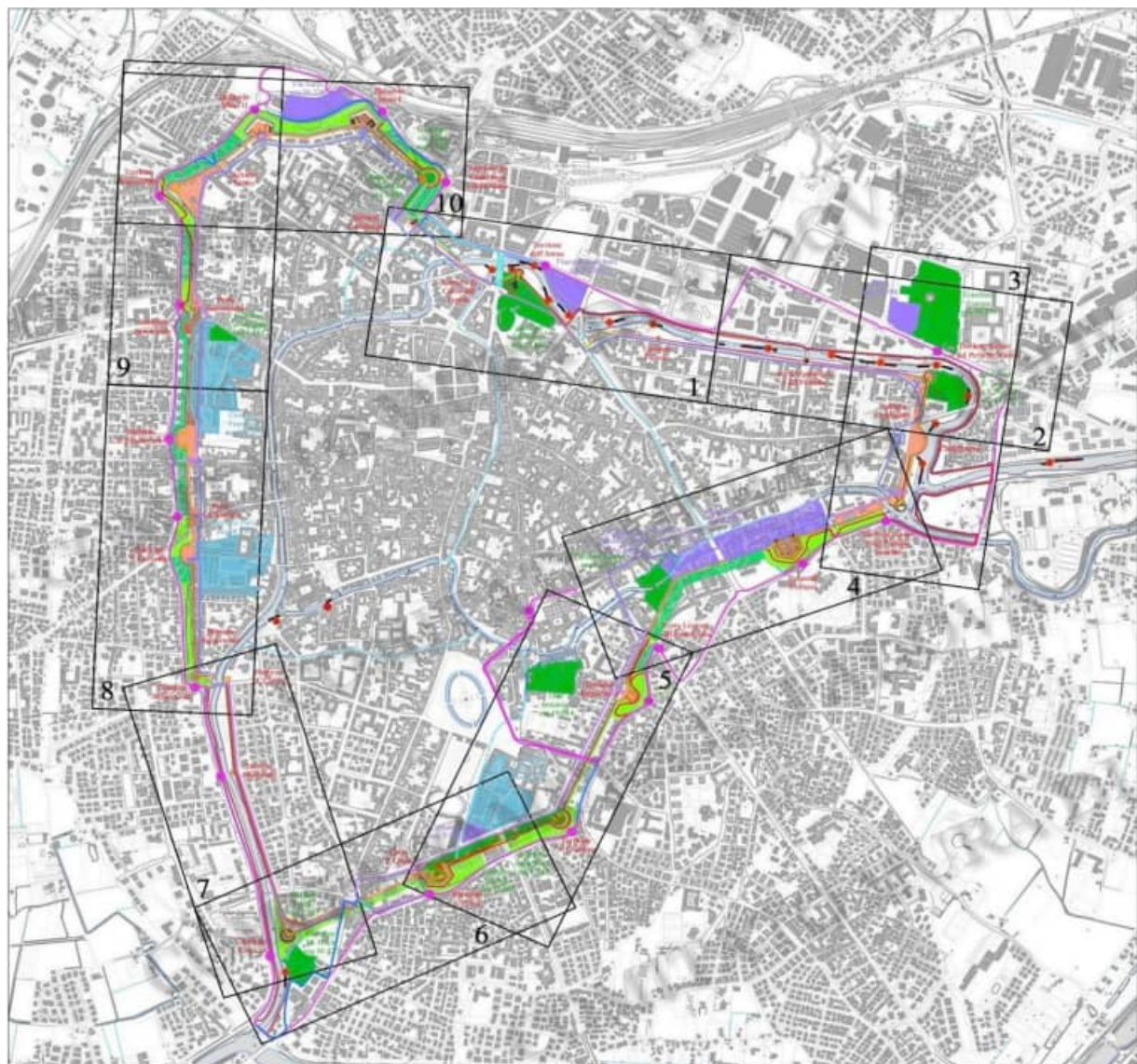
In parallel, thanks to the interest aroused by MURAVIVE, a group of professors from the IUAV University of Venice and the ICEA and DEI departments of the University of Padua promoted and implemented a project financed with ESF European funds, called PAMU - Multimedia Park of the Walls of Padua, a dedicated website for a virtual tour of the Walls complex.

The aspect that characterizes the walls of Padua, and therefore also the redevelopment plan, is that of being composed of the juxtaposition of many elements, of which each represents a case in itself but, at the same time part of an organic whole: historically, but also in the perspective of regeneration and enhancement. The walls represent the backbone of a linear park, the generating line of urban public space, gradually triggering the recovery of

areas and containers that are degraded but of high historical and urban value and the structuring of new safe bicycle and pedestrian routes for residents and new routes for tourists to visit the city.

The case of Padua allows a reflection on the experiences of “regeneration from below” and on the objective difficulty of initiating effective policies for the regeneration of the historical and cultural heritage: if the contemporary city is a complex of articulated, discontinuous and specialized situations (Poli, 2020), historical infrastructures can play an important role in the construction of planning and paths of social innovation and integrated and shared management, leading to a gradual process of re-appropriation and re-signification of these urban spaces, allow to reconfigure social fabric and symbolic values of the territory (Cellamare, 2019).

**Map 2. Overview plan of the park of the Walls a and Waters of Padua. Source: <https://www.muravivepadova.it/mura/lemura.html>**



#### **4. Two example urban projects: The gardens of Via Carlo Felice in Rome and the Wall Park of San Benedetto in Padua.**

The new garden on Via Carlo Felice constitutes one of the realized sections of the Linear Integrated Park of the Walls in Rome, with a total area of 2.7 ha close to the walls in the inner part between Piazza San Giovanni and Piazza Santa Croce in Gerusalemme.

The area, the final part of the Celian crest, was already described at the end of the 1500s as a small valley whose filling in began with Sixtus V, during the construction of the road between Santa Maria Maggiore and Santa Croce in Gerusalemme, and was completed in 1774 with Benedict XIV to create the tree-lined avenue, connecting the square in front of Santa Croce and the square of San Giovanni. It is exactly the relationship between the different elevations, (of the walls, the gardens, the street) that is the informing motif of the project to restore and create the new park.

The Project is part of the larger program of redevelopment of the Esquiline neighborhood, a strategic place of coexistence between different cultures, which is going through a moment of profound transformation of the social and economic fabric of the city. Funding for the work totaled 5 billion liras, partly from the Esquilino neighborhood redevelopment program.

The overall objectives of the project involved the restoration and enhancement of the Walls and the creation of a pedestrian path and equipped green spaces.

The proposed structure readdresses the history of the place through the garden design, which is developed as a “promenade” along which various types of spaces are articulated, on different levels and longitudinal paths, belvedere points and fountains; the perspectives open toward the walls and toward the areas in front of the basilicas of St. John and St. Cross in Jerusalem.

The central path along the street is bordered by a double row of holm oaks and a row of plane trees. The innermost part next to the walls is connected by several flights of steps interspersed with water features.



**Map. 3 Overall plan of the Garden project and view of the lowered part abutting the Aurelian Wall. Source: <https://paesaggiorigenazioneperiferie.it/carlo-felice/>**



In 2021, the Municipality of Padua acquired the former Prandina Barracks from the State Property Office, an asset listed as being of cultural interest by the Superintendence. The area of the former Prandina Barracks, close to the 16th-century walls and the city center, was once occupied by the women's monastery of San Benedetto. Monastery which, in 1810, by Napoleonic decree came under the control of the State Military and became an artillery barracks. The barracks, which remained operational until the late 1980s, includes multiple properties of special historical, artistic and cultural interest.

For the redevelopment of the area, thanks to the close collaboration between the Municipality, Superintendency and the Ministry, a master plan has been drawn up for 2024 that also defines the new name once the redevelopment is completed: St. Benedict's Walls Park. Leading the Project team will be Ferrara-based studio Qb Atelier srl of architects Filippo Govoni and Federico Orsini, called upon to design the new park together with a group of 10 other firms and professionals, each specializing in specific aspects of the design.

The plan calls for redevelopment, with the creation of an “inclusive green infrastructure” to enhance the historic center and the Renaissance walls of Padua. The intervention, in general, involves the liberation of the complex from all the overlaps that have occurred over time, so

as to return a vast green area to the city and the redevelopment and enhancement of the rampart system and the former monastery. It is planned to create a large park, which inside includes the listed buildings of the former barracks, the Cavallegeri Park and the area in front of Porta Savonarola. Over 67 thousand square meters of greenery, recovery of three buildings under Superintendence protection, a square for Corso Milano.

#### **Map. 4 Masterplan of the St. Benedict's Wall Park.**

**Source:** <https://www.comune.padova.it/sites/default/files/images/01%20Prandina.png>, <https://www.cafetv24.it/wp-content/uploads/2023/12/Parco-01.jpg>



Special attention is paid to the reorganization of traffic routes. It is planned to eliminate the current route of Via Orsini that does not coincide with the original route of the road of the walls, unloading the road system from the crossing traffic and enhancing the route of the “Road of the Walls of San Prosdocimo” with a tree-lined bicycle and pedestrian path.

#### **5. An inconclusive final consideration: toward new forms of sustainable governance of culture**

On the occasion of the year the European Year of Cultural Heritage, proclaimed by the European Union in 2018, EU Decision 2017/864 strongly reaffirmed that heritage in Europe was undervalued with respect to its potential as a tool/tool for value creation, skills, employment and quality of life because it lacked sustainable governance. By sustainable governance, the Commission meant “*participatory, multi-level and multi-stakeholder governance and enhanced cross-sectoral cooperation*” (EU 2018).

It reinterprets an externally relevant approach that wants to promote cultural diversity and a sense of belonging by overcoming the habit of thinking of Heritage as an artifact decontextualized from its territory and its management a matter of protection rather than design.

In fact, it is now clear that there is a need to think of cultural heritage in terms of integrated regeneration, restoring its territorial dimension and breaking down many of the walls that have arisen between the different disciplines that contribute to defining the arrangements (first and foremost urban planning but also sociology, economics, etc.).

In this approach must be integrated a push for innovation that is translated into actions aimed at renewing planning, equipping itself with updated strategic planning tools, seeking

new forms of confrontation with local communities, pursuing greater integration with other disciplinary sectors, including addressing issues of sustainability, reconverting its services, producing and offering new content. A drive that in recent years has resulted in an integrated approach to the regeneration project, characterized by multiple aspects.

A first aspect concerns the definition of a territorialization dimension of cultural heritage, that is, a dynamic process through which heritage elements, both tangible and intangible, are anchored to specific territorial and social contexts (Turri, 1998 and Dematteis, 2000). This process cannot stop at the mere spatial location of assets, but implies a profound interaction between heritage, the physical space in which it is embedded and the community that inhabits it, attributing meanings, values and collective identity to it. Territorialization transforms heritage into a local identity and development resource, influencing social practices, representations of place, and cultural and tourism enhancement strategies (Harvey, 1996). Through territorialization, heritage becomes an integral part of the cultural landscape, helping to define its uniqueness and attractiveness.

A second aspect, closely related to the first, concerns inclusion and, in general, the predisposition, in Cultural Heritage operations, to invest in social relations by achieving a sense of belonging, collective responsibility and identity. In this sense, knowing how to network is essential for all economic actors, and more so for cultural and creative ones, which are rich in initiatives but often 'poor' in financial resources. The relationships that are created-through the exchange of ideas and knowledge-provide added value and produce mutual benefits among the actors involved: in fact, the goal is to share resources, values and experiences in order to repropose them in a virtuous circle that will be self-sustaining.

Cultural and creative entities, by placing the issue of social sustainability at the center of their strategic actions, are inclined to create and consolidate collaborations and alliances on various levels (micro, meso, mega): with organizations operating within the same supply chain; with other economic actors to activate multi-sectoral synergies; with public bodies to guide policy choices. Therefore, it becomes essential to involve multiple organizations and entities of the Third Sector that, sharing the mission and goals of Agenda 2030, are directed toward sustainable development, generated by culture and aimed at future generations, which therefore act for the protection and valorization

Accessibility and enjoyment of cultural heritage are not only fundamental cultural rights, but also powerful tools for promoting social cohesion, reducing inequality, and fostering a sense of belonging. Projects and policies that aim to make cultural heritage accessible to different segments of the population, overcoming economic, physical, cognitive and cultural barriers, contribute significantly to building more inclusive and democratic societies. The valorization of the diverse cultural expressions present in an area, including the heritages of minorities and marginalized communities (Young, 1990), not only enriches the overall cultural landscape but also provides opportunities for recognition, intercultural dialogue and plural identity building, which are essential for effective social inclusion.

The relationship between cultural heritage and social inclusion is an increasingly central issue in contemporary debate, as highlighted by recent studies that emphasize the role of heritage in building more equitable and cohesive societies. Access to and participation in cultural heritage are recognized not only as cultural rights, but also as fundamental tools for promoting the inclusion of marginalized social groups and fostering intercultural dialogue: the enhancement of social heritage, which is intangible in nature and often linked to the practices and traditions of specific communities, can strengthen the sense of belonging and identity of minority groups, contributing to their social inclusion (Smith, Akagawa, 2009).

Similarly, the importance of a critical approach to the concept of heritage, taking into account the different perspectives and narratives present in a society, is highlighted in order to avoid forms of exclusion and marginalization (Harrison, 2013). In addition, heritage



management policies must be informed by principles of social justice and active community participation (Waterton, Watson, 2015) to ensure that the benefits of heritage are equitably distributed and that all citizens can feel part of their cultural heritage.

A final aspect concerns the broadening of the concept of territory itself: It is no longer a simple geographic delimitation, but a complex social and cultural space, shaped by the interactions between communities and their environment, which takes on, also through the use of information and communication technologies, an expanded strategic dimension: from real space to digital, innovative and creative space in which cultural heritage can be represented, interpreted and enjoyed. Both of these spaces can assume a fundamental role in the enhancement and enjoyment of cultural heritage, and their interaction can create new opportunities for social inclusion. For example, digital technologies can make cultural heritage accessible to people who cannot physically travel to the places where it is located, or they can foster the active participation of communities in the creation and sharing of digital content related to their heritage. However, it is important to be aware of the risks of exclusion that can result from the digitization of cultural heritage, and to adopt strategies to ensure that all citizens can access and benefit from these new opportunities.

Cultural heritage, both tangible and intangible, is an integral part of this extended territory, helping to define its identity, memory and sense of belonging: different narratives and perspectives coexist within a territory, often reflecting dynamics of power and inequality. Therefore, inclusive management of cultural heritage requires an approach that acknowledges the complexity and layering of the territory, promoting the active participation of all the communities that inhabit it.

In a very concise summary, the relationship between culture and city development is an interconnected and central issue in urban regeneration strategies. While culture defines the identity of a city and its community, its social and economic dimension is an essential element in activating resilient and sustainable urban development and regeneration processes.

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## **THE EUROPEAN CITIES: CULTURAL CHANGE FOR SUSTAINABLE CITY SPACES**

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### **Abstract**

In contemporary urban development, the evolution of cities into sustainable, green, biophilic environments is fundamental for enhancing the well-being of residents. At the heart of this transformation lies the concept of green cities, which emphasizes the integration of eco-friendly technologies and practices while fostering community engagement and preserving cultural heritage. Depending on the theoretical orientation and the scientific perception regarding what green cities are, their definition also varies. Some theorist defines the green city as "a city that is "in balance with nature", where all forms of nature - from living organisms to their habitats - are highly significant components of the urban form and part of a green infrastructure". Green cities could be seen as a metaphor for preserving existing nature while making it usable for urban residents. The "green" in the green city concept "relates to three types of environmental foci: material (such as the use of recyclable, biodegradable, environmentally neutral materials), energy (use and production of renewable energy; reduction of fossil fuels), and pollution (does not pollute or reduces pollution)". According to the concept of "green infrastructure," the model of a green city is characterized by the minimization of the negative human impact on the environment following the principles of sustainable development of the territory.

By some authors, various notions, notably, green city, eco-city, liveable city, and the smart city should be considered as an intertwining concept to mainstream sustainable development in urban areas.

**Key words:** Cultural Development, Green Cities, Innovation, Culture Ecosystem, Urban Development.

## THE IMPACT OF HERITAGE-LED URBAN REGENERATION ON DESTINATION IDENTITY AND DESTINATION MARKETING; STAKEHOLDERS’ PERSPECTIVE; THE CASE OF THE TOBACCO WAREHOUSE IN KAVALA.

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### Abstract

In Greece, urban regeneration process- especially based on industrial heritage- is not a widely adopted model. Due to the legislative framework- which more often functions as a hindrance rather than an incentive- characterizing a building as a listed one restricts automatically the means of conservation, promotion, and reuse. Furthermore, special emphasis is given in the monuments of classical antiquity, as we do not locate certain legislative framework concerning recording, conservation, preservation, protection and promotion of Greece’s Industrial heritage. At the same time, there is not systematic funding related to the conservation of listed buildings or industrial facilities and machinery that have become obsolete. Therefore, conservation, preservation, protection and promotion of Industrial Heritage and listed buildings primarily concern private ownership and initiative, as a result of mobilizing specific entities and stakeholders’ interests.

In this research, we examine the role of stakeholders in heritage-led urban regeneration process but also their contribution on shaping destination identity and promoting sustainable tourism. We focus on this subject as we locate a research gap concerning the supply side (internal stakeholders) and their role in shaping destination identity. More specifically, we will focus on the case study of Kavala, a city in Northern Greece, with a significant remnant of Industrial Heritage in the contemporary urban fabric. To achieve this, we are conducting qualitative research, addressing local and regional stakeholders involved in local government, creating local culture but also the formulation, organization, and implementation of tourism policy (DMO’s). Primary data were collected through semi-structured interviews with key stakeholders, later subject in thematic analysis, while secondary data concern mainly statistics.

Our aim is to explore and understand both the motivations and objectives behind local cultural production and tourism policy formulation, as well as to examine how the Tobacco warehouses’ regeneration will affect the perceptions and intentions of the creative clusters of Kavala benefitting socially the city, simultaneously contributing to the destination identity and sustainable tourism planning.

**Keywords:** Destination identity, heritage-led regeneration, tobacco warehouses, stakeholders, sustainable tourism

## ASSESSING THE FEASIBILITY OF PARTICIPATORY GOVERNANCE IN SUSTAINABLE TOURISM: CASE STUDY, SYROS

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### Abstract

The growing demand for sustainability in tourism presents a challenge as destinations balance tourism, local well-being, economic growth, and environmental conservation. Governance structures for sustainable tourism have drawn attention from researchers (Adebayo, 2018; Espeso-Molinero et al., 2020; Bichler, 2021; Sentanu et al., 2023), who advocate for greater community involvement in decision-making. However, achieving this requires assessing public willingness to participate, understanding of sustainability, and potential challenges. This study examines Syros, exploring local awareness of sustainability and interest in participatory governance—two factors that may determine the success of sustainability initiatives. Syros was chosen for its unique cultural heritage, a key sustainability pillar. Empirical research through interviews and a specialized questionnaire revealed barriers to participatory governance, including bureaucracy, limited awareness of sustainability's social dimensions, and insufficient knowledge of participatory methods. To address these issues, providing community education on sustainability is crucial. Addressing these challenges requires equipping the local community with greater sustainability knowledge, creating a foundation for their meaningful participation in governance models. Strengthening this foundation will enable more informed decision-making and practical solutions for long-term sustainability.

**Key Words:** Syros, Sustainability, Tourism, Cultural Heritage, Participatory Governance

### Introduction

Numerous scholars contend that community participation plays a crucial role in achieving sustainability across various destinations, whether they are huge rural areas in China, African communities such as Nquileni Village, or small Italian islands like Marettimo (Khazaei et al., 2015; Wondirad et al., 2019; Yang et al., 2019; Eyisi et al., 2021; Basile et al., 2021). However, to engage the local community effectively, it's essential to assess the governance framework, as community involvement hinges on the governance system (Bello et al. 2018; Bock et al., 2021). A phenomenon that might appear perplexing is the apparent lack of community involvement, despite the common opinion that community participation should be present. This issue is particularly notable within international organizations and associations, where such involvement is often minimal or non-existent (Kalinowski, 2020). Community participation is a highly researched topic of interest as it is believed by scholars to contribute to the responsible utilization of natural and cultural resources—This is achieved by safeguarding the economic interests of residents, respecting local heritage and intangible practices, and raising community awareness regarding the conservation of natural & cultural wealth (Wibowo, 2018; Hirsan et al., 2020; Arintoko et al., 2020; Bichler, 2021; Iqbal et al.,

2023). On the other hand, a moderate critique challenges this perception, suggesting that under certain circumstances, it may not be feasible (Bello et al., 2018; Moscardo, 2018; Reindrawati, 2023). Moreover, reviewers with even more critical perspectives propose that exclusively entrusting all decisions to local communities resembles a neoliberal approach of leaving ‘everything to the market’, potentially resulting in issues such as free riding and the tragedy of the commons (Roy, 2015; Richardson et al., 2019; Sharpley, 2023).

Drawing from this ongoing debate regarding its potential synergy with efficiency with sustainability goals, the theoretical framework centers around three key terms: Sustainability, Governance, and Community Participation. The aim is to consider how these variables might interact and impact the overall effectiveness of governance in advancing sustainability. This also involves identifying and evaluating disparities between theoretical comprehension and practical execution in engaging the local community in decision-making processes to recognize their potential influence based on the literature review. Syros, an island with significant tourism potential and renowned for its cultural heritage, has been selected as the experimental destination due to its uniqueness in the Cyclades plateau—Unlike traditional sea and summer tourism, Syros relies heavily on cultural tourism, which has emerged as a prominent cornerstone of sustainability in recent years. Ultimately, this examination seeks to determine whether participatory governance can contribute to the implementation of sustainability initiatives in the island. Previous research has primarily concentrated on the political and corporate dimensions of tourism governance, focusing on policy-making, sustainability, and corporate interests. However, there has been a significant oversight in recognizing the potential influence of local communities on decision-making processes (Bichler, 2021).

### **Understanding Participatory Governance in Sustainable Tourism**

This concept extends beyond traditional public management to address fundamental questions regarding the adaptation of democratic processes—such as citizen engagement, decision-making procedures, and administrative functions—to better serve the needs of society (Hue et al., 2022). However, its effectiveness in promoting efficiency, equity, and responsiveness in policies relies on the implementation of appropriate tools. These tools enable citizens to feel a sense of ownership in decision-making processes, allocate resources based on their priorities, needs, and preferences, and utilize their skills and knowledge effectively, the author suggests (2022).

When examining the rise of calls for participatory governance in recent decades, Bua et al. (2021) highlight how, despite rhetorical support from policymakers and global expansion, institutional mechanisms aimed at promoting social justice through the redistribution of power and wealth—such as incentives for mobilization from different sectors—were marginalized (Singha, 2025). Historically, the interest in discussing themes such as networks and community-based development emerged at the end of the 1980s, reflecting a clear manifestation against authority hierarchy (Bock et al., 2021). The focus shifted towards highlighting the role of citizen participation in enhancing the legitimacy of representative institutions by contributing to the generation of well-informed and reasoned solutions to complex issues. Secondly, despite the persistent risk of public agencies co-opting citizen input there has been a growing push from social movements for participatory institutions with significantly improved regulatory powers.

In any case, the involvement of local residents is important in the context of tourism as it contributes to democratization, ensures investments and community progress (Bichler, 2021). This implies that if the local community is not adequately engaged in both the planning process and the establishment of boundaries, there is a significant risk that the impact of



tourism could alter their communities (Thomas, 2013; Li et al., 2021). Despite this principle, in many intergovernmental organizations where local communities can have a say, civil society participation is either virtually non-existent (e.g., NATO), very limited (IMF, World Bank, WTO), or relegated to separate civil society summits (G20) Kalinowski (2020) argues. While community participation is highly encouraged in academic discourse (Lihua et al., 2020; Bichler, 2021; Magoola et al., 2023), it has not been extensively implemented in the real world. Considering the complexity of the tourism industry, which involves multiple stakeholders such as governmental bodies, private sectors, academia, and host communities, one might question whether a participatory approach is capable to when making decisions regarding tourism development for collective benefits.

In order to understand the possible involvement of the local community in the decision-making process, some examples have to be given. In 2003, Thailand adopted the “Designated Areas for Sustainable Tourism Development (DASTA)” administration, a public agency that coordinates the public and private bodies in order to have a more flexible cooperation. The outcome of this, is that system provides an avenue for increased participation, provided that the host community possesses the necessary capacity and empowerment to engage actively (Phanumat et al., 2015). In this scenario, there has been a noticeable shift towards inclusivity and participatory governance, as previously mentioned, where individuals and groups involved are now recognized as stakeholders and are expected to actively participate in evaluating various outcomes and actions (Burget et al., 2017).

However, 21 years after its implementation, the outcomes in these areas reveal spatial expansion of land use in tourism development, leading to changes in the natural landscape (Waikavee et al., 2024). The authors refer also that local governments failed to enforce their local biodiversity conservation rules in public lands, indicating that this participatory framework either did not achieve significant success or required further strengthening and modification of its role—Also, we can examine the case of South Africa (Piper et al., 2008). Spearheaded by the successes of participatory budgeting in Porto Alegre, Brazil, numerous countries in the global south have initiated comprehensive governance reforms aimed at involving citizens in public decision-making processes and ensuring better representation of historically marginalized social groups. The intention is to supplement the multi-party representative government system with a form of community participation rooted in indigenous democratic traditions. However, as evidenced by the author’s case studies, these invited spaces often fall short of their intended purpose. Rather than serving as platforms for genuine community engagement with local leaders, they frequently function merely as exercises in public relations, and in the worst-case scenario, become sites for co-optation by political elites. According to Droubi et al. (2022), when assessing South Africa's development, several factors contribute to this situation, including inadequate implementation by administrators. However, the primary reason is often cited as a lack of political commitment to community participation by political elites. As a result, public participation has been reduced to activities such as ward committees and mayoral public meetings, neither of which operates consistently or effectively, leading to their ultimate failure.

In the case of Cusco in Peru, an area of significant cultural interest, Ladkin et al., (2002) highlight several barriers impeding the community-based planning process. There is a notably mention that are some cultural barriers among the local population that hindering this process, as well as the bureaucratic obstacles. Also, local businesses, which play a significant role in tourism, often encounter bureaucratic hurdles that impede their participation in collaborative planning efforts. When examining Cusco's progress, García (2020) highlighted the shortcomings of this participatory decision-making forum. He noted that despite the group's initial strengths, its weaknesses were not ignored and became increasingly apparent over time. The significant diversity within the forum, reflected in various attitudes and debating

practices, along with an unstable equilibrium in the action-reflection dynamic, was exacerbated by a *modus operandi* that was not universally embraced.

Often, discussions in plenary sessions would extend for hours without reaching any concrete conclusions—For some, this was seen as part of the strengthening process. However, for others, it was perceived as a waste of time that led to frustration and exhaustion. For instance, one representative of the latter group expressed their concerns regarding the adoption of the Forum Cusco methodology, based on discussion and horizontal structure, as a fundamental issue and a cultural challenge as well. He argued that, while the approach initially seemed appealing, it ultimately proved ineffective. The lack of clear rules and commitments led to endless conversations without concrete outcomes. Over time, participants grew disillusioned, and the discussions became a space for airing grievances rather than making real progress. This highlights the challenge of implementing participatory governance without a structured framework to ensure efficiency and direction. Recent research by Castro-Arce et al. (2020) and Bhusal (2023) tested new frameworks aimed at addressing similar issues in Costa Rica, Australia, and Nepal, particularly focusing on conflicts and the absence of a shared vision—a challenge also observed in the case of Cusco—without significant success. Moreover, the Nepalese case study revealed that projects under participatory governance could result in complete failure, as its fundamental nature often mirrors the weaknesses of conventional top-down governance. This suggests that expecting different outcomes is unrealistic when the global framework remains unchanged—merely altering the lower echelons of the hierarchy, or ‘pawns,’ without addressing deeper structural issues.

The reasons for these failures are varied, although governance deficiencies frequently emerge as the primary cause (Ryan, 2021). Conflicts can arise when the community is overly active, but the same failure occurs when the community lacks engagement, after the initial enthusiasm. Community members became hesitant and less active in participating in the plans and programs of Barangay<sup>141</sup>, when some elected officials withdrew their support, Bussu (2022) noted. Participation during general assemblies and other community-related meetings also declined. As a result, irregularities in conducting general assemblies and purok<sup>142</sup> meetings occurred in the barangays. Elected officials proceeded to implement programs and plans with minimal community consultation, as attendance dwindled and decisions had to be made by someone, the author concludes (2022).

Certainly, there are positive examples of the successful implementation of participatory governance. Mitchell and Reid's (2001) study on Taquile Island in Peru, for instance, revealed a remarkable level of community integration, which resulted in significant socioeconomic benefits for the majority of residents over a decade of its implementation. Factors such as decision-making structures, local control or ownership, employment patterns, and resident involvement in the tourism sector all contributed to this cohesion. In contrast, neighboring Amantaní Island, which shares similar characteristics including ecosystem, population, and economy, experienced markedly different outcomes. By the mid-1990s, Taquile had transformed into a cohesive society with minimal socioeconomic disparities, characterized by widespread participation in tourism initiatives and community development efforts.

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<sup>141</sup>In the Philippines: a village, suburb, or other demarcated neighborhood; a small territorial and administrative district forming the most local level of government (source: Oxford English Dictionary)

<sup>142</sup>A purok (English: district or zone) is an informal division within a barangay in the Philippines. While not officially considered a local government unit (LGU), a purok often serves as a unit for delivering services and administration within a barangay. The purok system in the Philippines is promoted as a voluntary self-organization at the sub-village level, which strengthens community ties. Each purok leader is familiar with the households in their area, typically managing 30 to 60 families. This localized management helps provide timely and accurate assistance and improves community resilience (Source: Matthies, 2017).

Conversely, Amantaní faced social and political conflicts arising from this participatory model, with only a small minority benefiting from its economic gains (Milano et al., 2024). This stark divergence underscores the necessity of examining why these models often fail rather than succeed, and exploring the underlying reasons for this discrepancy.

### **Factors Contributing to Challenges in Participatory Governance**

In addition to obvious barriers such as bureaucracy or lack of information—factors that stem from external reasons rather than the core concept itself—there are deeper underlying causes that are interconnected with numerous distinct cases (Osmani, 2008; Turnhout et al., 2020; Escobar et al., 2022; Rahman et al., 2024). While participation efforts to expand decision-making processes to enclose a broader spectrum of voices, achieving complete inclusion is evidently unfeasible (Turnhout et al., 2020). For instance, in a destination with, say, 1000 residents, it's impractical to involve every each of 1000 individual in an inter-governmental role. Participation inevitably involves selection in determining who can participate, with some individuals recognized as relevant participants while others are excluded, leaving them voiceless and unable to express their involvement or exercise their citizenship, leading to bias or selective decisions.

Furthermore, Selart et al., (2020) suggests that the pursuit of consensus often leads to implicit pressure to conform, resulting in the suppression of diversity in perspectives. The notion of community employed in participatory processes may exacerbate this suppression by portraying local communities as uniform entities with cohesive viewpoints and objectives, thereby neglecting the intricacies involved in delineating community boundaries and interests (Rahman et al., 2024). This phenomenon, often referred to as the 'tyranny of participation', underscores the oppressive nature of certain participatory approaches a case in point is observed in China's efforts to regenerate urban heritage areas, exemplified by the case study of the Baitasi Historic District in Beijing (Wei, 2022). This approach also suppresses intra-community diversity and differences & Pre-existing commitments to achieving consensus can influence how citizens engage and what they are expected to do, risking their assimilation into the process to the extent that they lose sight of their original motivations for participating.

Participatory approaches and methods, while aiming to empower participants and represent local needs, unfortunately often end up reinforcing existing power structures and interests (Turnhout, 2010). "Participation" can often serve as a veiled disguise for maintaining the status quo: it camouflages power imbalances, glosses over differences, and allows elites to advance their own agendas, as these powerful entities can manipulate participatory processes, presenting their interests as community concerns and shaping the outcomes in their favor (Setokoe, 2020). An example illustrating the concentration of control within the influence of elites is observed in Java, Indonesia. The communities on Java Island deeply respect their leaders, and disregarding them is deemed impolite (Rizal, 2020). This situation seems to grant leaders the authority to make decisions on behalf of everyone, limiting the community's choices.

Meaningful participation hinges largely on the capabilities and skills of participants (Hegga, 2020). For instance, within the context of sustainable tourism initiatives, expecting the majority of citizens to possess scientific expertise on this issue is quite unrealistic. Someone would fairly argue that this lack of scientific knowledge among the populace may lead to uninformed decisions. Therefore, if we exclude them from the participatory process in order to have more scientific lead decisions, we undermine its integrity, reintroducing selectivity. However, neglecting this aspect risks excluding citizens lacking these skills, rendering them unable to participate meaningfully and have their voices heard. Frequently, citizens are extended invitations based on their classification as stakeholders: individuals

perceived to have a vested interest in the matter and expected to advocate for it. This preconceived notion severely restricts citizens' ability to alter their preferences and interests, posing a challenge to the aspirations of achieving consensus and collective decision-making (Escobar, 2017). Essentially, participatory approaches predispose and shape participants' roles from the outset, dictating certain subject positions and constraining their agency (Turnhout et al., 2020). It's not uncommon for participants to feel restricted by predefined methods of involvement, prompting them to frequently opt to "step off the participatory ladder." (Zakhour, 2020) This means they aim to assert their independent political stance and disrupt the planning process, seeking greater autonomy and impact on decision-making.

### **Syros: An Overview of the Island's Identity and Development**

Syros, an island with significant tourism potential and renowned for its cultural heritage, has been selected as the experimental destination due to its uniqueness in the Cyclades plateau—Unlike traditional sea and summer tourism, Syros relies heavily on cultural tourism, which has emerged as a prominent cornerstone of sustainability in recent years. Syros holds a significant place in the history of Greece, having a continuous presence since prehistoric times and passing through the hands of various civilizations such as the Minoans and the Mycenaeans. According to Cyclades Chamber of Commerce (2019), it played a crucial role as an ally of Athens in the Delian alliance during ancient times and in the Hellenistic and Roman periods, it witnessed notable development as evidenced by the discovery of coins from that era. The Byzantine era marked its conversion to Christianity, while the Venetian occupation left a lasting imprint as the island came under the rule of prominent families like the Sanoudi and Crispi, who were Dukes of the Archipelago for nearly four centuries (1204-1579). During the Ottoman era, Syros enjoyed significant privileges that contributed to its economic development. Alongside religious freedom, the island also witnessed the introduction of different religious beliefs, including the presence of Capuchins and Jesuits.

The port of Syros experienced rapid growth, transforming Ermoupolis into the largest industrial and commercial center in 19th century Greece which in turn sparked an economic miracle. This affluence is exemplified by the neoclassical mansions and edifices that grace the island, including the Ermoupolis town hall, a magnificent structure reminiscent of a royal palace, masterfully designed by Ernst Ziller (1837-1923). This blend of influences gave rise to a distinctive neoclassical architectural style that defines the island's character today. Beyond their architectural significance, these buildings embody the island's cultural essence, preserving stories, traditions, and the collective history of its inhabitants across generations. As a result, Syros became a living testament to the convergence of diverse cultural forces, reflecting a vibrant mosaic of the past that continues to captivate visitors and residents alike, as many tourists visit Syros to explore its historical landmarks and cultural sites, such as the medieval town of Ano Syros, the Ermoupolis City Hall, and the Apollon Theater.

### **Methodology**

The chosen questions emphasize two key factors: the community's understanding of sustainability concepts and their initial interest in engagement. Firstly, assessing the community's understanding of sustainability concepts and their awareness of environmental, social, and economic issues and their ability to comprehend the implications of sustainable practices. A higher level of understanding suggests a hypothesis that the community is more likely to recognize the importance of sustainability and the need for collective action to address related challenges. Secondly, evaluating the initial interest among community members reveals their willingness to actively participate in initiatives focused on

sustainability. This interest reflects the community's motivation and engagement level, indicating their readiness to contribute time, effort, and resources to collaborative efforts aimed at achieving sustainability goals.

Through the analysis of these variables, we aim to ascertain whether the participation of the local community in participatory initiatives can significantly improve the effectiveness of governance for sustainability actions, as theorized by numerous scholars. If the community demonstrates a strong understanding of sustainability concepts and a high level of initial interest, it may suggest that they are primed for active engagement and collaboration. This, in turn, suggests a second hypothesis regarding the potential for participatory initiatives to achieve greater effectiveness and impact in driving sustainable practices and outcomes in the future. Conversely, if these factors are lacking, it may indicate limited prospects for success in participatory governance.

In addition, exploring the challenges like transparency, issues with representation, accessibility, and others, as well as motivations, is an integral part of this research. It allows us to distinguish between two distinct interests: A) the interest in being involved in participatory governance for implementing sustainability in general, and B) the interest in being involved in participatory governance for implementing sustainable tourism specifically. This differentiation is crucial because e.g., motivations vary widely: some prioritize environmental concerns and envision a more sustainable future overall, while the discussion may change when the focus is solely on sustainable tourism. For those whose livelihoods depend on tourism, economic factors may be the key motivation for their involvement, as cost is often a barrier to implementing sustainable tourism practices.

To examine these variables, an online survey was conducted (September–October 2023), focusing on Perceptions of Sustainability and Participatory Governance. Respondents were assessed on their familiarity with sustainable practices, sustainable tourism concepts, and views on community participation in decision-making. Additionally, interviews were conducted in two phases (August 2023, April–May 2024) to explore attitudes toward participatory governance, sustainability knowledge, and motivations, particularly economic factors. Participants included individuals from Ermoupolis and Ano Syros, ensuring demographic diversity, with additional interviews across the island based on population distribution. Finally, it was essential to engage with three main stakeholders regarding the issue of sustainability and tourism governance. This purposive sampling approach allowed comprehensive information about the examined variables.

## **Analysis of Research Findings**

### ***i. Perceptions regarding Sustainability***

When asked to define sustainability, the majority of interviewees emphasized balancing economic development with environmental conservation. For instance, one respondent described it as "ethical exploitation" of finite resources to prevent depletion, while others critiqued capitalism's infinite growth model. Although all participants addressed environmental concerns, only a few also highlighted social dimensions, such as equity and quality of life. Regarding familiarity with sustainable practices (e.g., waste management, energy conservation, water preservation), 34.8% reported moderate familiarity, while 12.5% felt very familiar, and 22.3% were completely familiar. Conversely, 11.6% were moderately unfamiliar, 15.2% neutral, and a small percentage (3.6%) admitted to being very or completely unfamiliar. When discussing sustainable practices, **many interviewees** highlighted renewable energy (solar/wind) but noted potential ecological impacts, particularly in NATURA areas. Waste reduction, composting, recycling, and sustainable transport (e.g.,

cycling, public transit, car bans in Ermoupolis) were also frequently mentioned. Familiarity with sustainable tourism development varied: 25.9% were moderately familiar, 11.6% very familiar, and another 11.6% completely familiar. Meanwhile, 5.4% were completely unfamiliar, 10.7% very unfamiliar, and 14.3% moderately unfamiliar, with 20.5% remaining neutral. At the same time, most interviewees demonstrated a moderate to good understanding of sustainable tourism, primarily emphasizing its role in preserving natural heritage and minimizing environmental impact. However, only a few explicitly acknowledged the social dimensions, such as community well-being, cultural preservation and social equity.

**Table 1:** Age-Based Responses on Sustainable Initiatives Participation and Evaluation of Syros as a Sustainable Destination

|                                                        |       |    |   |      |       |   |   |
|--------------------------------------------------------|-------|----|---|------|-------|---|---|
| Likelihood of Participation in Sustainable initiatives | 56+   | 20 | 0 | 4.50 | 1.618 | 2 | 7 |
|                                                        | 18-25 | 20 | 0 | 5.00 | 1.461 | 2 | 7 |
|                                                        | 26-35 | 34 | 1 | 6.00 | 1.440 | 2 | 7 |
|                                                        | 36-45 | 24 | 0 | 6.00 | 0.881 | 4 | 7 |
|                                                        | 46-55 | 13 | 0 | 5    | 1.481 | 1 | 7 |
| Evaluation of Syros as sustainable destination         | 56+   | 20 | 0 | 3.00 | 0.852 | 1 | 4 |
|                                                        | 18-25 | 20 | 0 | 3.00 | 0.894 | 1 | 4 |
|                                                        | 26-35 | 34 | 1 | 4.00 | 1.163 | 1 | 7 |
|                                                        | 36-45 | 24 | 0 | 4.00 | 0.932 | 2 | 6 |
|                                                        | 46-55 | 13 | 0 | 3    | 1.266 | 1 | 6 |

*Note: The table compares the responses of participants across different age groups regarding their likelihood of participating in sustainable initiatives and their evaluation of Syros as a sustainable destination. The columns represent the sample size (N), missing, median (M), standard deviation (SD), minimum Value (Min), maximum Value (Max),*

Regarding age, there is a general trend of increasing likelihood of participation in sustainable initiatives as age decreases, with the highest median likelihood observed in the 26-35 age group. The age group 36-45 has the narrowest range of likelihood, indicating less variability in responses compared to other age groups. The age group 56+ exhibits a wider range of likelihood compared to other age groups, suggesting more diverse attitudes towards participation in sustainable initiatives among older respondents. The wider range of likelihood among older respondents indicates that within this age group, some individuals show very little interest in participating in sustainable initiatives, while others demonstrate a stronger inclination towards such efforts, surpassing the median line of interest. In terms of the evaluation of Syros as a Sustainable Destination, there is variability across different age groups, with no consistent trend observed. The age group 26-35 has the highest median evaluation, suggesting that younger respondents tend to view Syros more favorably as a sustainable destination compared to other age groups. On the other hand, the age group 46-55 has the widest range of evaluation, indicating more diverse opinions within this age group regarding Syros' sustainability.

## *ii. Perceptions regarding Participatory Governance*

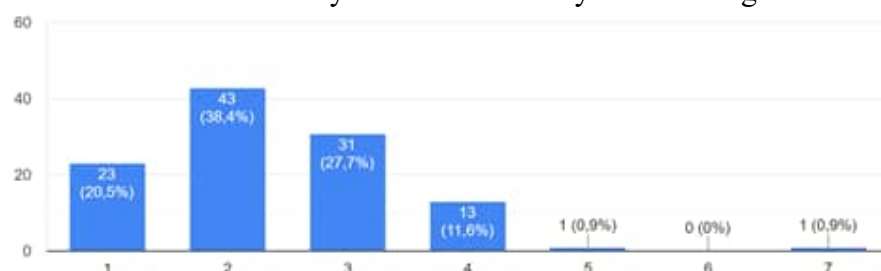
When asked about their familiarity with participatory governance, most respondents showed some level of unfamiliarity. 16 individuals (14.3%) were completely unfamiliar, another 16 (14.3%) were very unfamiliar, and 31 (27.7%) were moderately unfamiliar. In contrast, 19 (17%) were moderately familiar, 9 (8%) were very familiar, and 3 (2.7%) were completely familiar. In interviews, a slight majority correctly defined participatory governance as public involvement in decision-making, though many questioned its real-world application. When asked whether decentralization could positively impact sustainable tourism, 43 (38.4%)



believed it would, while 38 (33.9%) were uncertain, 11 (9.8%) disagreed, and 20 (17.9%) had no opinion.

Regarding community involvement in tourism decisions, 35 (31.3%) found it somewhat important, 31 (27.7%) moderately important, and 35 (31.3%) very important, showing general support for local participation. Interviews further reinforced this perspective, with the vast majority interviewees advocating for community engagement in governance. Many participants emphasized that "Locals should be involved as they experience the consequences, unlike investors," highlighting a fundamental concern for direct stakeholder impact. The sentiment reflects a broader recognition of local knowledge and firsthand experience as crucial elements in sustainable tourism governance. However, some questioned its effectiveness—one respondent argued, "I don't see how more local involvement necessarily leads to better outcomes."

**Table 2:** Assessment of Community Involvement in Syros' Planning and Development



*Note: Participants' ratings of community involvement in the planning and development of tourism in Syros, assessed on a scale ranging from 1 (very low) to 7 (very high).*

This data indicates that the majority of respondents perceived the current level of community participation in tourism planning and development on Syros to be relatively low, with a significant portion giving a rating of 1 (N=23, 20.5%), 2 (N=43, 38.4%) and 3 (N=31, 27.7%). Only a very small percentage felt that community participation was at a high level, with 13.4% rating it as 4+. Also, the interviewees expressed a similar perception, with 12 out of 15 rating <4.

When asked about their interest in participatory governance, responses varied. The majority of those interested came from the middle age group, while opinions among younger and older participants were more diverse, with some expressing pessimism. To explore potential economic motivations, participants' backgrounds in tourism were examined. Several interviewees worked in tourism or had family ties to the industry. Among them, some supported participatory governance for sustainability reasons, emphasizing environmental protection, while one saw it as beneficial for business. Outside the tourism sector, only a few participants cited economic reasons for potential involvement, with most emphasizing environmental sustainability. Among those not interested, common barriers included time constraints, lack of knowledge, and legal complexities. Work and family obligations were also mentioned, along with concerns about transportation challenges.

### *iii. Evaluation of Challenges for Community Participation*

In this section, the seven key challenges identified in the questionnaire are presented, based on participants' responses and existing literature on barriers to participatory governance. These challenges highlight the factors that discourage or prevent individuals from engaging in community decision-making processes.

A) Lack of Information and Education: A notable portion agrees on its importance, with 33 participants (29.5%) strongly agreeing and 28 (25%) agreeing, while 31 respondents (27.7%) somewhat agree. Nevertheless, a smaller fraction, including 9 participants (8%) who somewhat disagree, 3 (2.7%) who disagree, and 1 (0.9%) who strongly disagree, doesn't perceive this as a significant issue. The majority of interviewees voiced concerns about limited knowledge being a significant issue, noting that insufficient information and education can hinder effective governance decisions, suggesting a preference for decisions made by those with relevant expertise.

B) Limited Access to Information: Opinions on this challenge vary widely. A significant proportion acknowledges its importance, with 17 respondents (15.2%) strongly agreeing and 15 (13.4%) agreeing, while 24 participants (21.4%) somewhat agree. However, 35 respondents (31.3%) somewhat disagree, and 7 (6.3%) disagree, while 2 (1.8%) strongly disagree, suggesting it is not a major barrier. Most interviewees did not consider limited information a significant obstacle, with 9 out of 15 expressing this view. One participant mentioned that information is easily accessible online, suggesting it's not a barrier. Another noted it could be more challenging for older generations but emphasized that inclusion could mitigate this issue.

C) Limited Representation and Voice: The majority of participants recognize the challenge of limited representation and voice in community participation. Specifically, 19 respondents (17%) strongly agree, and 21 (18.8%) agree, with an additional 34 participants (30.4%) somewhat agreeing, indicating widespread acknowledgment of this issue. However, viewpoints varied among interviewees. Some expressed a conservative perspective, suggesting that representation is adequate; For example, one participant mentioned that representation seems sufficient because of regular elections. Conversely, 7 interviewees believed representation is insufficient, noting that despite elections, many community members' voices are still not adequately heard. Others had mixed feelings on the issue.

D) Lack of Support from Local Authorities: Respondents largely agree on the impact of this challenge. A significant portion recognizes the significance of local authorities' support, with 38 participants (33.9%) strongly agreeing and 29 (25.9%) agreeing. Another 31 respondents (27.7%) somewhat agree, highlighting a consensus on the importance of local authority support. When interviewees were asked about the issue of lack of support from local authorities, they overwhelmingly supported this statement. Stakeholders emphasized that integrating society into decision-making necessitates an improved legislative framework for local governance, as current regulations hinder effective public involvement. They argued that while more public assemblies and participatory opportunities are beneficial, genuine co-decision-making faces significant practical and legislative challenges. Achieving consensus with the entire community can lead to decision-making paralysis and jeopardize critical infrastructure projects by risking the loss of European funds due to stringent timelines.

F) Lack of Interest: This challenge elicits diverse opinions, with responses distributed across the spectrum. A noteworthy portion acknowledges its relevance. Specifically, 11 respondents (9.8%) strongly agree, and 19 (17%) agree. An additional 14 participants (12.5%) somewhat agree, indicating a moderate level of concern. However, 21 respondents (18.8%) strongly disagree, and 9 (8%) disagree, reflecting a substantial segment that doesn't view this as a significant challenge. Additionally, interviewees had very different opinions. Five of them cited it as a very important issue, while six respondents considered it relatively important to not important. The remaining respondents did not view it as important at all.

G) Lack of Time: Respondents have varied perspectives on the impact of limited time. A significant portion, 27 participants (24.1%), strongly agree on its significance. Conversely, 17 (15.2%) disagree, and 8 (7.1%) strongly disagree, indicating a notable segment that does not view time constraints as a major barrier. During interviews, opinions were divided. Many

noted the substantial workload in today's era, suggesting that a longer day might be necessary for greater participation, while others dismissed time constraints as an excuse, citing the availability of digital tools and online platforms for managing commitments efficiently.

H) Economic Interests that Hinder Community Influence: The majority of respondents believe that economic interests present a significant barrier to community influence. Specifically, 24 participants (21.4%) strongly agree, and 35 (31.3%) agree, indicating a prevailing understanding of this challenge's importance. This sentiment was echoed in the interviews with a balanced perspective. One interviewee highlighted the dominance of economic interests over community needs, suggesting that powerful corporations, especially those influenced by foreign entities, often make it difficult for local communities to succeed in initiatives. Another interviewee believed that while economic interests are significant, they don't always obstruct decisions on redevelopment, urban projects, or environmental preservation.

## **Discussion**

Numerous scholars contend that community participation plays a crucial role in achieving sustainability across various destinations. In this study, we explored the dynamics of community participation in sustainability initiatives and governance, focusing on the local context of the island of Syros. The aim was to consider how these variables might interact and impact the overall effectiveness of governance in advancing sustainability. This also involved identifying and evaluating disparities between theoretical comprehension and practical execution in engaging the local community in decision-making processes, recognizing their potential influence based on the literature review. Ultimately, this examination sought to determine whether participatory governance can enhance the realization of sustainability initiatives.

This research confirmed that both sustainable development in the tourism industry and participatory governance generates substantial debate in the academic community. This debate is not so much about their theoretical contributions -which is widely accepted- but about their realistic and practical applicability. As proof, sustainable tourism as a concept has been explored by many researchers, who seek to determine whether it is possible for a destination to be truly sustainable (Higgins-Desbiolles, 2020; Mohamadi et al., 2022; Alonso-Muñoz et al., 2022). One of the primary weaknesses and challenges lies in minimizing environmental pollution, particularly in transportation, which serves as a major source of emissions for the tourism industry—But transportation is intrinsic to tourism; it enables people to travel to various destinations and explore new experiences. However, it is essential to acknowledge that a more dynamic approach calls for incremental steps—not by challenging the whole economic system at once. These small steps, while they may not eliminate the impact, can help destinations become more environmentally and socially sustainable over time.

Regarding participatory governance, the situation is more complex than initially perceived. Despite its theoretical appeal, the concept encounters significant barriers in practical application. Theoretical analyses often advocate for community participation in decision-making processes, emphasizing its importance for democratization, conservation, preservation efforts, and particularly for decisions related to tourism projects (Hirsan et al., 2020; Arintoko et al., 2020; Bichler, 2021; De Luka et al., 2021; Zikargae et al., 2022; Magoola et al., 2023). However, in practice, participatory governance has not been extensively implemented in real-world scenarios. Some have criticized what they perceive as "the new participatory paradigm," noting that empowerment initiatives frequently result in disempowerment; in many instances, democracy becomes synonymous with conformity

(Wang et al., 2023). This implies that the issues persist over time, and viable solutions remain scarce, leading to failure many of these democratization efforts through participation before even being implemented.

There are positive examples, such as Taquile island in Peru (Mitchell et al., 2001; Milano et al., 2024), but there are also many cases where the concept did not work well due to various factors like bureaucratic barriers and lack of human resources or technocratic knowledge, as well as inherent challenges within the concept itself—These include problems with participant selection & achieving consensus. When we examine these challenges, we find that the majority of them are also applicable in Syros, as our findings indicate that while there is strong recognition of the need for community involvement in decision-making, possible participation is hindered by many reasons. For instance, political and legal factors present substantial practical challenges, primarily due to lack of transparency, bureaucratic complexities, and inconsistent enforcement of laws—issues that also were acknowledged by many scholars in distinct cases (Tosun 2000; Ladkin 2002; Piper et al., 2008; Castro-Arce et al., 2020). These challenges erode trust in the governance process and discourage community involvement, hindering the mobilization of collective action. Moreover, the lack of collaboration among stakeholders, ministries, and other parties further complicates the coordination of sustainable development efforts through this mechanism. Finally, economic factors also come into play, as individuals willing to engage in participatory governance may reconsider their stance when decisions potentially impact their interests. It's crucial to acknowledge that while traditional types of governance may face challenges related to cooperation, the integration of additional decision-making stakeholders like the community demands seamless cooperation and communication among all involved parties. Without this, the system risks collapsing prematurely.

In any case, the convergence of the hypotheses posed in the initial parts of the research suggests that the implementation of participatory governance is presently premature, owing to a variety of external and internal factors as it was demonstrated previously. It should be acknowledged, though, that participatory governance has the potential to positively impact sustainability efforts—when all the appropriate requirements are adequately met—it is crucial to acknowledge its limitations. Based on our analysis, considering participatory governance as a panacea for sustainability issues is problematic, as it alone cannot solve environmental, social, and economic challenges that the island faces at the moment, as well as future tourism-related concerns. Unpredictable factors can often undermine its efficiency, raising doubts about whether a destination can invest the necessary time and effort to realize sustainability initiatives through this framework.

Obviously, there are some limitations in our study to acknowledge. Regarding the sample representation, the residents' sample may not fully represent the entire island, as the majority of interviews were conducted during specific holiday periods and some areas, did not have participation. Therefore, the conclusions drawn from their responses cannot be considered definitive. In any case, one of the most crucial directions that require attention—based on our research findings—is the necessity for greater and broader knowledge of these issues to empower the local community in effectively managing them. An informed and educated community is undoubtedly better equipped to devise viable and innovative solutions to the island's sustainability challenges. Sustainable development principles underscore the importance of both individual and collective efforts in promoting eco-friendly choices in daily life, independent of local society's engagement in intergovernmental roles promoting sustainability.

## Conclusions

The study has meticulously explored the research questions posed in our exploratory study, aiming to provide comprehensive findings derived from survey data collected from participants on Syros Island. Sustainability, characterized by its multifaceted nature, posed a significant challenge for interviewees when tasked with defining it definitively. Reflecting the scholarly discourse (Dobson, 1996; Sharpley, 2000; Johnston et al., 2005; Castellani et al., 2010; Torres-Delgado et al., 2014; Budeanu et al., 2016; Asmelash et al., 2019), participants offered diverse perspectives rather than a singular, consensus-driven definition. Despite this diversity, there was a discernible alignment on core sustainability principles, indicating progress towards a shared understanding among community members.

The interviews & questionnaire findings revealed numerous instances of sustainable practices related to development and tourism on Syros, reflecting a generally positive community perception. However, they also uncovered instances of overconfidence in sustainability awareness, particularly concerning the neglect of essential social dimensions integral to sustainable development. Key aspects such as equality, social justice, and cultural preservation often received less attention compared to environmental and economic concerns, signaling the need for more balanced and inclusive approaches facilitated by proactive initiatives from local authorities. Regarding sustainable tourism, our findings illustrated varying levels of familiarity among community members, with most associating it predominantly with environmental conservation intertwined with economic benefits. Notably, younger generations exhibited heightened awareness and interest, likely influenced by digital media and environmental advocacy. Gender disparities in sustainability inclination were minimal, underscoring a universal commitment to environmental stewardship across diverse demographic groups.

The widespread dissatisfaction expressed by the interviewees with the current governance model underscores the complexity of finding a suitable solution. Community involvement in tourism-related decision-making processes emerged as crucial yet currently underutilized on the island. Middle-aged respondents expressed stronger support compared to younger demographics, who cited skepticism and distrust in existing systems as barriers. While there was a clear interest in participating in governmental initiatives, unfamiliarity with participatory governance mechanisms posed a significant challenge. Several barriers to effective community participation were identified, including economic dominance in decision-making, inadequate representation, and time constraints. While discussing community engagement in theory is straightforward, translating it into practice requires the presence of appropriate procedures that enable the community to participate in decision-making processes. Without these mechanisms in place, community engagement remains a theoretical concept, often used for political agendas and the legitimization of pre-established decisions.

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## THE ECONOMIC, SOCIAL AND ENVIRONMENTAL IMPACT OF SPORTS TO TOURISM IN THE CASE OF GREECE

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### Abstract

Tourism as a sector is a very important one globally. Regarding Greece, it is an even more important sector since it represents nearly 20% of its GDP. However, in recent years it has been observed a reduction in per tourist income that generates the question if there is a way or another sector that may contribute positively to the increase of this income. Moreover, if this contribution can exist within the framework of sustainability and have a positive impact to its three pillars of economy, society and environment.

The present paper investigates the impact the inclusion of sports events within the touristic package has to the overall tourism footprint of a region. Specifically, the main concern of the research is to highlight the close relationship between sports and tourism as well as whether there are benefits from this relationship to the investigated region or not from a sustainability perspective. Finally, the most important question this research seeks to find is if there is a significant economic impact to a regions tourism when sports events take place.

For the needs of the research a special questionnaire was formed. The replies of the accumulative 1503 respondents in 2024, show clearly that there is a great relationship between sports and tourism. Also, the multilateral impact of sports to tourism is being highlighted from the perspective of the tourist in Greece. Finally, the three major findings are that sports may be the means and the motive for a tourist to extend his vacations, to consider the overall touristic experience more attractive as well as to spend more money per day.

**Key words:** sports tourism, sustainable sports, tourist expenditure, economic impact

### Introduction

Tourism is an activity having its roots in ancient times and has evolved into one of the most powerful industries in the world. Since World War II, tourism has experienced explosive growth, with mass tourism dominating. Modern tourism and its aspects are the subject of many scientific concerns, as it influences but also influenced by social, economic, technological and environmental parameters being a pivotal economic sector worldwide, contributing substantially to GDP, employment, and cultural exchange. This article provides an in-depth analysis of the importance of tourism while examines the issues of declining tourist spending and seasonality, exploring ways alternative tourism can enhance the appeal of mainland Greece. All proposed solutions are considered within the framework of sustainable development, ensuring positive impacts on the economy, society, and the environment.

Some of the most important issues that concern the international scientific community are overtourism, climate change and others. Regarding Sustainability and Overtourism (Dodds and Butler 2019, Butler and Dodds 2022), mass tourism in popular destinations has caused environmental and social issues (Anuar et al. 2019, Koens et al. 2018, Mihalic 2020). The

excessive concentration of tourists causes pressure on local infrastructure, leading to environmental degradation (loss of natural landscapes, pollution, increased waste). It disrupts local communities, increasing the cost of living and creating social tensions (Slyusarevskyy et al. 2021, Thelen 1969). It requires the adoption of management policies, such as imposing visitor caps, diversifying tourism products and strengthening sustainable tourism (Hardy et al. 2002, Weaver 2006, Panagiotopoulos et al. 2022a, Panagiotopoulos et al. 2022b). Climate Change also affects tourism directly due to the rising temperatures, extreme weather conditions and rising of sea levels. Some destinations face significant challenges due to changing climate conditions, while the need for resilient and adaptive strategies, such as diversifying tourism products and shifting to alternative forms of tourism, is increasing.

In the case of Greece, the tourism industry is one of the most important sectors of the economy, with its contribution to GDP (nearly 18%) being particularly high (Statista 2025) while supporting various industries. It provides employment to nearly 946,000 individuals, making it a pillar of economic stability with the major economic and touristic activity to be seen mainly in coastal towns, islands, and cultural heritage sites. Most visitors come from Europe (UNWTO 2025, INSETE 2024a) and show growing numbers over the latest years but decreasing numbers in overnight stays. Overall, the level of tourist satisfaction is 9,1/10 (INSETE 2024b).

However, there are several concerns and challenges regarding tourism in the country, both at an economic, social and environmental level, with overtourism and its environmental impacts being the most prevalent. Such conditions are the cause for overcrowded places of interest (mainly some islands), reaching the touristic and environmental threshold (if not transcend it), diminishing the environment enhancing pollution having as a result the significant degradation in visitors' and residents' experience. Other challenges, such as the reduction in income per tourist and seasonality with most visitors arriving between June and September, have raised concerns about the sector's long-term sustainability despite increasing tourist arrivals in absolute numbers. Specifically, in 2021 the average spending was 702€ per day for 8,9 nights, in 2022 was 620€ for 7,8 nights, in 2023 was 603€ for 7,0 nights and finally in 2024 the average daily spending per tourist was 590€ while staying for less than 7 nights, at least in the first semester of the year (INSETE 2024a).

Greece is facing intense overtourism phenomena, especially in popular destinations such as Santorini, Mykonos and Rhodes (Lagarias et al. 2023, Sarantakou and Terkenli 2021, Panousi and Petrakos 2021). The main problems that arise are, a) the excessive burden on infrastructure, as the available facilities (roads, sewage systems, hospitals) cannot serve the huge number of visitors, especially in the summer months, b) the destruction of the natural environment, such as excessive water and energy consumption on the islands, coastal erosion and the accumulation of waste and c) the increase in the cost of living for permanent residents, as the large tourist development leads to a surge in the prices of real estate and basic goods. In addition to these, its rich cultural heritage is being compromised through the degradation of archaeological sites due to mass tourism (e.g., Acropolis, Delphi, Knossos). The main reason is the commercialization of Greek cultural identity and the imbalance between tourism development and the preservation of cultural monuments.

Some solutions that have been proposed in recent years to halt these phenomena are the implementation of visitor caps in certain destinations, the promotion of sustainable tourism practices (e.g., reduction of plastic waste, use of renewable energy sources) and the decentralization of tourism development to lesser-known destinations in order to reduce pressure on the islands (Lagarias et al. 2023, Sarantakou and Terkenli 2021, Panousi and Petrakos 2021). Other solutions could be developing winter tourism by investing in ski resorts, thermal spas, and mountain retreats to attract visitors in colder months and fight seasonality. Promoting conference and business tourism by hosting international conventions, exhibitions,

and corporate retreats all year or enhancing accessibility to off-peak destinations by strengthening transportation links to less-visited areas and advertising its potential to encourage balanced tourism distribution. Finally, another way to increase tourism income and promote stable tourism is by encouraging digital nomad tourism (Zerva et al. 2023) by attracting remote workers who can contribute to the economy throughout the year by offering long-term stays in significant scenic locations. These proposals may be able to combat the seasonality that characterizes tourism in Greece as well as the regional imbalance in the tourism economy.

### **The importance of sports tourism**

The Greek tourism industry is mainly based on summer tourism, which creates economic imbalances with high dependence on the summer period (June-September) as well as increased needs for seasonal work and unstable employment conditions. Solutions proposed by studies (Dalir 2024, Alshuqaiqi 2019) are a) the development of alternative forms of tourism (agritourism, conference tourism, cultural tourism) in order to strengthen tourist traffic outside the summer season, while simultaneously strengthening winter tourism (mountain tourism, skiing, ecotourism), b) creating incentives for tourism development in less developed areas and c) extending tourist period by developing several events at the start or the end of that period. Mainland Greece holds vast tourism potential that remains largely unexploited. Alternative tourism such as sport tourism (including adventure tourism, and wellness retreats), eco-tourism, agrotourism and other forms can make inland destinations significantly more attractive (Moradi et al. 2023, Moularde and Weaver 2018, Moradi et al. 2025). Offering authentic cultural immersive experiences beyond traditional tourist hotspots, enhancing Greece's competitiveness by differentiating from neighboring countries through niche tourism offerings and promoting local gastronomy and wine tourism by highlighting regional cuisine and wine-making traditions as key tourism attractions are three ways to benefit mainland regions. However, sport tourism may be the key form of alternative tourism in order to deal with all of the problems and peculiarities mentioned above. Sports activities and events play a crucial role in enhancing tourism, contributing significantly to both the economy and the sustainable development of various regions. Sporting events, both large and small (Panagiotopoulos 2024, Cave and Leader 2003, Gibson, et al. 2003), attract visitors, boost local economies, and create opportunities for sustainable development.

The problems of tourism in Greece mentioned above seem to be addressable through alternative ways of tourism and efforts to increase the preference for agrotourism, ecotourism and motives for tourists to travel to less crowded destinations. Another way to address those problems, may be the development of new tourism models, such as "digital nomadism" (Zerva et al. 2023), where workers combine teleworking and tourism. It is mainly needed a shift in demand from traditional mass tourism and traditional overcrowded destinations towards more personalized experiences and specialized forms of tourism, with sports tourism being one of the most important sectors of alternative tourism. Sport Tourism, globally consists almost 10% of total tourism according to UNWTO (<https://www.unwto.org/sport-tourism>), aims to different target groups, is a form of sustainable way of tourism (Panagiotopoulos et al. 2022b), contributes to all 3 pillars of sustainable development (Panagiotopoulos et al. 2022a), tends to bring more money per tourist compared to conventional tourism and there are several sports both summer and winter to cover all 12 months in demand. From purely economic perspective, sports tourism already contributes to more than 2% to European GDP (E.C. 2017). Sports tourism combines the movement of people along with sports activities and has developed into a dynamic sector with economic, social and environmental impacts (Sudarmanto et al. 2025, Panagiotopoulos et al. 2022b)

being a form of sustainable tourism that satisfies current needs without compromising future tourism potential. The concept of sports tourism emerged in the 1970s, when the connection between tourism and sports began to be studied systematically. Gammon and Robinson (1997) highlight five main reasons for the development of sports tourism:

1. The increase in the popularity of sporting events.
2. The importance of sports activity for health.
3. The recognition of sport as a tool for cultural and diplomatic connection between countries.
4. Improving the organization and management of sporting events at a global level.
5. The facilitation of movement due to technological progress.

Sports tourism contributes significantly to a country's economy, generating income from tickets, accommodation, catering and local businesses (Rossini et al. 2024). At the same time, it strengthens social cohesion (Çiftci 2025, Moustakas 2023, Hudelist et al. 2025), promotes a healthy lifestyle (Campillo-Sánchez et al. 2025) and facilitates cultural exchange (Sudarmanto et al. 2025). Therefore, sports tourism is a lever for promoting sustainability, contributing 12,5% positively to all 3 pillars of sustainable development, specifically in 12 out of 96 U.N. indicators of 2007 (Panagiotopoulos 2022a). Modern trends in tourism reveal the need for sports activities during the tourism period, with respect for the natural environment, such as hiking, cycling, eco-friendly water sports and others. In addition, the ever-increasing use of renewable energy sources in sports facilities and the trend to reduce the environmental footprint of sports events, contribute to the long-term preservation of the touristic product, characterizing it as sustainable. The contribution of tourism to global GDP (10%) is remarkable (WTTC 2024), with countries such as Greece (18% of GDP) relying on it as a key economic pillar while major sporting events attract visitors, create jobs and influence investments in infrastructure (Rossini et al. 2024). Similarly, on a social level, the promotion of sports as part of tourism activities enhances the quality of life of citizens (Li and Ling 2025, Vlassas 2025) and is often a tool for social integration and cultural exchange. This, along with many other interesting facts, are pinpointed by an empirical research conducted on a random sample of 1503 tourists in Greece analyzed below.

## **The research**

In order to determine the degree of active sports participation of tourists during their holidays and whether they include exercise in their tourism habits as well as the factors that shape an attractive tourist destination according to them, an empirical survey was conducted among tourists in Greece. Among other things, main questions concern economic trends, cultural aspects as parallel actions and environmental concerns in tourism. Data collection involved surveys assessing tourists' travel motivations, participation in sports, and spending patterns. The results were analyzed using statistical methods (SPSS) to identify significant correlations, shifts in preferences and shaping tourism consumer profiles. The research concerns the triptych sports-tourism-sustainable development and the correlation among them, particularly how travelers perceive and engage with sports activities while visiting destinations. The findings aim to provide insights into how sports tourism contributes to economic growth, social well-being, and environmental sustainability. For this reason, a specially designed structured questionnaire concerning tourists of Greece was designed consisted of 31 questions and 69 variables. The analysis showed very good reliability with Cronbach's  $A > 0,81$ .

From the sample of 1503 respondents, 51% were men and 49% were women. The 78% declared their place of residence as Greece, while 22% live abroad. The 58% of the respondents were in the age groups from 23 to 40 years, while a 74,9% were graduates of higher education and holders of a master's degree. Regarding their income, 49.4% declared an



annual income from 8,000€ to 25 thousand euros. The specific percentages regarding the demographic characteristics of the sample are shown on the figures below.



### Travel and Tourism Preferences

During tourism in Greece, 37.3% of respondents stay for 5 to 7 days, while regarding the frequency of trips, 41.4% of respondents answered with a moderate frequency and an average of 3.07 for a mean value of 3. The main reason for their trip, and for the 64.2% of them, is relaxation and recreation. However, in terms of average duration per purpose of travel, a significant correlation appears ( $F=25.372$  with  $p\text{-value}<0.01$ ), with business reasons (3,54), sports activities (3,32) and visiting monuments (3,25) showing the highest averages and greater than the mean value of 3, as shown in the image below (Figure 1).



Figure 1 Main reason for travel

The respondents stated that tourist destinations should provide, as a priority, an unaltered natural environment (67%), sports opportunities (57%), the possibility of visiting museums-temple-monuments (55.7%), cultural activities (43%) and nightlife (37.4%). The respondents stated that during their holidays they most often visit seaside resorts and beaches (Av. 4.21) and quiet places of natural beauty (Av. 3.71). Regarding the behavior of the respondents during their holidays, their attitude was positive in all the variables of the question, with their interest increasing more or less in all 6 variables with a stronger tendency in contact with the environment (Av. 4,80), in the quality of food (Av. 4,74) and visiting museums/monuments (Av. 4,56) (Figure 2). It is noted that 79.4% of respondents stated that there is a high probability of them visiting a place again if they have had a previous satisfactory experience.

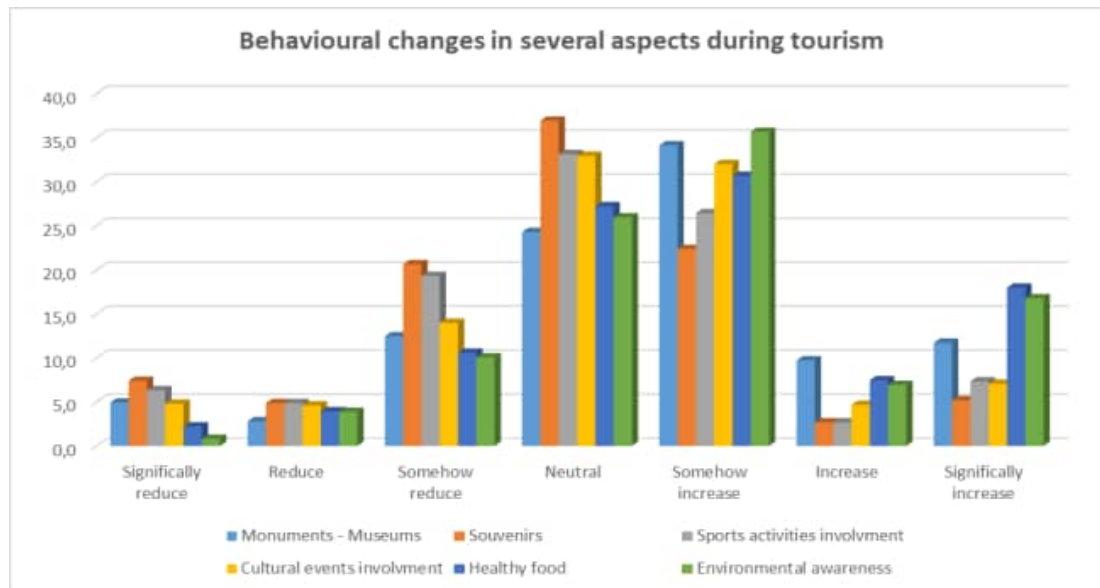


Figure 2 Behavioral changes in several aspects during tourism

### Tourism in Greece

Regarding tourism in Greece, the vast majority of respondents (56%) stated that they prefer the island regions. For the 15th question regarding the duration of tourism in Greece, 45.7% of respondents stay in Greece for at least 8 days, 37.3% stay 5 to 7 days and 17% up to 4 days (Figure3). Regarding the sectors that should be changed and resources should be provided in order to increase the potential of Greece as a tourist destination, their attitude is particularly positive (answers quite a lot) for all sectors. Recreational activities and nature stand out with an average of 4.10 and the exploitation of the country's monuments and museums with 3.93, followed by the remaining sectors with averages ranging from 3.74 to 3.83.

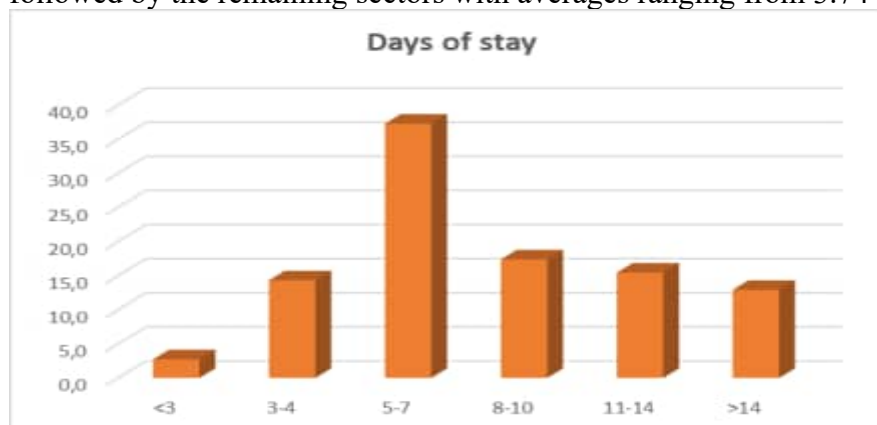


Figure 3 Average days tourism in Greece last

An important element is the relationship between the time respondents spend on tourism and certain variables, thus outlining the profile of this group of respondents. Specifically, a significant correlation ( $P < 0.01$ ) is shown with a) the frequency of travel (P.C. 0,214), b) their interest in food quality and healthy eating (P.C. 0,135), c) the perception that sports related to tourism (P.C. 0,132), d) the interest in sports activities during their vacations (P.C. 0,089) and e) visiting a place again (P.C. 0,097). At the same time, it is related to age, income and education.

### Tourism and Sports

Regarding the respondents' involvement in sports life and sports in general, 74% of respondents stated that they are involved in sports as athletes or at least as sports fans. The attendance of sports matches moderately to daily concerns the 34.1% while the 56.2% (values 0 to 4) does not attending sports matches often. In the question "What sports do you attend sports matches for?", 41.1% of respondents attend everything, with 27.3% preferring football and basketball, 12.7% other team sports and 18,9% individual sports.

Regarding the relationship of respondents with sports and tourism activities, there are the following findings. Respondents participate in sports activities during their travels at a rate of 42.3% with moderate to high frequency and 57.6% a little or not at all (options 1 and 2). The 65.2% are interested in the existence of the possibility of participating in sports activities while 34.8% are not interested at all or are minimally interested (options 1 and 2) (Figure4). By correlating these 2 variables, it is clearly observed that the more frequently respondents participate in a sports activity during their travels, the more interested they are in being provided with the opportunity to participate in sports activities during them. The frequency of respondents' participation in sports activities, even as spectators, during their travels, is related to the intensity of their interest in participation. There is a clear positive correlation between interest and participation (Pearson  $r = 0.490$  with  $p\text{-value} = 0.00$ ).

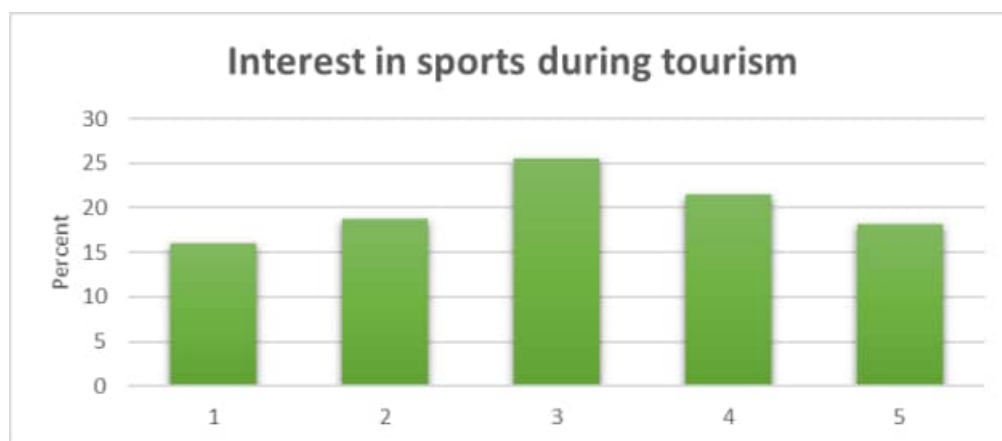


Figure 4 Interest in sports activities during tourism

The 46% of respondents stated that they had attended a sporting event during their vacation in the last 3 years, while 54% had not. The correlation between the frequency of respondents' participation in sporting activities, even as spectators, during their travels and their statement that they had actually attended a sporting event during their vacation in the last 3 years (Pearson  $X^2 = 129.639$  with  $p\text{-value} < 0.01$ ). The form of the correlation is depicted in the image below (Figure 5).

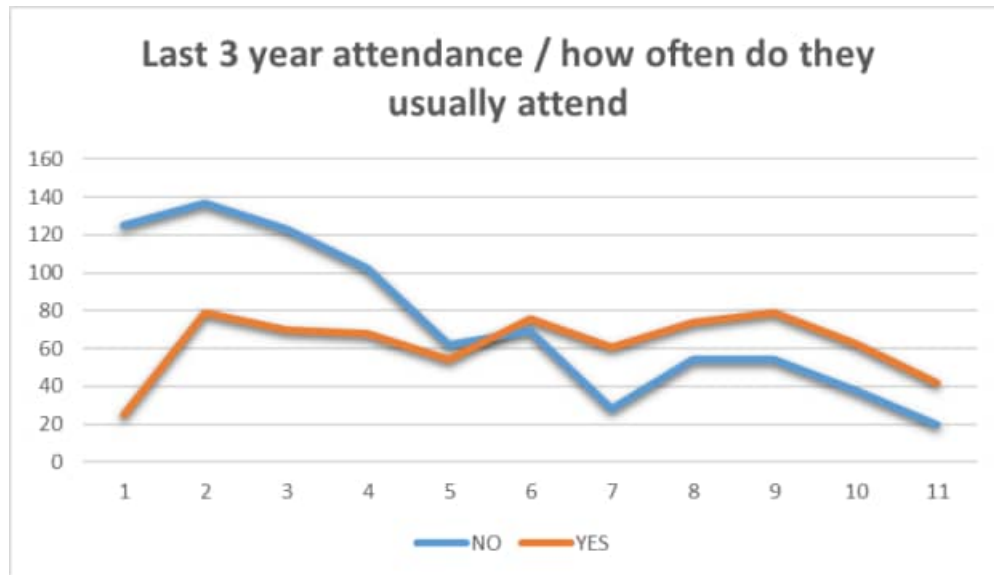


Figure 5 Last 3-year attendance compared to how often do they usually attend

The profile of those who have attended a sporting event during their vacation in the last 3 years, which differentiates them from those who have not had this experience, is summarized as: a) they travel more frequently, b) watch sports matches more often, c) are more interested in and participate in sports activities during their trips more often, d) choose their tourist destination by giving importance to the inclusion of sports facilities in the tourist package, e) would visit a country on the occasion of watching a major sports event, f) consider sports as a motivation for holidays in Greece, g) believe that sports provide a more attractive package for choosing a country as a destination, h) participate more in cultural events during their holidays, i) are more interested in having organized sports activities in the area they visit, j) believe that tourism is combined with sports activity, k) state that they would visit a place again if they had already had a satisfactory experience, l) are willing to spend more money in a hotel that is suitable for sports activities and m) have linked exercise with tourism to a greater extent. At the same time, male residents abroad with higher incomes appear to have higher averages without particularly significant differences.

Regarding the degree of connection between tourism and sports, 16.7% answered not at all, 30.7% a little, 30.1% found a moderate connection and 22.6% a positive connection (16.5% a lot and 6.0% an absolute connection). 80.2% of respondents believe that sports in any form contribute to the development of a place, compared to 0.9% who disagree.

The results of the two questions above document the relevance of the connection between sports and tourism with the belief that sports contribute to the development of a place (Pearson correlation =0.264 with p-value =0.00), in contrast to those who do not know whether sports contribute positively to the development of a place. It is necessary to outline the profile of those who believe that sports contribute to the development of a place and account for the 83.3% of the sample. It is noted that this audience is a "target" and most of the associations recorded in this group appear to similarly associated with the group analyzed earlier and concerns those who participated in sports activities during their travels within the last 3 years. In summary, those who state that sports contribute to the development of a place compared to the group that answered "I don't know" since only 14 respondents answered "no", it appears that: a) they travel more frequently, b) watch sports matches more often, c) participate in sports activities during their travels more often and are more interested in having the opportunity to participate, d) choose their tourist destination by giving importance to the inclusion of sports facilities in the tourist package, e) would visit a country on the

occasion of watching a major sports event, f ) consider sports as a motivation during their holidays in Greece, g) believe that sports provide a more attractive package for choosing a country as a destination, h) participate more in cultural events and visit monuments during their holidays, i) are more interested in having organized sports activities in the area they visit, j) believe that tourism is combined with sports activity, k ) state that they would visit a place again if they had already had a satisfactory experience, l ) are willing to spend more money in a hotel that is suitable for sports activities, m ) have linked exercise with tourism to a greater extent and n ) their interest in souvenir shopping, visiting museums, engaging in activities, healthy eating and contact with the environment during their vacations increases significantly. At the same time, regarding the demographic characteristics of this group, the profile with a significance of  $P < 0.01$  fits a man, aged 32 to 40, of higher educational level without income being a criterion, although the class 35,001€ - 45,000€ presents a lower average compared to the others.

A significant percentage of 87.0% (Figure 6) would spend more money to stay near a facility that is suitable for exercise or a sports experience, while 13.0% would not, with the dominant choice being "up to €7" and "up to €21" with the percentage of 17.9% and 17% of the sample respectively. A significant correlation is found between this specific question and the ones below, as shown in Figure 7.

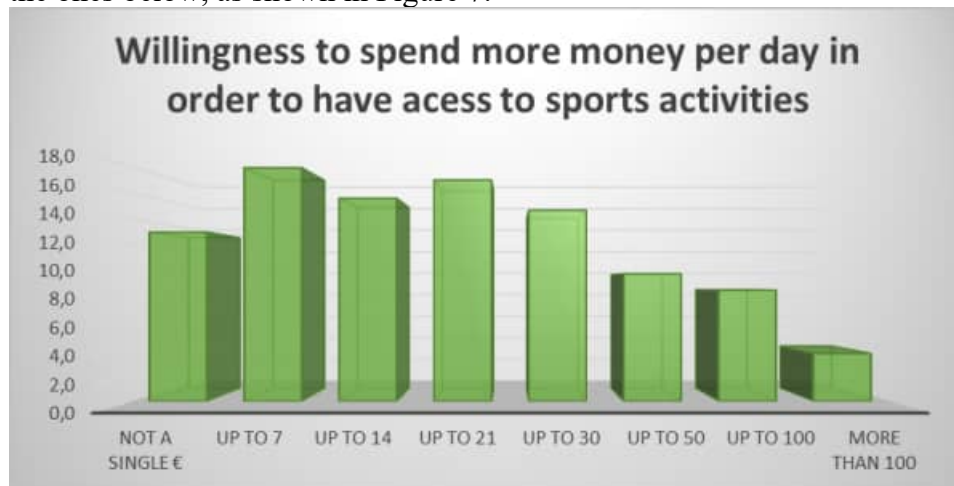


Figure 6 More money spending for a facility that is suitable for exercise or a sports experience

The profile of those who are willing to spend more money in a hotel (per stay / per day), if this is appropriate for exercise or a sports experience, is related to a positive tendency for the following: a) to travel more frequently, b) to attend sports competitions, c) to participate in sports activities during their travels and to be more interested in having the opportunity to participate, d) to give importance to sports benefits in the tourist package, e) to visit a country on the occasion of attending a major sports event, f ) to consider sports as a motivation during their holidays in Greece, g) to believe that sports provide a more attractive package for choosing a country as a destination, h) to participate more in cultural events during their holidays, i) to be more interested in the existence of organized sports activities in the area they visit, j) to state that they would visit a place again if they had already had a satisfactory experience, k ) to associate sports with tourism to a greater extent and l ) their interest in engaging in sports activities and buying increases. At the same time, as the intention to spend more increases, their annual family income and educational level seem to increase accordingly.

| How much more money would you spend on a hotel (per stay / per day) if it was suitable for exercise or a sports experience?           |            |         |
|---------------------------------------------------------------------------------------------------------------------------------------|------------|---------|
|                                                                                                                                       | Pearson Co | P value |
| How often do you travel?                                                                                                              | 0,174      | 0,000   |
| How often do you watch sports matches?                                                                                                | 0,167      | 0,000   |
| How often do you participate as an athlete or even as a spectator in a sporting activity during your travels, even if only by chance? | 0,185      | 0,000   |
| In the destination you visit, to what extent are you interested in being given the opportunity to participate in a sporting activity? | 0,207      | 0,000   |
| How important are sports facilities in your holiday package for you when choosing a tourist destination?                              | 0,275      | 0,000   |
| To what extent would you visit a country with the aim of watching a major sporting                                                    | 0,234      | 0,000   |
| When you travel to Greece, do you consider sports/exercise to be a motivation for you?                                                | 0,269      | 0,000   |
| Do you believe that sports provide a more attractive tourist package for choosing a country as a destination?                         | 0,229      | 0,000   |
| 18.4 Cultural events and events                                                                                                       | 0,116      | 0,000   |
| 19.3 Sports facilities and sports facilities                                                                                          | 0,196      | 0,000   |
| How interested would you be in having organized sports activities in the wider area of the place you are visiting?                    | 0,327      | 0,000   |
| Do the facilities for exercise and sports in Greece meet your needs as a tourist?                                                     | 0,082      | 0,002   |
| How likely is it for you to visit a place again if you are satisfied?                                                                 | 0,174      | 0,000   |
| To what extent have you linked tourism activity with sports (or sports and exercise with tourism)?                                    | 0,319      | 0,000   |
| Is there an increasing interest in visiting museums?                                                                                  | -0,081     | 0,002   |
| Is there an increasing interest in shopping?                                                                                          | 0,081      | 0,002   |
| Is there an increasing interest in engaging in sports activities?                                                                     | 0,147      | 0,000   |
| Is there an increasing interest in eating healthy?                                                                                    | -0,056     | 0,000   |
| Is there an increasing interest in caring for and interacting with nature?                                                            | -0,067     | 0,006   |
| What is the range of your total annual family income in €?                                                                            | 0,216      | 0,000   |
| What is the highest level of education you have completed?                                                                            | 0,094      | 0,000   |

Figure 7 The profile of those who are willing to spend more money in a hotel (per stay / per day), if this is appropriate for exercise or a sports experience

Important findings that were not presented individually are the following questions of the questionnaire that are presented briefly. Sports services within the holiday package regarding the choice of tourist destination are an important factor for 27.1%, 22.5% consider them to be of moderate importance, while 26.5 consider them to be of minor importance and 23,8% not at all an important factor in the choice. A major sports event could be a reason for traveling to another country for 41.8% of the sample, while 21.6% maintain a neutral attitude towards this factor, with 36.5% stating that it is not a reason for traveling (definitely not 17.6% and probably not 18.9%). Sports/exercise is a strong motivation for 18.8% of the sample when traveling to Greece, 31.3% maintain a neutral attitude answering the median while the 29,6% consider it a minimal motivation and the 20,2% of respondents have a negative attitude. Through sports, a more attractive tourist package is provided for choosing a country as a destination according to 39.5% of the sample (quite a lot 25.3%, absolutely 14.2%), to a moderate extent according to 30%, and slightly the 20.3%, while 10.2% do not believe the above statement at all. An important element regarding the tourists' willingness to do sports is presented in question 20 where 79.4% of the sample has a particular interest in the existence of organized sports activities in the wider area of the place they are visiting (Figure 8). The last question, which was not presented individually, relates to the satisfaction or not of tourists



with the existed state of the facilities for exercise and sports in Greece. 8.5% of the sample stated that they were not at all satisfied, 25.3% a little, while 42% described moderate satisfaction. On the contrary, 17,1% of respondents seemed quite satisfied and 7.1% expressed absolute satisfaction.

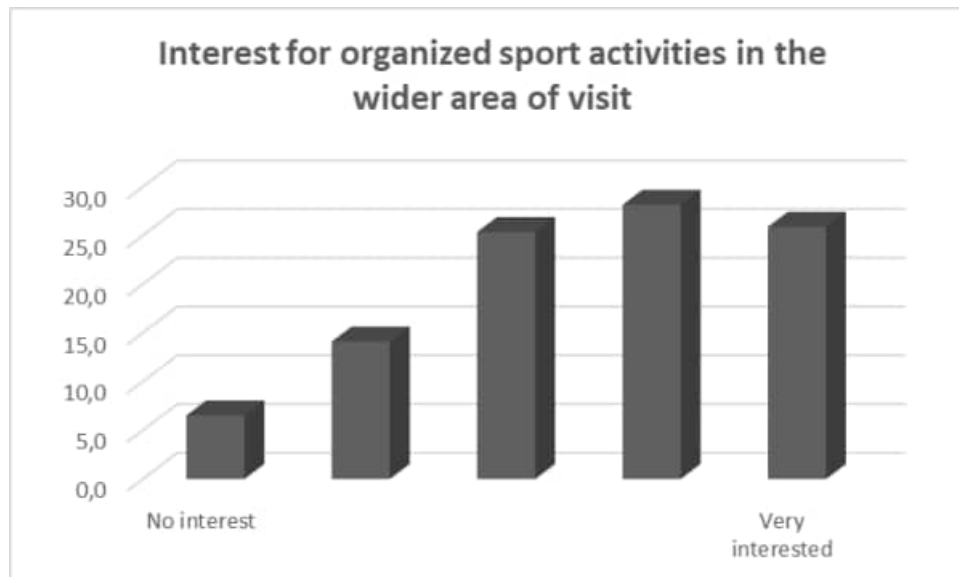


Figure 8 Interest for organized sports activities in the wider area of the place of visit

Finally, a significant correlation of great importance is the finding that the more often tourists travel the more often they tend to watch sports matches, the more interested they are in having the opportunity to participate in sports activities. Also, sports are a motivation for them when they travel to Greece. The more often they travel, the longer their vacations last, etc. Additionally, there are five significant tourist profiles that can be outlined:

- Those taking longer vacations ( $P < 0.05$ ), show a significant correlation with:
  - a) the frequency they travel, b) their interest in sports activities on their vacations, c) their interest in food quality and healthy eating
- Those who have attended a sporting event during their travels within the last three years ( $P < 0.05$ ):
  - a) travel more often, b) participate in sports activities during their trips more often, c) would visit a country on the occasion of watching a major sporting event, d) consider sports as a motivation for holidays in Greece, e) participate more in cultural events during their holidays. Male residents from abroad with higher income.
- Those who believe that sport contributes to the development of a place (80,2%) they tend more often to:
  - a) watch sports, b) participate in sports activities during their travels and are interested in the possibility of participating, c) visit a country for the purpose of watching a major sporting event. The profile with significance  $P < 0.05$  fits to a man, aged 32 to 40, of higher educational level.
- Those who would spend more money on accommodation suitable for a sports experience (87%):
  - a) participate in sports activities during their travels b) visit a country to watch a major sporting event, c) consider sports as a motivation during their holidays in Greece, d) would visit a place again if they had already had a satisfactory experience, etc.
- Those traveling for relaxation and recreation (64.2%):

They are highly likely to revisit a place they are satisfied with, they have an increased interest in organized sports activities at the place of visit, they would visit a country in order to attend a major sports event and they believe that sports provide a more attractive tourist holiday package.

### **Summarized findings and other correlations**

The overall impact of sport to tourism seems to be great with significant contribution in several aspects. Most important finding consist the fact that sports indeed have a major impact on tourism concerning economic, social and environmental aspects. Regarding the economy, the research showed that it can contribute positively since 87% of respondents are willing to spend more money in order to stay in an accommodation that is suitable for sports activities, while they consider exercise as a motivation for travel and at the same time show a strong interest in sports facilities and a general tendency to participate in organized sports activities. Also, a major sports event is by itself a motivation for tourism in another country for more and more tourists (63,5% moderate to high), which constitutes a statement that major sports events may stimulate the economy through an increase of incoming tourism. An important element of this statement is that it is significantly related to special interest groups such as those who travel for relaxation and recreation (>50%), groups with higher incomes, residents of abroad, and people who travel more frequently.

In addition to the above, it also appeared that sports may contribute to the social aspect of tourism by spreading culture, exchanging customs and traditions of people as well as shaping education. The research showed that tourists who are more interested in sports activities and sports facilities during their trip tend to travel more and have a particular interest in attending cultural events and visiting monuments and museums in the place they visit. Also, these groups tend to be of a higher income class and spend more money on sports facilities, which makes them a target group from the perspective of tourism. However, in addition to the above, these categories of tourists are also more interested in healthy nutrition and environmental protection. Most of the respondents said that what they seek from a tourist destination is the unaltered natural environment, which they seem to have the intention to protect, something that indicate the potential contribution of sports to the environment, its safeguarding and protection. In addition, there is an increase in tourists' interest during their travels to contact with nature and caring for the environment, for the quality of food, for visiting monuments and museums, attending cultural events, buying souvenirs and engaging in sports activities. They also believe that a tourist destination should have an unaltered natural environment, opportunities for sports as well as cultural attractions such as monuments and museums. It is therefore concluded that there is a contribution of sports to tourism, concerning all three pillars of sustainable development, the economy, society and the environment.

Some significant summarized findings are:

- The tourism-sports relationship has a greater connection in the consciousness of younger age groups and higher educational levels.
- The more sports/exercise is a motivation for the respondents to take a vacation, the more the amounts they are willing to spend on an accommodation suitable for sports activities.
- Tourists are increasingly prioritizing destinations that offer structured sports experiences while seeking destinations that provide safe, outdoor sporting opportunities.
- Tourists show an increased interest in destinations that offer eco-friendly sports activities and maintain natural environments.

- The tendency for health-conscious and active vacations has significantly increased.
- Participation in sports activities during tourism concerns more than 65%.
- Through sports, a more attractive tourist package is provided for 69,5%, while the 79,4% shows interest in the existence of organized sports activities in the wider area of the place they are visiting.
- Those who participate in sports activities during tourism in parts of Greece plan long-term vacations and spend more money in order to be close to facilities that provide sports opportunities.

## Conclusions and Perspectives

Sports tourism is a dynamic and growing sector of tourism, with significant economic, social and environmental impacts. Its exploitation as a strategic tool for economic and regional development is crucial, especially for countries with a rich sporting and cultural tradition, such as Greece. The development of structured, targeted and frequent promotion of Greece's tourism products in alternative destinations as well as the integration of sustainable practices are essential elements for the strengthening of sports tourism and the preservation of the Greek tourism industry in the future through the creation of sustainable and attractive tourist destinations suitable for sporting activities.

The prospects for sports tourism are extremely positive, as the global demand for sports and physical activity during holidays is constantly increasing (Li and Ling 2025, Vlassas 2025). Countries that invest in the development of sports facilities, in improving infrastructure and in promoting special sports tourism packages tend to benefit both economically and socially (Panagiotopoulos 2022b). Finally, the integration of sustainable practices in sports tourism and tourism in general ensures long-term benefits and income, while protecting the natural and cultural environment of tourist destinations.

Specifically, the impact of sports to tourism is of paramount importance with:

- **Contribution to the economy:** 87% are willing to spend more money to stay in accommodation suitable for sports activities, show a general tendency to participate, and consider exercise as a motivation for travel.
- **Contribution to culture:** Those who are more interested in sporting activities on their trips travel more and tend to show interest in cultural events and visiting monuments and museums.
- **Contribution to the environment:** Those who are most interested in sports activities are also interested in healthy eating, environmental protection and contact with nature.

According to all the above, there is a suggestion for tourism stakeholders to design of tourist packages combined with sports activities, as a pole of attraction for incoming tourism who is willing to extend their vacations as well as their financial expenses. Providing a higher quality tourism product, focused on sports activities, may encourage travelers to return to the same destination. The great desire of tourists for sporting activities during their holidays and travels could be a springboard to exploit the potential of Greece's individual areas that are suitable for various sporting activities aiming to seasonality reduction. Finally, it may be a good investment in various sports such as motorsports or mountain sports that attract specific target groups who are willing to spend more per day for such experiences in order to maximize the income from tourism while maintaining the incoming tourist numbers. This study highlights the need for destinations to invest in high-quality sports facilities, organize competitive sporting events, and adopt eco-friendly tourism initiatives. Tourism development

strategies should consider the rising demand for sports-related experiences, integrating them with environmental sustainability in order to achieve sustainable regional development.

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## **DEVELOPMENT OF ALTERNATIVE FORMS OF TOURISM IN THE ISLAND REGION OF THE MUNICIPALITY OF WEST SAMOS**

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### **Abstract**

This paper focuses on the development of sustainable tourism in Western Samos, analysing the natural, cultural and religious resources of the island. The aim is to propose the promotion of alternative forms of tourism that have the potential to contribute to the economic development of the region without harming the environment and the local community. The island, with its rich natural resources and its rich cultural fabric, is ideal for the development of alternative forms of tourism such as wine and religious tourism. Activities such as hiking on nature trails, visiting traditional wineries and exploring historic monasteries can attract visitors seeking authentic experiences. In order to successfully implement this plan, actions such as the creation of organised routes, training of guides and promotion of the local product are proposed. In this way, West Samos can strengthen the local economy, protect the environment and preserve its cultural heritage.

**Keywords:** sustainability, tourism, alternative tourism, religious tourism, Samos, tradition, local economy

## **THE FORMATION OF THE PHYSIOGNOMY OF THE CITY OF NAFPAKTOS**

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### **Abstract**

The present paper refers to the physiognomy of the city and is a study. The aim is to investigate the factors that contribute to the formation of this physiognomy and the opinion of residents and visitors on the issues in question. As a case study, the city of Nafpaktos of the Region of West Greece is chosen.

In order to answer the main questions of the work and to investigate the main factors that shape the physiognomy of the city of Nafpaktos a survey was carried out aimed at the residents of and visitors to the city. For the needs of the research, a questionnaire was created which included (10) closed-type structured response questions, was anonymous and distributed to 187 people. The research was carried out in the months of October and November 2024. The questionnaire was addressed exclusively to adults, aged 18 to 65

The paper concludes with interesting conclusions and proposals. An important conclusion is that in order to protect the special physiognomy of the city of Nafpaktos strategies related to the more general protection of all issues related to its sustainable development should be implemented. It is proposed that both the local government, as well as the businesses of all service and production branches, work towards the protection and highlighting of the special character of the city of Nafpaktos

**Key words:** Physiognomy of the city, sustainable development, the city Nafpaktos

Pre-organised Special Session:

**“Cities Physiognomy”**

***Organized and chaired by Joseph Stefanou & Roido Mitoula***

## THE FORMATION OF THE PHYSIOGNOMY OF THE CITY OF HERAKLION IN CRETE ISLAND. THE OPINION OF RESIDENTS AND VISITORS.

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### Abstract

This thesis is a study on the elements that constitute the identity of a region, specifically the city of Heraklion, located in the Island of Crete. It examines the combination of various factors that contribute to the perception of Heraklion's identity. At the same time, it highlights concerns regarding the erosion of Heraklion's identity and identifies the sectors where government structures should focus to strengthen them, thereby shaping the path toward sustainable development. The implementation of state structures and education promoting a new ideology and perception can lead to the preservation of the region's identity. The primary driving force is the well-being of the people who interact daily with the city, as the purpose of all research and "sustainable" plans is the protection of the city's identity in relation to the balance between economic, social, and environmental aspects of human life.

**Keywords:** identity, culture, sustainable development, society, environment, Heraklion.

### Introduction

The identity of cities is one of the most critical factors for understanding their social, economic, and cultural essence. This concept expresses the city's identity by combining its character with the emotional and ideological impressions it leaves on residents and visitors. Interpreting a city's identity requires studying multiple parameters such as the natural environment, customs, traditions, and its history.

During this analysis, it is essential to understand how these factors are reflected in people's daily lives and how they are expressed or utilized in social and cultural activities. The unique aesthetic of each place is a key feature of its identity. However, with globalization, this uniqueness often diminishes, as cities tend to adopt common characteristics, leading to homogenization.

This thesis focuses on the identity of Heraklion, examining the factors influencing it, such as the natural environment, social and cultural characteristics, and historical background. Additionally, it analyzes residents' perceptions of their city and explores the possibility of reversing the trend of globalization to preserve local identities. Sustainable development through renewable energy sources, the need for stable social and economic structures, and the protection of both the natural and socio-cultural environment form the central pillars of this approach.

Through research conducted on 214 individuals, the comparison between bibliographic research and real-life perceptions of residents reveals the true image of Heraklion's identity, leading to conclusions regarding the city's prospects in a rapidly changing world and the actions required to maintain its uniqueness within globalization.

## **Description of the City – Geographical Definition**

The city of Heraklion is the largest and most densely populated city in Crete. It serves as the capital of the Regional Unit of Heraklion and is the fourth-largest city in Greece. Located on the northern coast of Crete, at the edge of the Gulf of Heraklion, the city holds exceptional strategic and geographical significance, evident since the Minoan era when it served as the port of the Knossos palace. Heraklion is deeply connected to the island's history and cultural heritage while also functioning as a central commercial, administrative, and tourist hub for all of Crete.

Regarding its geographical position, Heraklion is situated on a small plain surrounded by hills and mountains. It is located 80 kilometres from Rethymno and 81 kilometres from Lassithi, while the distance from Athens is approximately 300 kilometers. Its geographical location makes it ideal for connectivity with other regions of Greece and abroad, explaining its crucial role in the country's transportation network (Karetsou, 2008). Additionally, its direct access to the East and Egypt has historically made it a key point for transit trade, a fact demonstrated throughout its history.

The natural landscape around Heraklion combines coastal and mountainous elements. The city stretches along the coast of the Gulf of Heraklion, overlooking the Aegean Sea, maintaining a strong connection with the sea, which is a major driver of economic activity through its port. The Gulf of Heraklion serves as a natural harbour, supporting not only maritime transport but also boosting the region's rapidly growing tourism sector in recent years. (Rackham, 2004)

The port of Heraklion is one of the most significant in Crete and Greece overall, as it is a primary link between the island and the rest of the country, as well as international destinations. It is the largest port in Crete and connects to Athens, Piraeus, Rhodes, Santorini, and other tourist destinations and it is widely known as the "Royal Harbor," while it facilitates both passenger and commercial activities, serving the shipping and tourism industries, which are among the city's primary economic sectors. (Karetsou, 2008)

Heraklion is surrounded by the "Psiloritis" mountain range and the mountains of Crete, forming a natural barrier that gives the city a distinct local character. The inland area of Heraklion is filled with plains and vineyards, while the climate is typically Mediterranean, characterized by mild winters and hot, dry summers, which favor agriculture and tourism development, and benefits the city from the abundant sunshine and favorable weather conditions, making it ideal for outdoor activities and tourism. (Andriotis, Papadakis, 2023)

Heraklion's geographical position, natural environment, and infrastructure make it one of the most important hubs in Crete and one of the most dynamic urban destinations in Greece. With its strategic location, the city combines tourism development with agricultural activities (agritourism) while preserving elements of Cretan identity. This identity is shaped by the diverse cultures that have influenced the region over time, leaving their mark on various aspects of life.

## **Geophysical Culture of the City of Heraklion**

The geophysical culture of Heraklion is an intriguing combination of geological, geographical, and cultural factors that shape the city's natural and cultural identity. As mentioned earlier, Heraklion's location in Crete is of great significance, as its geological and geophysical structure has influenced both its development and architectural heritage. The city is situated in an area with high seismic activity, which has played a crucial role in shaping its growth potential. At the same time, its unique geomorphological features have contributed to the formation of its landscape and infrastructure.

From a geological perspective, Heraklion lies on carbonate formations, with seismic activity playing a decisive role in its historical evolution. A notable example is the severe earthquake of 1856, which left only 18 out of 3,620 houses habitable (Starida, 2014). Similar natural disasters and earthquakes are recorded throughout Heraklion's history, leaving an indelible mark on the city's urban structure. (Papadopoulos, 2011).

Additionally, Heraklion's coastal front, particularly its port, is affected by geological processes such as coastal erosion and rising sea levels. According to studies (Doukakis, 2004), these processes impact the city's commercial and maritime activities, which have been a significant factor in its economic development from antiquity to the present day (though with diminished influence in modern times). The port of Heraklion, which has been a center of trade and shipping for centuries, remains a vital point for the city despite the natural challenges it faces.

The city's cultural heritage is closely linked to the geophysical characteristics of the region. Knossos, located just 5 kilometers from Heraklion, is one of the most important archaeological sites in Crete and the world. The architecture of the palace takes advantage of the area's natural geomorphology. The Minoans, as noted by Evans (1921) (Evans, 1921), utilized Heraklion's geographical position to construct the famous palace of Knossos, which is directly connected to the landscape and climate of the region. The city's development during the Venetian and Ottoman periods was also influenced by its geological characteristics, with the construction of its walls and port incorporating the topographical particularities of the area (Kizilaslan, 2011).

In modern times, Heraklion's continuous development necessitates the management of geological and geophysical factors to ensure the city's sustainability and safety. Papadopoulos (Papadopoulos 2011) highlights the importance of the geological resilience of buildings and infrastructure, emphasizing the need for strategies to protect against earthquakes and other natural disasters. Advances in modern technology and geological studies now provide tools to upgrade infrastructure, aiming to enhance Heraklion's resilience to natural catastrophes.

The preservation and promotion of Heraklion's cultural heritage extend beyond restoring historical monuments. Sustainable urban development must also take into account geophysical conditions and climate change. The interaction between geology and culture is a crucial area for research and practical approaches to the future of Heraklion.

## **History of the City**

The history of Heraklion is rich in cultural, historical, and archaeological elements, reflecting its evolution from antiquity to the modern era. The region has been inhabited since prehistoric times, with the most well-known settlement being the area surrounding the Palace of Knossos. Knossos was the center of Minoan civilization, extending its influence beyond Crete. It was a highly developed city, as evidenced by artifacts such as Minoan pottery found in Egypt, indicating active trade relations. (Archaeological museum of Heraklion, 2024)

During the Roman and Byzantine periods, Heraklion saw the construction of numerous churches based on Byzantine ecclesiastical architecture. However, one of the most significant historical periods for the city was the Venetian era, lasting nearly four centuries, from 1212 to 1669. The Venetians conquered Crete, established their own administration, and exerted a strong cultural influence, transforming Heraklion into one of the most important cities in the Mediterranean. During this time, the city was called "Candia" (later "Rabdh al-Khandaq," meaning "Fortress of the Moat") (Tzobanaki, Chrysoula (2012)), and its development was remarkable. The Venetians expanded the port, built the imposing "Koules Fortress", and constructed many buildings and churches, boosting both trade and maritime activities. Their presence left an indelible mark on the city, with Venetian gates, castles, and architectural



monuments still standing today (Karetsou, 2008). Even the Cretan dialect retains numerous Venetian words that became part of everyday speech over time.

Following the siege of Heraklion and its surrender to the Ottomans in 1669, the city came under Ottoman rule. This period was also significant for Heraklion's development, as the Ottomans constructed mosques and public buildings, often converting existing structures for their own use. The Ottomans maintained the name Candia (Rabdh al-Khandaq) and developed infrastructure that reinforced the city as a political and religious center of Crete. (Karetsou, 2008)

During the 19th century, Heraklion became the focal point of Cretan uprisings, culminating in the 1866 Revolution and the island's liberation from the Ottoman Empire in 1898. From that point onward, Heraklion experienced rapid growth, leading to significant urban expansion and the development of modern infrastructure. The city embraced its island identity and officially became part of the Greek state in 1913. (Andriotis, Papadakis, 2023)

Today, Heraklion's monuments, spanning from the Minoan era to the Venetian and Ottoman periods, remain key attractions for visitors. Museums such as the Heraklion Archaeological Museum and the Natural History Museum of Crete continue to highlight the region's cultural heritage. The city's historic center is filled with archaeological sites and landmarks that showcase its long history and the influence of various civilizations in shaping Heraklion's identity. However, in today's globalized world, the visibility of this rich culture and historical legacy is often overshadowed by modernization.

## **The Culture of the City of Heraklion**

The culture of Heraklion is deeply rooted in the history and traditions of Crete, blending ancient elements with the influences of successive conquerors and cultural movements that have shaped the island over time. From antiquity to the present day, the city maintains a rich cultural heritage, expressed through its institutions, customs, traditions, literature, music, and gastronomy.

Heraklion is home to significant cultural institutions that preserve and promote the island's history and artistic traditions. Notably, the Heraklion Archaeological Museum houses exceptional collections from the Minoan period, while the Natural History Museum of Crete (Xanthoudidis, 1981). Offers unique exhibitions on the island's natural environment. Additionally, the Center for Cretan Literature supports contemporary Cretan literary and artistic expression.

The customs and traditions of Heraklion are deeply connected to Crete's historical and cultural legacy. Religious celebrations, such as festivals dedicated to Saint Titus and Saint Minas, are major events, while traditional practices like "rakokazanemata" (raki distillation gatherings) remain popular. Cretan music, dances, and songs—including the pentozali, syrtos, and kastrinos maleviziotis—continue to be an integral part of social life.

Heraklion has played a crucial role in the development of Cretan literature and poetry. Notable figures include Nikos Kazantzakis and Vincenzo Kornaros, the latter known for his renowned works *Erofilo* and *Erotokritos*. Kazantzakis, in particular, influenced modern Cretan thought and literature (Karetsou, 2008), addressing universal values, human struggles, and spiritual quests in his works. His legacy is honored in Heraklion, where his tomb is located on the Venetian walls. Today, the city continues to inspire contemporary writers and poets who draw from its history and traditions.

The gastronomy of Heraklion is another key cultural expression. Traditional Cretan dishes, such as pork with stamnagathi (wild greens), "boutia" (slow-cooked lamb), rabbit stifado, and snails, reflect the island's rich culinary heritage. Pastries like "bougatsa" and "baklava" remain popular, while the traditional Cretan raki is an essential part of every

celebration and social gathering. Many traditional Cretan dishes also incorporate influences from Ottoman and Asia Minor cuisine, such as various pies and dolmades. (Karetsou, 2008)

Overall, Heraklion's culture is a unique blend of traditions, artistic influences, and historical heritage that remains interwoven with everyday life. The city continues to be a vibrant cultural hub while preserving and promoting its Cretan identity on both a local and international level.

### **The Architectural Heritage of the City of Heraklion**

The architectural heritage of the city of Heraklion is exceptionally rich and diverse, combining elements from antiquity, the Venetian period, the Ottoman era, and modern times. Ancient architecture in Heraklion is primarily linked to the Minoan and Hellenistic periods. Although archaeological findings from the ancient city of Heraklion are limited, significant remnants exist from ancient Knossos, located near the city. The Minoan Palace of Knossos, with its famous Minoan frescoes and palace buildings, has greatly influenced the architectural perception of the region and the wider area of Crete.

During the Venetian period (1212–1669), the city developed with significant fortifications and public buildings. The most characteristic architectural element of this era is the Venetian Walls, which enclose the city and remain visible in many places. Another notable structure is the Koules Fortress, an imposing castle protecting the city's harbor. The Venetian gates, such as Chaniá Gate and Kommeno Benteni, as well as the layout of the squares and narrow streets, reflect the necessities of the time. For instance, Chaniá Gate served as a key connection between the city and its surroundings and played a crucial role in the planning and placement of the Venetian walls around Heraklion. (Xanthoudidis, 1981).

Following the Venetians, the Ottoman period (1669–1898) introduced architectural elements such as mosques, madrasas (Islamic schools), and fountains, often built on existing Venetian structures. At the same time, the city retained many Ottoman-style houses, characterized by heavy wooden windows and narrow courtyards. (Karetsou, 2008)

In modern times, the city has developed a range of neoclassical buildings, particularly around the city center, combining traditional Cretan architectural elements with Western influences from contemporary architecture. (Andriotis, Papadakis, 2023)

The architectural heritage of Heraklion is a living testament to the various cultural influences that have shaped the city, with each era's elements intertwining to create the architectural landscape we recognize today. However, one must ask: Is this heritage truly appreciated, and how does the state protect and preserve it? Below is an article from the Cretan newspaper Patris regarding a historical monument, an Ottoman remnant, the Konaki of Bey Sekeria:

**Article from *Patris* newspaper, March 20, 2024:**

*"Finally, the Konaki of Bey Sekeria in Heraklion, located on Apokoronou Street, is being restored and repurposed. As seen in the photos, the new owner is preparing luxury suites and a wellness space."*



*Photo from an article from Patris newspaper, March 20, 2024 depicting the “Konaki of Bey Sekeria”*

This raises the question: How is this heritage being utilized, and who benefits from such renovations that may destroy the existing legacy?

**Notable Figures of the City of Heraklion**

The notable figures of Heraklion, both historical and contemporary, have played a crucial role in shaping the city's identity, strengthening its cultural, social, and political character. From antiquity to the present day, Heraklion has produced significant personalities who have contributed to its development in various fields.

One of Heraklion's most famous residents is Nikos Kazantzakis. His works, such as *Zorba the Greek*, along with his philosophical writings, have left an indelible mark on both the city and the country. Kazantzakis' connection to Heraklion is deeply rooted in local culture. His grave, located on the Venetian Walls, and the museum dedicated to his life and work serve as central landmarks of the city.



Another prominent artist associated with Heraklion is Doménikos Theotokópoulos, known as El Greco (N. Panagiotakis 1987). Born in Heraklion in 1541, during the city's Venetian rule, El Greco became one of the most important figures of the Renaissance. His early training in painting and iconography took place in Heraklion, significantly influencing his artistic development. The city acknowledges El Greco's cultural significance and honors his memory through exhibitions and events showcasing his work and Cretan heritage.

*Photo of the famous statue in the center of Heraklion depicting:*

*“Kazantzakis, Kornaros and El Greco”*

In politics and society, figures like Eleftherios Venizelos—though born in Chania—had a profound impact on Crete and Heraklion, leading efforts during the unification of Crete with Greece. His political legacy remains influential, and today, his statue stands in front of Eleftheria Square, the city's central square, reflecting his importance to Heraklion. (Argyropoulos, 2017)

In contemporary times, artists such as musicians Thanasis Papakonstantinou, Vasilis Papakonstantinou, and Miltos Paschalidis continue to shape Heraklion's cultural life through their music, reinforcing the city's status as a hub of artistic expression.

Thus, Heraklion's identity is shaped through these historical and modern personalities, giving the city a multidimensional character that blends tradition with contemporary creativity.

### **Concentrators of the city's physiognomy**

Concentrators of the city's physiognomy refer to spaces and areas that, through the concentration of human, social, cultural, and economic activities, reflect the image and identity of the city. These concentrators are vital for the city's function and development, as they concentrate energy and generate social and cultural dynamics that define Heraklion's character.

The most prominent concentrators is the historic center, which includes landmarks such as the Venetian Walls, Liberty Square, and the Koules Fortress, all of which serve as key references for Heraklion's historical and cultural identity. The historic buildings and museums in the center house part of the city's cultural wealth and attract both locals and visitors, highlighting Heraklion's cultural heritage.

Another important concentrator is the Port of Heraklion, a major economic and commercial hub for Crete and Greece. At the same time, the port has a strong tourism function, serving as a gateway for thousands of visitors each year, further emphasizing the strategic significance of the Koules Fortress and the city's potential for cultural and heritage promotion.

Similarly, the city's historic center and traditional markets, such as the Heraklion Market and Daskalogiannis Square, serve as hubs that connect society and the economy. Markets and

commercial areas boost urban activity by providing spaces for trade, social interaction, and daily life. This vibrant commercial life and the diversity of shops attract both residents and visitors, bridging traditional commerce with modern business activity.

Overall, Heraklion's concentrators —historic, cultural, commercial, and public spaces— are integral to understanding the city's identity, making it a living organism with rich social and cultural dimensions.

### **The Surrounding Environment of the City**

Crete, and consequently the city of Heraklion, is characterized by its deep connection with nature and the beauty of its natural environment, which blends harmoniously with urban elements. The region features a variety of landscapes, from coastal areas to mountainous zones, while the northern coast of the island, with the Cretan Sea, offers a unique natural setting for both residents and visitors. At the same time, Crete's rich flora and fauna, along with its natural resources, struggle to integrate with the city's extensive urbanization. Heraklion's geographic location, rapid development, monuments, and archaeological sites coexist with the modern urban fabric. However, one could argue that these natural beauties are somewhat hidden beneath the intense urban appearance of the city.

Significant efforts have been made in recent years to protect the environment and redevelop urban areas. However, Heraklion continues to face challenges from population growth, pollution, and urban sprawl, often without adequate spatial and environmental planning. The expansion of public spaces and the enhancement of green areas are essential for improving the quality of life and preserving the city's natural and cultural environment. Integrating sustainable practices in resource management and urban development is a key goal for the city's future. (Karetsou, 2008)

Ultimately, the region surrounding Heraklion combines natural wealth with historical heritage but also faces the modern challenge of urbanization. Addressing this requires a strong strategy for sustainable development and the protection of urban resources.

### **Institutional Framework for the Protection of the City of Heraklion**

The institutional framework for the protection of the city of Heraklion includes a series of laws, decrees, and strategies aimed at preserving cultural heritage, protecting the environment, and ensuring the city's sustainable development. Heraklion is a city of particular interest at both national and international levels, as its monuments are part of UNESCO's World Heritage network. Additionally, the city was recognized by UNESCO as a "Creative City of Gastronomy" in October 2023. (Municipality of Heraklion, 2023)

The protection of Heraklion's cultural heritage is governed by the country's general institutional framework, including Law 3028/2002 on the Protection of Antiquities and Cultural Heritage (Gazette, 2002). This law establishes the obligation to safeguard archaeological sites and monuments from any form of destruction or alteration. Furthermore, the revised Spatial Framework of the Region of Crete, approved on November 8, 2017, along with its Strategic Environmental Impact Assessment, aims to ensure sustainable development while respecting both the natural and cultural environment. Consequently, the role of archaeological services and the Ministry of Culture is crucial in implementing these policies. At the same time, the local authorities of Heraklion, in collaboration with relevant institutions, must manage the protection and promotion of the city's historic center.

As stated in Law 3028, Government Gazette A 153/28-6-2002:(Gazette, 1986)

"The cultural heritage of the country, from antiquity to the present day, is subject to protection under the provisions of this law. The purpose of this protection is to preserve

historical memory and enhance the cultural environment for present and future generations. The national cultural heritage includes cultural assets located within Greek territory, including territorial waters and other maritime areas under Greek jurisdiction according to international law. Cultural heritage also includes intangible cultural heritage. Within the framework of international law, the Greek state also guarantees the protection of cultural assets that have been removed from Greek territory. Additionally, the Greek state ensures the protection of cultural assets historically linked to Greece, regardless of their location."

At the same time, the institutional framework for protection includes environmental measures, such as Law 1650/1986 on Environmental Protection, which influences urban planning and development activities in the region to safeguard natural resources and ensure residents' quality of life. Gradually, urban landscape redevelopment policies are incorporating environmental criteria to mitigate the effects of urbanization. (Gazette, 1986)

Additionally, as the largest urban center in Crete, Heraklion is at the center of significant spatial and urban interventions. Below is a list of Government Gazette (ΦΕΚ) publications related to the city's planning and development, providing a framework for action:

- The General Framework for Spatial Planning and Sustainable Development, which includes urban development and infrastructure, such as port maintenance, tourism enhancement, and natural resource protection. (Gazette, 128/A/2008)
- The Special Framework for Spatial Planning of Renewable Energy Sources (RES), which addresses the siting of RES projects to reduce dependence on conventional fuels and enhance energy sustainability. (Gazette, 2464/B/2008)
- Law 4759/2020: Reform of Spatial and Urban Planning Legislation, which introduces modernized interventions in spatial management, impacting Heraklion on multiple levels. (Gazette<sup>245/A/2020</sup>)

In conclusion, the institutional framework for the protection of Heraklion integrates cultural heritage preservation with contemporary urban development needs through detailed legislative regulations and strategic plans. However, the successful implementation of these measures depends on the smooth collaboration between local authorities, archaeological and environmental services, and civil society.

### **The Economy of Heraklion (Primary, Secondary, and Tertiary Sectors)**

As the largest and most developed city in Crete, Heraklion's economy is based on a combination of sectors covering all stages of production, including the primary, secondary, and tertiary sectors. These sectors work together to strengthen the local economy and improve the standard of living.

#### ***Primary Sector***

Heraklion's primary sector consists of agriculture, livestock farming, and fishing. Despite industrialization and the growth of the tertiary sector, it remains significant. Crete, and particularly the Heraklion region, is known for producing high-quality agricultural products such as olive oil, wine, fruits, and vegetables. Olive cultivation is the most important sector, with Crete being one of the world's largest olive oil producers. Additionally, livestock farming and dairy production—including products like feta and graviera cheese, which are PDO-certified—contribute significantly to the local economy due to high demand. Fishing, though on a smaller scale, remains an important economic activity, particularly in Heraklion's coastal areas. A characteristic example can be seen at Heraklion's port, where fishermen are still a visible presence. (Skordalaki, 2011)



### Secondary Sector

The secondary sector in Heraklion includes food and beverage manufacturing, the chemical industry, and construction. The food and beverage industry, particularly olive oil processing, is the most developed activity in this sector. Crete, and especially Heraklion, is a center for food production and processing (e.g., rusks, dairy products) with international reach, contributing to job creation and the region’s export activities. Additionally, the construction industry is significant, driven by infrastructure projects supporting tourism and urbanization. The growth is revealed by the statistics given by ELSTAT as follows: (ELSTAT, 2018)

|                                   | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 |
|-----------------------------------|------|------|------|------|------|------|------|
| Ισοζύγιο δευτερογενών εισοδημάτων | 0.0  | 0.2  | -0.5 | -0.1 | -0.4 | -0.8 | -0.7 |
| Ισοζύγιο πρωτογενών εισοδημάτων   | -1.3 | -1.9 | -2.8 | -3.1 | -2.8 | -2.5 | -3.2 |

### Third Sector

The services sector is the most developed part of Heraklion’s economy, mainly due to tourism, which serves as the primary driver of the city's economic activity. Heraklion attracts thousands of visitors each year, drawn by its historical monuments and natural beauty. Tourism supports other service sectors such as catering, transportation, and commerce. Besides tourism, the third sector includes public administration, education, and healthcare, which provide essential jobs and support the city’s functioning (EOT, 2003). However, these services require strong governmental support to maintain expected performance levels.

Overall, while the third sector dominates, the primary and secondary sectors still play a crucial role in Heraklion’s economic production and development. However, their significance is overshadowed by the dominance of services. For Heraklion to remain sustainable, greater support for the primary and secondary sectors is necessary. This raises an important question: how can a city sustain itself when its main economic sector—tourism—is not stable?

### EU-Funded Projects

As part of sustainable development, the European Union funds major infrastructure and development projects aimed at enhancing sustainability, environmental protection, and citizens' quality of life (ΕΣΠΑ 2021-2027). Below are some key projects implemented through EU funding:

- **Upgrading Heraklion Port:** This project involves improving port infrastructure, developing new services, and enhancing maritime and tourism activity. The works include modernizing piers, developing logistics systems, and improving energy efficiency.
- **Upgrading Venizeleio Hospital (ESPA Program):** This includes modernizing hospital facilities, acquiring new medical equipment, and improving healthcare services, with a focus on strengthening public healthcare and enhancing the quality of medical care.
- **Creation and Expansion of a Bicycle Lane Network:** This project promotes sustainable mobility, reduces traffic congestion, and enhances transport safety by constructing new bicycle lanes and upgrading the existing network, connecting key city areas like universities, commercial districts, and the coastal zone. (European Commission - Green Deal 2022-2026)

- **Waste Management Strategy:** This involves creating and upgrading waste processing and management infrastructure through modern recycling and composting technologies, reducing Heraklion’s environmental footprint and promoting a circular economy. (Region of Crete 2020-2025)
- **Cultural Heritage Protection Programs:** These support the restoration and maintenance of historical monuments such as Koules Fortress and other Venetian and Ottoman buildings in Heraklion. Additionally, they fund cultural heritage digitization and educational initiatives. (Ministry of Culture and Sport 2021-2026)
- **Development of Digital Infrastructure and Broadband Connectivity:** This project improves digital connectivity in the city by expanding high-speed broadband networks and providing citizens with access to digital services, boosting the local economy and e-governance. (Digital Strategy of Greece 2020-2030)
- **Water Supply and Sewerage Network Improvements:** This project involves replacing outdated pipelines, reducing water losses, and enhancing drinking water quality, along with upgrading the sewage system to protect the environment and reduce pollution. (ΔΕΥΑ Heraklion)
- **Sustainable Urban Development Plan (SUAP):** This initiative includes the redevelopment of public spaces, pedestrianization of central areas, development of green infrastructure, and improving accessibility for people with disabilities, aiming to enhance residents' quality of life and create a more environmentally friendly urban landscape. (Municipality of Heraklion - ΣΒΑΑ)

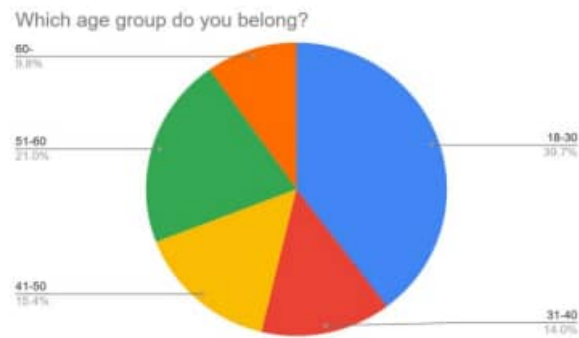
In conclusion, EU-funded projects shape the future of Heraklion, supporting sustainable development, cultural heritage preservation, and social cohesion. Their implementation improves residents' quality of life and strengthens the city’s competitiveness at national and international levels.

## Field Research

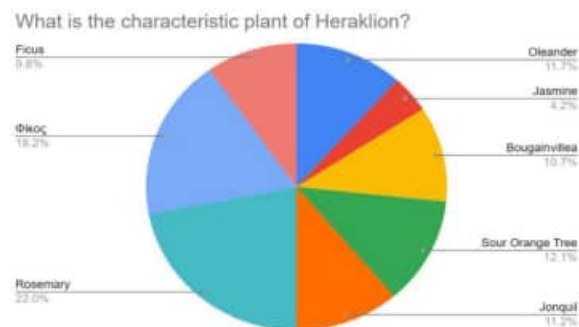
As part of this study, field research was conducted among residents and visitors of Heraklion to collect data regarding their perception of the city's identity and all the factors that contribute to it. Specifically, the questionnaire included six closed-ended questions and two open-ended questions and was answered by 214 participants. The responses to the open-ended questions were categorized to provide statistical insights. The questions posed are detailed below, accompanied by the relevant charts:

| Questions asked:                                                                                |
|-------------------------------------------------------------------------------------------------|
| To which age group do you belong?                                                               |
| What is the characteristic plant of Heraklion?                                                  |
| What is the most characteristic monument of Heraklion?                                          |
| What is the most characteristic dish/delicacy of Heraklion?                                     |
| What is the most characteristic sound of Heraklion?                                             |
| What is the most characteristic event of Heraklion?                                             |
| Who is the most iconic personality of Heraklion?                                                |
| Which of the recent projects in the city, funded by the EU, do you consider the most important? |
| What is its most negative characteristic?                                                       |
| What is its most positive characteristic?                                                       |

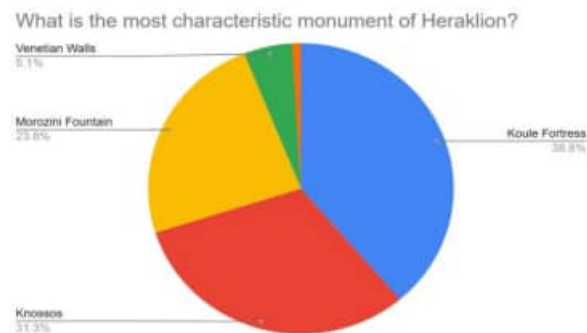
### 1. To which age group do you belong?



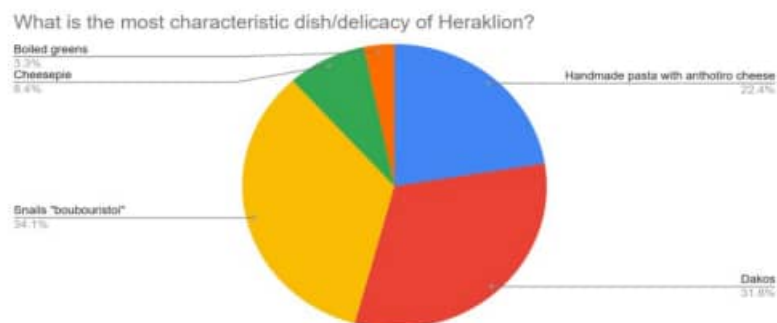
### 2. What is the characteristic plant of Heraklion?



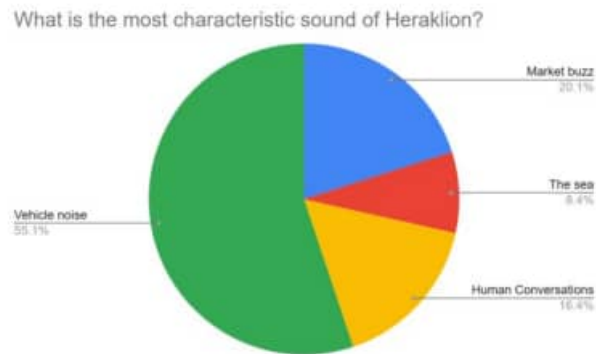
### 3. What is the most characteristic monument of Heraklion?



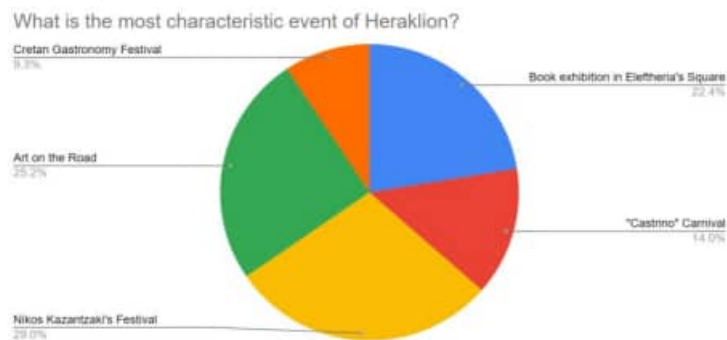
### 4. What is the most characteristic dish/delicacy of Heraklion?



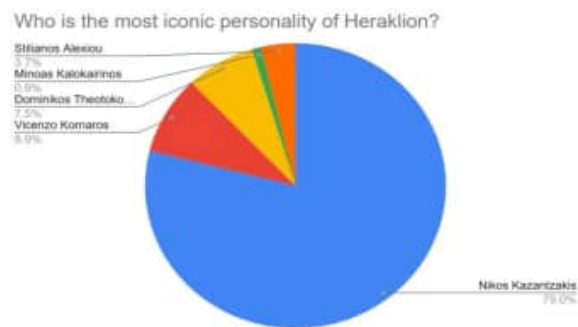
### 5. What is the most characteristic sound of Heraklion?



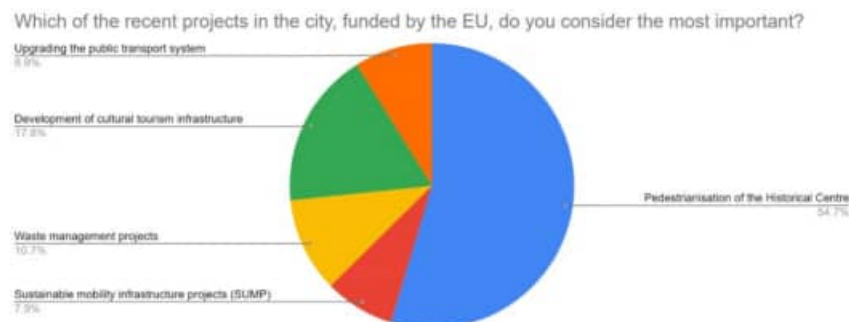
### 6. What is the most characteristic event of Heraklion?



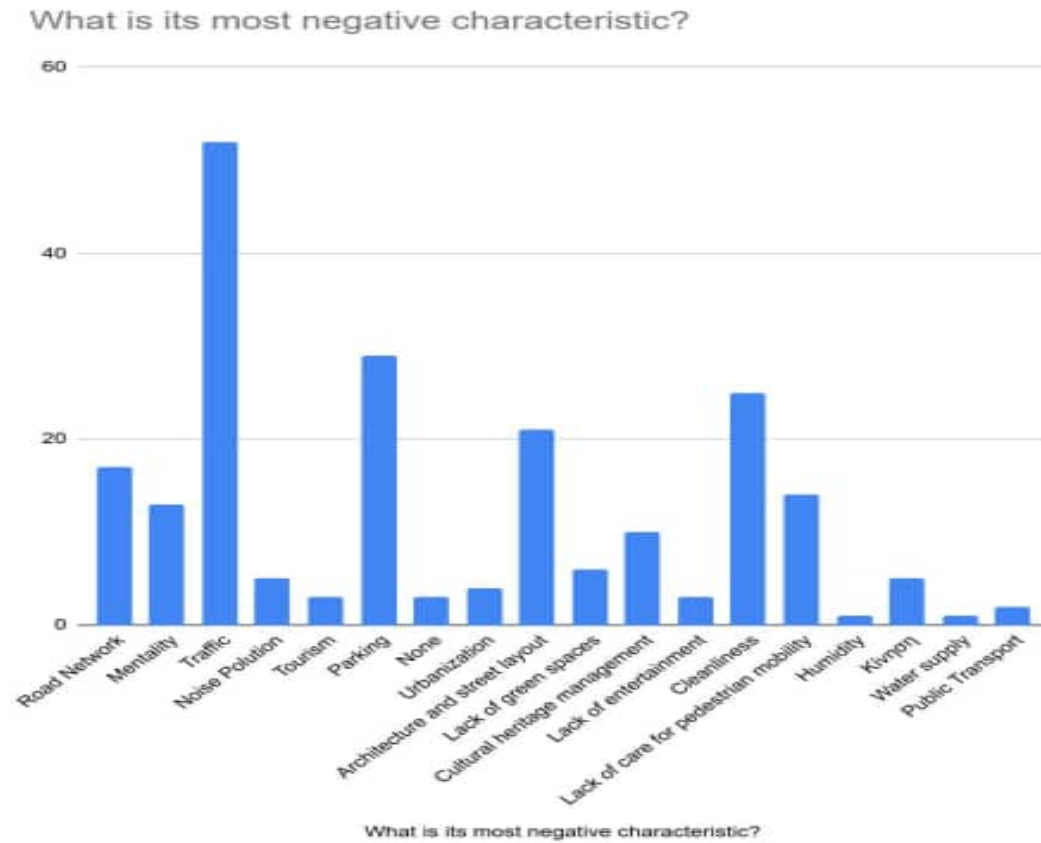
### 7. Who is the most iconic personality of Heraklion?



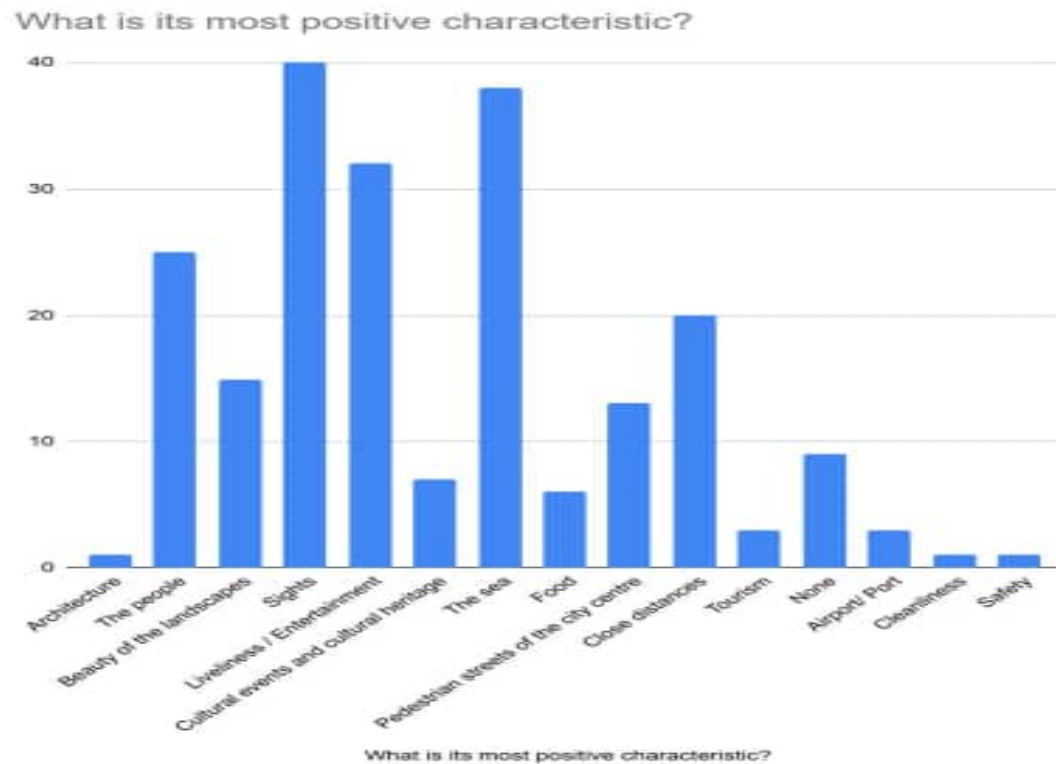
### 8. Which of the recent projects in the city, funded by the EU, do you consider the most important?



## 9. What is its most negative characteristic?



## 10. What is its most positive characteristic?



## Conclusions

The research, based on the recorded responses, reveals that Heraklion is primarily recognized for its historical heritage (Knossos, Koules), its Mediterranean vegetation (Fig, Rosemary), and the diverse age distribution of the respondents. Its gastronomy is characterized by the boumpouristoi snails and dakos. The most characteristic event related to the "Nikos Kazantzakis Festival" seems to be directly connected to the answer about the most notable personality of the city, where the overwhelming majority highlights Nikos Kazantzakis.

At the same time, with an overwhelming majority, it is emphasized that the most significant infrastructure funding project that contributed to the city was the pedestrianization of the historical center. Despite the pedestrianization and the reduction of vehicles in the city center, the question about the characteristic sound of the city reveals that the sound of vehicles prevails, proving that the goal for sustainable mobility has not yet been achieved, negatively impacting the experience and perception of the city's character.

In conjunction with the noise of vehicles, more information is provided by the answer regarding the most negative characteristic of the city, with the traffic of vehicles and the lack of parking being among the highest percentages, showing that there is a need for transport infrastructure that serves more areas (both remote and central), as well as generally infrastructure for promoting sustainable mobility.

In conclusion, combining the last answer about the most positive characteristic of the city, it seems that the attractions, the sea, and the city's vibrancy in terms of entertainment and commercial activity contribute to the appreciation of the city's character. This demonstrates that the sectors of cultural heritage (attractions) and nature (sea) contribute to the positive perception of the city, and their protection and promotion can contribute positively to the preservation of the city's character. Despite Heraklion's urbanized form and lack of infrastructure, it has all the prerequisites to become a self-sufficient city, offering society sustainable development that will support every social, economic, and environmental sector.

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## **THE FORMATION OF THE PHYSIOGNOMY OF THE CITY OF IOANNINA - THE OPINION OF RESIDENTS AND VISITORS**

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### **Abstract**

The present paper refers to the physiognomy of the city and is a study carried out by the Department of Economics and Sustainable Development of Harokopio University. The aim is to investigate the factors that contribute to the formation of this physiognomy and the opinion of residents and visitors on the issues in question. As a case study, the city of Ioannina of the Region Epirus is chosen.

In order to answer the main questions of the work and to investigate the main factors that shape the physiognomy of the city of Ioannina a survey was carried out aimed at the residents of and visitors to the city. For the needs of the research, a questionnaire was created which included ten (10) closed-type structured response questions, was anonymous and distributed to 150 people. The research was carried out in the months of October and November 2024. The questionnaire was addressed exclusively to adults, aged 18 to 80

The paper concludes with interesting conclusions and proposals. An important conclusion is that in order to protect the special physiognomy of the city of Ioannina strategies related to the more general protection of all issues related to its sustainable development should be implemented. It is proposed that both the local government, as well as the businesses of all service and production branches, work towards the protection and highlighting of the special character of the city Ioannina.

**Key words:** Physiognomy of the city, sustainable development, the city of Ioannina

## THE FORMATION OF THE PHYSIOGNOMY OF THE CITY OF MONEMVASIA - THE OPINION OF RESIDENTS AND VISITORS

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### Abstract

Monemvasia is a fortified historic medieval town, found on the southeastern Peloponnese coast, in Greece. To this day, it remains one of the oldest and few inhabited castles in Europe. The old medieval town is nestled upon a rock formation connected to the mainland only by a narrow causeway. The new town of Monemvasia, where most of the locals nowadays live, is developed on the mainland, just on the other side of the causeway.

This paper examines the unique spatial and cultural identity of Monemvasia, known for its dramatic topography. Monemvasia exemplifies the interplay between natural landscape, historical continuity, and architectural legacy. Through a combination of historical research, spatial analysis, and visitor-based survey methodology, the paper aims to analyze several aspects of the town's physiognomy, including its geographical and geomorphological features, its rich Byzantine and post-Byzantine history, its architectural heritage, and its role in contemporary cultural and economic life. A key focus explores how these various elements do contribute to the town's character as well as sustainable development.

A structured questionnaire, from more than 150 individuals with direct experience of the site, offered understandings into the sensory, emotional, and cultural markers, through residents and visitors' perceptions and experiences, aiming to assess how Monemvasia's identity is communicated, interpreted, and remembered. Findings underscore Monemvasia's power as a living heritage site: the Byzantine churches such as Agia Sophia, stone architecture, the sound of the sea, traditional sweets, and the poetic presence of Yannis Ritsos emerge as recurring symbols. This research highlights the rare fusion of natural beauty, cultural heritage, and historical depth of Monemvasia where history and modern life coexist harmoniously. Finally, it frames the town within the context of sustainable heritage management, stressing the explicit need for balanced strategies that fully protect its authenticity while readily supporting cultural tourism.

**Keywords:** Monemvasia, heritage landscape, physiognomy, castle, visitor perception, sustainable development, medieval urbanism

### Introduction

Monemvasia stands among the most celebrated historical locales throughout Greece, geographically distinctive and culturally replete. Monemvasia, also often referred to as the "Gibraltar of the East", is a uniquely positioned town that encapsulates centuries of Greek and Mediterranean history. (Bzinkowski 2020) The medieval town rises dramatically from the Myrtoan Sea, is positioned on a rocky outcrop of Peloponnese, linked to the mainland by a narrow isthmus and its natural feature which gives the town its name: from the Greek "μόνη" (only) and "ἔμβασις" (entrance). This singular entry point symbolizes more than physical

access, as it marks a passage into a space suspended in time, where natural elements, architectural memory, and living tradition converge.

Over the centuries, Monemvasia has served as a strategic stronghold, a trade hub, and a cultural centre. Today, it still fascinates visitors not only for its preserved Byzantine architecture and stunning coastal views but also for the immersive experience it offers, a sensorial journey through stone-paved alleys, the strong scent of the sea, and echoes of poetic voices of Yannis Ritsos, whose roots are etched into the town's soul.

This paper seeks to explore the physiognomy of Monemvasia not merely as a physical form, but as an experiential and symbolic construct. Drawing from historical documentation and from visitor-centered survey, the study investigates how various dimensions spatial, cultural, emotional interact to form a cohesive identity. The results of the survey provide insights into which features leave a lasting impression, such as the religious architecture, the medieval urban structure and traditional gastronomy. Furthermore, the research situates Monemvasia within the wider discourse of sustainable heritage preservation, recognizing both its fragility and its enduring value in the face of modern pressures such as tourism and urban development.

## **Geography and Geomorphology**

Monemvasia is located at the southeastern edge of the Peloponnese, within the regional unit of Laconia, and presents a truly unique phenomenon in the Greek landscape. Built upon a massive rocky formation in the Myrtoan Sea, Monemvasia is connected to the mainland only by a narrow causeway of about 200 meters that is a defining feature that gave the town its name, meaning “single entrance.” The rock itself, measuring approximately 1.8 kilometers in length and reaching a height of nearly 300 meters, is primarily composed of limestone, which accounts for its rugged and enduring character. Geomorphologically, Monemvasia's rock is classified as a tombolo, shaped over millions of years by tectonic movements and the erosive action of the sea. A major seismic event around 375 A.D. further influenced its present form, reinforcing its isolated and defensible nature. Despite the steep cliffs that surround it, the summit of the rock is relatively even, allowing the development of the historic Upper Town, while the Lower Town extends along its more accessible southeastern side. (Saroglou, H., et al. 2012)

The wider area of the Municipality of Monemvasia is officially designated as mountainous, with 52.63% of its territory classified as such, although it also boasts a significant coastal front. This coexistence of mountainous and seaside landscapes adds to the area's richness and diversity. The natural environment around Monemvasia supports a variety of plant and animal life. There are many marine species and birds find refuge on the rock's cliffs and surrounding shores. The climate is Mediterranean, with its mild winters, hot summers, and long periods of sunshine, nurtures olive groves, aromatic plants, and several rare endemic species. Moreover, the municipality is traversed by a dense network of streams and rivers, such as Ariana in the northeast and Langada in the south, which help define its natural boundaries. Together, these elements underline how Monemvasia's geography and geomorphology have shaped not only its historical role but also its ongoing identity as a place of natural beauty and cultural significance.

## **History, Architecture and Cultural Identity**

The unique geographic and geomorphological features of Monemvasia have not only shaped its natural landscape but have also played a decisive role in its historical evolution and cultural development. The unique rock formation, offering natural defense and strategic

advantage, determined the town's emergence as a vital stronghold and commercial center throughout various historical periods. In turn, the built environment and cultural expressions that developed within its fortified walls reflect the continuous interaction between the natural setting and human activity. Understanding the history, architecture, and cultural life of Monemvasia thus requires an appreciation of how deeply its identity is rooted in its extraordinary physical context.

The history of Monemvasia is deeply interwoven with its unique geography, shaping its role as a strategic fortress and a vibrant cultural center over the centuries. Founded in the 6th century A.D. by inhabitants seeking refuge from invasions, Monemvasia quickly developed into a significant commercial and military hub, especially during the Byzantine era. Its strategic location allowed it to control important maritime routes between the Eastern Mediterranean and the West, while its natural fortifications made it one of the most resilient strongholds in Greek history. Throughout the medieval period, Monemvasia flourished under successive rulers, including Byzantines, Venetians, and Ottomans, each leaving their imprint on the town's character and built environment. Today, the old town remains entirely pedestrianized, as vehicles are not allowed within the castle walls. (Kalliga 2003) This restriction helps preserve the authenticity and atmosphere of the site. The urban structure is traditionally divided into two parts: the Upper Town, also known as “Goulas,” which is largely in ruins but historically significant, and the Lower Town, which is still inhabited today and remarkably well preserved. (Eygenidou 2004) In the lower old town of Monemvasia preserves its appearance with a lot of narrow, stone-paved alleys, fortified walls, densely packed stone houses, traditional courtyards limited modern intrusions and more than forty preserved churches, among them the iconic Church of Agia Sophia, perched dramatically on the cliff's summit. Beyond the castle, the modern settlement, commonly referred to as “Gefyra” (meaning “Bridge”), has grown into the functional and residential heart of the area. This part of Monemvasia hosts the majority of the local population and offers all essential public services and infrastructure needed for daily life. It also serves as a lively center for tourism, with numerous hotels, restaurants, cafés, and workshops producing and selling traditional local products. Along the seafront, the modern marina accommodates fishing boats, sailing yachts, and seasonal passenger ferries from Piraeus, supporting both local livelihoods and visitor access. Parking facilities in Gefyra allow visitors to leave their vehicles before crossing into the historic town on foot, maintaining the distinct character and pedestrian charm of the medieval fortress. Culturally, Monemvasia has been for long a symbol of endurance and creativity. Its rich traditions are evident not only in its built heritage but also in its culinary practices, religious festivities, and literary associations. The town is famously linked to the poet Yannis Ritsos, whose works capture the timeless essence of Monemvasia's landscape and spirit. Even today, Monemvasia remains a living testament to a past that continues to inspire, offering a rare combination of historical depth, architectural integrity, and vibrant cultural life. (Kalliga 2010)

### **Living Identity, Cultural Memory, and Sustainable Continuity**

Monemvasia's character cannot be captured by its architecture alone. It lives through the people who shaped it, the traditions that persist, and the quiet, enduring presence of the landscape. Among the many figures associated with the town, the poet Yannis Ritsos stands apart, not just for his literature work, but for the way his words seem carved from the very stone of the place he was born. His life and poetry are inseparable from the rhythms of Monemvasia: the sea, the silence, the resilience. The poet's work is internationally recognized, and he was nominated for the Nobel Prize in 1971. He was awarded the State Poetry Prize in 1956 for his 'Sonata of the Moonlight' and in 1977 he received the Lenin Prize for Peace and

Friendship among Peoples. The poetry collection 'Monovasia' is entirely dedicated to his place of origin. In memory of him, the central alley of the castle has been named after him, and it is called 'Yiannis Ritsos Street.' Additionally, a bust of the great poet Yiannis Ritsos has been placed in the outdoor area of his family home.

The town's physiognomy is also defined by more subtle "condensers" of identity, such as stone alleys, small chapels, the bridge, and the daily rhythms of residents. All of these are contributing to a sense of place that is lived as much as it is admired. Monemvasia's surrounding environment with the coastal waters around the rock and across the mainland further enhances its character.

Monemvasia's economy is shaped mainly by tourism and the use of local resources. The production of extra virgin olive oil playing a key role both locally and for export. There's also some fishing and limited livestock activity in the surrounding areas. Small scale processing of local goods like wine and olive oil supports the secondary sector. Still, it's tourism that drives most of the local economy, especially in the summer months, with businesses like hotels, cafés, and restaurants providing steady work and income for the community.

Preservation isn't left to chance. A network of legal protections and institutional oversight ensures that changes to the town align with its character. The castle of Monemvasia is located within the protected area of the Natura 2000 network with the code GR2540001. Furthermore, the area has been designated as a Landscape of Outstanding Natural Beauty with the code AT1010010. It is also classified as an archaeological site and a Traditional Settlement. Projects co-funded by the European Union have helped strike a delicate balance of upgrading the essential infrastructure without compromising the feeling of stepping into another century. The installation of an accessibility lift for the castle, improvements in wastewater treatment, and the development of the marina are examples of investments that serve both locals and visitors. These interventions not only modernize necessary infrastructure but also align with the broader goals of sustainable development, ensuring that Monemvasia remains a dynamic and resilient community while honoring its past.

## Survey

For the purposes of the present work an online survey was conducted regarding how visitors perceive the physiognomy and identity of Monemvasia. The questionnaire included ten questions and was distributed through travel forums and social media groups focused on the region. A total of 152 anonymous responses were collected from individuals who are living or had visited the area. The survey was conducted in January 2025.

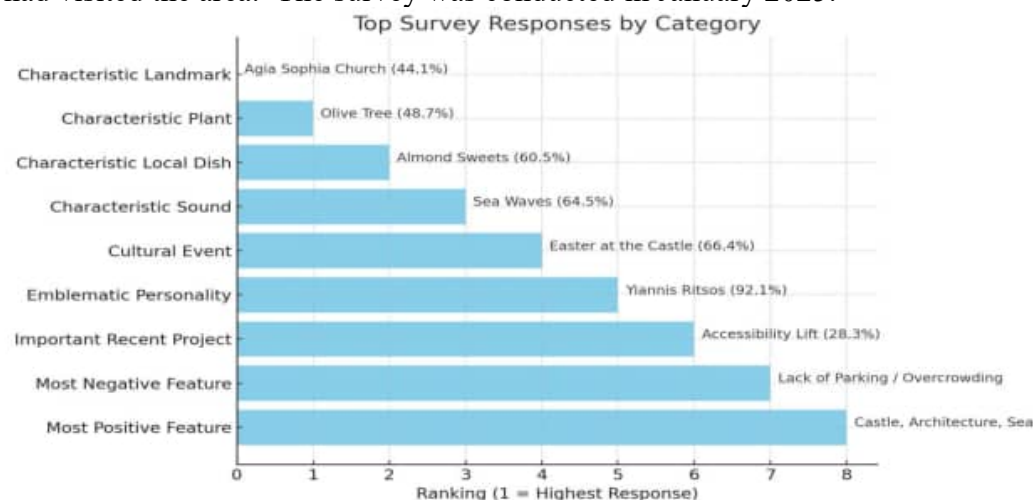


Figure 1. Top responses from each question



According to the results in terms of age 21.1% of the respondents were 18-30 years old, 15,8% were 31-40 years old, 24.3% were 41-50 years old, 21,7% were 51-60 years old and 17.1% were older than 60 years.

To the question "What is the most characteristic landmark of the area?" the 44.1% answered "The church of Agia Sophia", the 28.9% "the church of Elkomenos Christos", 19.1% "Yiannis Ritsos house", 4.6% "the bridge" and 3.3% "Monemvasia Archaeological Collection". The majority of respondents identified the Church of Agia Sophia, located at the top of the rock on the Upper Town, as the most characteristic monument of Monemvasia and the total 73% recognize two churches in the old town as the most famous monument of Monemvasia. The dominance of religious monuments highlights how deeply Monemvasia's identity is tied to its Byzantine architectural and spiritual heritage.

To the question "What is the most characteristic plant of the town?" 48.7% answered "Olive tree", 24.3% "Lilium Candidum", 11.8% "Capers", 9.2% "Jasmin" and 5.9% "Tulips". From the answers we find that the olive tree, that is one of the most common plants in south Greece, is also considered the most representative plant of the area of Monemvasia.

To the question "What is the town's most characteristic local dish?" 60.5% answered "Monemvasia Almond Sweets", 11.8% "Tsaitia", 11.2% "Malvasia wine", 8.6% "Stuffed Zucchini Blossoms" and 3.9% answered both "Extra virgin olive oil and Diples". Traditional sweets and historic wine production connect visitors to the town's gastronomic identity.

To the question "What is the most characteristic sound of the town?" 64.5% picked "The sound of the sea waves", 16.4% "The church bells", 13.8% "Cicadas sound" and 5.3% "Human conversations". Most respondents associated the town with the sound of the sea, highlighting the town's close connection to its coastal environment, as it is almost entirely surrounded by the sea.

To the question "Which cultural event or traditional festivity best represents the identity of the town?" 66.4% answered "Easter at the castle of Monemvasia", 14.5% "International festival of Malvasia", 13.8% "Summer concerts" and 5.3% "Monemvasia run challenge". Religious traditions remain a powerful community and visitor experience, combining spirituality with the town's historic atmosphere.

To the question "Who is the most emblematic personality associated with the town?" 92.1% answered "Yiannis Ritsos", 5.9% "Antonis Sgardelis", 1.3% "Iraklis Tracheilis" and 0.7% "Kalligas Alexandros and Xaris Kalliga". The respondents almost unanimously chose Ritsos as the personality linked with Monemvasia as Ritsos' poetry, often inspired by Monemvasia itself, reinforces the emotional bond between the town and his cultural legacy.

To the question "Which recent project is considered the most important" 28.3% answered "Installation of an accessibility lift for individuals at Monemvasia Castle", 27,6% "Installation of lighting at Monemvasia Castle", 21.7% "Improvement of wastewater treatment facilities", 19,7% "Upgrade of Monemvasia Marina", 2.6% "Installation of lighting at the Monemvasia Tourist Port". Accessibility improvements were considered the most significant project, that allows a wider audience, including people with disabilities, to experience the historic environment.

To the question "What is considered the most negative feature of the town?" most respondents pointed to lack of parking and overcrowding during peak tourist seasons. Infrastructure limitations threaten visitor satisfaction and the quality of the overall experience. To the question "What is considered the most positive feature of the town", the majority of respondents highlighted the castle of Monemvasia surrounded by the sea, with the historical atmosphere, the architectural authenticity, and the natural landscape as the most positive aspects of Monemvasia. The combination of historical preservation and natural beauty clearly defines Monemvasia's charm for visitors.

## Conclusions

This study aimed to analyze the physiognomy of Monemvasia focusing on the interplay of its physical features, their history, the architecture, and the culture that still exists there. The findings reaffirm Monemvasia's status as a rare example of an inhabited medieval settlement, where history and daily life coexist within a uniquely preserved urban and natural landscape.

The geographic singularity of Monemvasia, as a massive rock almost entirely surrounded by the sea and connected to the mainland by a single causeway, continues to define both its physical identity and its historical significance. Visitors marvel at the magnificently preserved stone buildings, the Byzantine monuments alongside traditional cultural expressions, which leaves a lasting impression on visitors.

The visitor survey demonstrated which elements are most strongly associated with Monemvasia: the emblematic Church of Agia Sophia, the omnipresent olive tree, the sound of the sea, the taste of traditional local products such as almond sweets and Malvasia wine, and the lasting legacy of Yannis Ritsos. Changes to the accessibility of the castle, were widely recognized as positive developments enhancing visitor experience and inclusivity.

Nevertheless, challenges remain. Issues such as limited parking facilities and overcrowding during peak tourist seasons were consistently highlighted as factors that could affect the Monemvasia's sustainability as a cultural destination, which could undermine the quality of the visitor experience if not properly managed.

In conclusion, Monemvasia offers a powerful model of sustainable cultural heritage management, balancing historical preservation with contemporary needs. Respondents emphasized the town's ability to transport them "back in time". Moving forward, emphasis must be placed on protecting the town's authenticity while carefully managing visitor flows, thereby ensuring that Monemvasia continues to thrive as a living testament to Greece's enduring cultural legacy.

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## THE FORMATION OF THE PHYSIOGNOMY OF THE CITY OF VOLOS. THE OPINION OF RESIDENTS AND VISITORS.

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### Abstract

The present paper refers to the physiognomy of the city and is a study carried out by the Department of Economics and Sustainable Development of Harokopio University. The aim is to investigate the factors that contribute to the formation of this physiognomy and the opinion of residents and visitors on the issues in question. As a case study, the city of Volos is chosen. In order to answer the main questions of the work and to investigate the main factors that shape the physiognomy of the city of Volos a survey was carried out aimed at the residents of and visitors to the city. For the needs of the research, a questionnaire was created which included ten (10) closed-type structured response questions and two (2) open type questions, was anonymous and distributed to 155 people. The research was carried out in the months of October and November 2023. The questionnaire was addressed exclusively to adults, aged 18 to 65 years old. The paper concludes with interesting conclusions and proposals. An important conclusion is that in order to protect the special physiognomy of the city of Volos, strategies related to the more general protection of all issues related to its sustainable development should be implemented. It is proposed that both the local government, as well as the businesses of all service and production branches, work towards the protection and highlighting of the special character of the city of Volos.

**Key words:** Physiognomy of the city, sustainable development, the city of Volos

### Introduction

In this paper, the physiognomy of the city of Volos will be studied and analyzed. Firstly, we are going to see what is defined as the physiognomy of a city. The word physiognomy means the set of characteristic features of a person or thing. However, the term mainly refers to humans, so by examining the physiognomy of a city, we are looking for its identity and character through an anthropomorphic approach. In this way, we form a particular opinion about this area. Therefore, as the etymology of the word defines, physiognomy is the opinion about the nature of the city. The Physiognomy of a city therefore has to do with the cultural characteristics such as poetry, art, morals, customs, natural characteristics such as the green of the city, the blue surfaces, the morphemes that all our senses offer about the city (smell, touch, taste, sound, etc.) and the ideological and mythological dimensions of the city such as historicity, accessibility, etc. Thus, through the physiognomy, the reason and the myth of the city are revealed, which concerns the rational element and is related to the degree of originality, the associations that the city evokes, with the strong images, the degree of banality, etc. (Stefanou, 2000) The current Greek city must maintain its physiognomy and resist the leveling phenomenon of globalization. A powerful capacitor of the physiognomy of a city can be its name itself, the very high degree of sociability that develops in the Greek city due to

various characteristics such as the climate or the geographical and geophysical characteristics. Another characteristic that constitutes the physiognomy of a city is the daily small pleasures for which they are famous, for example, Volos is known for its tsipouro restaurants, so the taste and smell landscape play a particularly important role in maintaining the city's special identity. This element that several Greek cities have and is decisive for the recognition of their physiognomy is the nostalgia that they provoke, reminding to the people the originality of the past years. (Stefanou, Mitoula, 2003) The physiognomy of a city must be protected, as it is directly linked to its sustainable development. This protection will ensure the appropriate conditions for the survival of the city. The city should manage its natural resources wisely and take care of the preservation and protection of the geophysical and cultural character of the urban environment. (Stefanou, Mitoula, 2003) The case examined in this paper is the city of Volos. The choice of this city was made because of its special character. It is one of the largest medium-sized urban centers in the country), located approximately in the center of Greece with easy and quick access to the two major metropolitan centers of Athens and Thessaloniki. A coastal city that beautifully encloses the Pagasetic Gulf and is inextricably linked to Mount Pelion which surrounds it. This paper aims, through research, study and critical reflection, to highlight the special characteristics of this particular city, which also constitute its physiognomy. By examining the natural characteristics as well as those that are the result of human intervention in the surrounding area, its civilization and culture through relevant bibliography, sources and the conduct of a survey with questionnaires, an attempt is made to approach and capture the physiognomy of the city of Volos.

## **Methodology**

The methodology of the work for Part A was the bibliographical research that covered both the theoretical framework for the physiognomy and sustainable development of the city, as well as the material specifically for the city of Volos and the recording. The library of Harokopio University and the Municipal Library of Volos were the main sources of searching for the bibliography. Also, official websites of the Internet, such as that of the Municipality of Volos, played an important role in collecting the material used to record the work.

The methodology of the work for Part B was the conduct of a survey. A questionnaire was created, which included ten (10) closed-ended questions with a structured response and two (2) open-ended questions, was anonymous and distributed to 155 people. The survey was carried out in October and November 2023. The questionnaire was addressed exclusively to adults. The results of the responses were recorded, analyzed and compared with the bibliographic research of Part A.

### **Part A: Description of the city**

#### ***1. Geographical Identification of the city***

The city of Volos is the capital of the Regional Unit of Magnesia of the Region of Thessaly. It occupies an area of 387.14 km. <https://www.pedthessalias.gr/meli-tis-ped/nomos-magnisias/dimos-volou/> and the municipal unit has a population of 85,803 inhabitants, according to the 2021 census. [https://www.statistics.gr/documents/20181/17286366/APOF\\_APOT\\_MON\\_DHM\\_KOIN.pdf/41ae8e6c-5860-b58e-84f7-b64f9bc53ec4](https://www.statistics.gr/documents/20181/17286366/APOF_APOT_MON_DHM_KOIN.pdf/41ae8e6c-5860-b58e-84f7-b64f9bc53ec4) It is 325 km from the capital Athens and 215 km from the co-capital Thessaloniki. (Ministry of Tourism, 2004) It borders the Regional Unit of Larissa and the Regional Unit of Fthiotida. It is connected to the main road axis of the country

(PATHE) at two points, at the Velestino junction and at the Mikrotheve junction. The residential area is surrounded to the northeast by the mountain Pelion, to the south by the Pagasetic Gulf and to the west by the Thessalian plain. (Volos Development Company, 2014)

*Map 1: Geological Map of Volos*



Source: <https://www.taxydromos.gr/magnesia/volos/217592/olokliromenos-geologikos-chartis-gia-to-volo/>

## **2. Geophysical determination of the city**

Volos is a city belonging to Greece, which has a temperate-typical Mediterranean climate with mild and rainy winters and hot and dry summers and of course with sunshine most days of the year. The individual climatic type of Volos is characterized as intense mid-Mediterranean with a prolonged dry season. (Operational Program 2020-2023 Municipality of Volos). The relief of the area is characterized by 55% plain, 12% semi-mountainous and 33% mountainous. (Volos Development Company, 2014)

Volos has two hills. First, the low hill of Goritsa two hundred meters high in the east, which is densely vegetated. Its vegetation, following reforestation carried out in the 1940s and 1950s, mainly consists of Aleppo and rough pine (*Pinus halepensis* and *brutia*) and scattered cypresses (*Cupressus sempervirens*) (document from the Volos Forestry Office). The hill is today an oasis in the urban landscape of the city, which residents use for exploration, recreation or sports, overlooking the Pagasetic Gulf. [http://odysseus.culture.gr/h/3/gh351.jsp?obj\\_id=2674](http://odysseus.culture.gr/h/3/gh351.jsp?obj_id=2674) The second hill is that of Episkopi, located in the center of Ano Volos and is a conical rocky hill, without much vegetation. [https://www.kastra.eu/castlegr.php?kastro=episkopivol#google\\_vignette](https://www.kastra.eu/castlegr.php?kastro=episkopivol#google_vignette)

Regarding urban green spaces and parks, which enhance the sustainability of cities as they offer a better quality of life to city residents through the promotion of the natural environment, social benefit and cultural development (Tsopouridou, 2009), the city of Volos has a negative balance in the parks that exist in neighbourhoods and a positive balance in the squares and playgrounds. (Marou, 2023)

Table 1: The largest parks and squares in the city

|                                                |                         |
|------------------------------------------------|-------------------------|
| • San Constantine Park                         | • Freedom Square        |
| • Anavros Park                                 | • Evangelistria Square  |
| • Asylum Park                                  | • Youth Square          |
| • Karagats Park                                | • University Square     |
| • Municipal Cultural Park or Grove of N. Ionia | • Nea Demetriada Square |
| • Chiliadou Park                               |                         |
| • OTE Park of N. Ionia                         |                         |
| • Pedio tou Areos Park                         |                         |
| • Cyprus Park                                  |                         |
| • Saints Anargyroi Park                        |                         |
| • Coastal Sculpture Park                       |                         |
| • Rigas Feraios Park                           |                         |
| • Kallithea Park                               |                         |

Source: [https://www.citybranding.gr/2013/03/blog-post\\_21.html](https://www.citybranding.gr/2013/03/blog-post_21.html)

In general, the city, especially in its center, presents a compact form of construction, with medium density, but with a noticeable lack of public spaces. (Marou, 2023)

#### Blue surfaces

As mentioned above, Volos is washed by the Pagasetic Gulf, which is a closed, shallow sea at the mouth of which it meets the Volos port. Its area is 175 sq. km and has a maximum depth of 102 m. <https://www.hellenicaworld.com/Greece/Geo/gr/PagasitikosKolpos.html>. There are two rivers in the city, the Krausidon River and the Anavros River. The Krausidon River, which is the largest with a length of 12 km, is a green and oxygen lung for the heavily urbanized city of Volos. Unfortunately, the morphology of the river and the continuous discharge of sewage into the river, degrade its quality. Its sources start from the southern mount of Pelion, and its mouth is in the Pagasetic Gulf, after the river first passes through the residential zone of the city. Also, the Krausidonas River was until 2010 the natural boundary between Volos and Nea Ionia (the second largest municipality of the Magnesia Prefecture). <https://ir.lib.uth.gr/xmlui/bitstream/handle/11615/45127/10535.pdf?sequence=1&isAllowed=y> The Anavros River, almost parallel to the Krausidonas River, is the natural boundary to the east, from which the Nea Demetriada region of Volos begins. It also flows into the Pagasetic Gulf and is a breath of oxygen for the area. [https://el.unionpedia.org/c/%CE%92%CF%8C%CE%BB%CE%BF%CF%82/vs/%CE%9D%CE%AD%CE%B1\\_%CE%94%CE%B7%CE%BC%CE%B7%CF%84%CF%81%CE%B9%CE%AC%CE%B4%CE%B1\\_%CE%92%CF%8C%CE%BB%CE%BF%CF%85](https://el.unionpedia.org/c/%CE%92%CF%8C%CE%BB%CE%BF%CF%82/vs/%CE%9D%CE%AD%CE%B1_%CE%94%CE%B7%CE%BC%CE%B7%CF%84%CF%81%CE%B9%CE%AC%CE%B4%CE%B1_%CE%92%CF%8C%CE%BB%CE%BF%CF%85) It is a well-known river because, according to Greek mythology, Jason, returning from Pelion, where he was trained by the Centaur Chiron, helped an old woman cross the river in Iolkos by carrying her on his back. This woman was the goddess Hera in disguise. In this attempt, Jason lost his sandal, which is why he is called “Monosandal.” <https://sites.google.com/site/hellasmithology/heroes/jason>



### Urban Flora

In the context of protection from climate change, cities must increase their flora, as many trees play the role of purifiers of the city's air, increase biodiversity, reduce noise pollution, improve the health of citizens, etc. The urban flora of the city of Volos consists mainly of orange trees, plane trees, pine trees, cypress trees, almond trees, sour orange trees and lemon trees. (Group of Teachers of the 1st Educational Region of Magnesia, 1959) However, having an almost identical relationship with Mount Pelion, Volos is also famous for other fruit trees that produce products of high taste and quality that have received a "protected designation of origin", such as the apples of the village Zagora of Pelion and the lemon peaches of Pelion. (Ministry of Tourism, 2004)

### Urban fauna

The urban fauna of the city consists mostly of dogs, cats, seagulls, sparrows, ducks. In the Pagasetic Gulf we find sparrows, cod, bream, medlars, breams, perch. (Stergiou, 1991). It also hosts a multitude of small schooling fish such as anchovies, sardines, bream, horse mackerel, and anglerfish. <https://www.kathimerini.gr/k/gastronomos/1019546/ti-psaria-trone-oi-voliotes/>

## **3. The history of the city**

### The name of the city

There are several opinions regarding the origin of the name Volos. Firstly, the city of Volos is built near ancient Iolkos, which is located in the area of present-day Ano Volos, and for this reason it is believed that the word Volos came from a corruption of the ancient name Iolkos. (Iolkos > Giolkos > Golos > Volos). Secondly, the word Volos is attributed to the Slavic deity "Volos" or "Veles" which is associated with the Greek goddess Demeter, as the city was previously called Demetriada. Thirdly, there is a possibility that it was a corruption of the Italian word golfo, which means gulf, and that the city was named so because of the Pagasetic Gulf. (Group of Teachers of the 1st Educational Region of Magnesia, 1959)

### Mythology

According to the mythology of the area in Pelion, it is called the mountain of the Centaurs, as the Centaurs had their residence there. The most famous and wisest centaur was Chiron, who had students Achilles, Asclepius and Jason. The usurper Pelias, Jason's uncle, asked him to travel to Colchis and bring back the Golden Fleece, with the promise of giving him back the throne. Jason therefore becomes a shipbuilder and builds the Argo, using special woods of Pelion, as advised by the goddess Athena. In the Argonaut expedition, Jason was accompanied by fifty people, as many as the ship's oars. Among them are Hercules, the Dioscuries, Orpheus, Peleus, Laertes, but also a woman, the huntress Atalanta. <https://www.volovres.gr/%CE%B2%CF%8C%CE%BB%CE%BF%CF%82-%CE%B9%CF%83%CF%84%CE%BF%CF%81%CE%B9%CE%BA%CE%AE-%CE%B1%CE%BD%CE%B1%CE%B4%CF%81%CE%BF%CE%BC%CE%AE/>

### Neolithic and Mycenaean era

The Neolithic settlements of Sesklo and Dimini (8,000-7,000 BC) are considered among the largest and most important in the Balkans. Archaeological excavations have identified over 40 Neolithic settlements, many of which continued to exist during the Bronze Age (3,000-1,500 BC). Finds of Mycenaean sites have been identified in the current district of Palea Volos, on the hill of Saints Theodoroi and in Pefkakia. (Thessalian Research Society, General Secretariat of the Olympic Games, Ministry of Culture, 2004)

*Figure 1: Neolithic Settlement of Dimini*

Source:

<https://loveteaching.com/2017/02/%CE%BD%CE%B5%CE%BF%CE%BB%CE%B9%CE%B8%CE%B9%CE%BA%CE%BF%CE%AF-%CE%BF%CE%B9%CE%BA%CE%B9%CF%83%CE%BC%CE%BF%CE%AF-%CF%83%CF%84%CE%BF-%CF%83%CE%AD%CF%83%CE%BA%CE%BB%CE%BF-%CF%83%CF%84%CE%BF-%CE%B4/>

### The Ottoman Empire in Volos

In 1423, the Castle of Palea succumbed to the Ottoman yoke, resulting in the transfer of all economic and intellectual activity of the region to Pelion, which was favored by the Turks. When the revolution of 1821 began, the villages of Pelion revolted, while the castle of Volos was besieged without result. In 1881, Volos and Magnesia in general were annexed to the modern Greek state. (Thessalian Research Society, General Secretariat of the Olympic Games, Ministry of Culture, 2004)

### The industrial years

After the liberation from the Turks, the population of the city of Volos increased and commercial prosperity took place. The large railway and port projects contributed to the industrial development of the region, with the main ones being the tobacco, metal and food industries. At the same time, the place experienced cultural and social prosperity.

<https://www.volovres.gr/%CE%B2%CF%8C%CE%BB%CE%BF%CF%82-%CE%B9%CF%83%CF%84%CE%BF%CF%81%CE%B9%CE%BA%CE%AE-%CE%B1%CE%BD%CE%B1%CE%B4%CF%81%CE%BF%CE%BC%CE%AE/>

### Asia Minor disaster

In 1922, with the Asia Minor catastrophe, many refugees from Asia Minor arrived in Volos and settled in the Xirokampos area and created the settlement of Nea Ionia Volos. These people carried with them their intense culture and spread it to the city of Volos. They spread the music of rebetiko, their customs and traditions, but what they brought and changed forever the life of the city in terms of entertainment, economy, and culture was the concept of consuming the alcoholic drink called “tsipouro” accompanied by relevant food. (Ministry of Tourism, 2004)

### World War II & later years

The city of Volos did not manage to emerge unscathed from both World War II and the subsequent civil war. The disastrous earthquakes of 1955-1957, which destroyed a large part of the city and were the reason for the reconstruction of the urban center, completed the bad situation. <https://www.ha.uth.gr/index.php?page=oral-archive-009>

All this situation resulted in a reduction in the number of industries from 67 pre-war to 54, while the workforce also decreased dramatically as industries such as the tobacco industry of Matsaggou and the Papageorgiou textile factory closed.

The city recovered in the following years and experienced significant industrial and cultural development. Specifically, in 1966, the Industrial Area of the city of Volos was established, which is the second oldest industrial area in the country. <https://avepevolou.gr/> Also, important buildings such as the Municipal Theater, the Municipal Conservatory, the Municipal Library were completed, while the reconstruction of apartment buildings will begin after 1980.

<https://www.volovres.gr/%CE%B2%CF%8C%CE%BB%CE%BF%CF%82%CE%B9%CF%83%CF%84%CE%BF%CF%81%CE%B9%CE%BA%CE%AE%CE%B1%CE%BD%CE%B1%CE%B4%CF%81%CE%BF%CE%BC%CE%AE/>

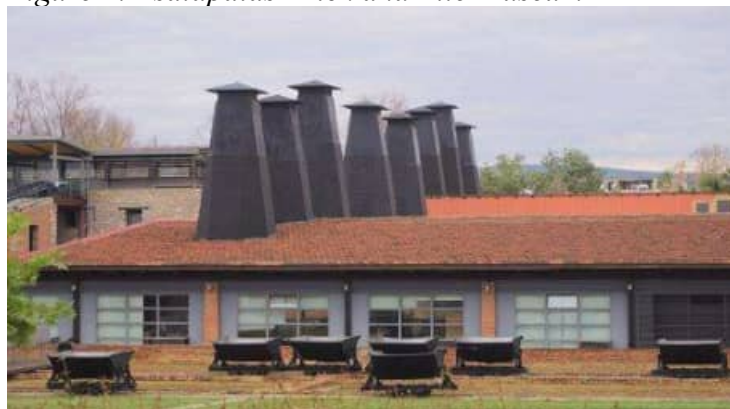
#### 4. The culture of the city of Volos

Volos is a city that has always had a strong element of culture.

The most important cultural institutions in the area are:

- The Museum of the City of Volos, which is the first modern City Museum in Greece, which began operating in December 2014. It is housed in the building of the former Papantou tobacco warehouse, which was built in 1920 and in its courtyard houses part of the wall of the castle of Palea. The museum tells the history of the city. <https://vmoc.gr/index.php/Id>
- The Athanasakio Archaeological Museum of Volos, which was built in 1909 with the sponsorship of Alexios Athanasakis. It is one of the most important Greek museums, which hosts exhibits of the region from the Neolithic, Classical and Alexandrian periods. <https://dimosvolos.gr/el/mouseia>
- The N. & S. Tsalapatas Brick and Tile Museum, of the Piraeus Bank Cultural Foundation, which is located in the old Nikolaos & Spyridonos Tsalapatas Brick and Tile Factory, in Volos, and the purpose of the Museum was to present the entire production process of bricks and tiles. <https://www.piop.gr/el/diktuo-mouseiwn/Mouseio-Plinthokeramopoieias-Tsalapata/to-mouseio.aspx>

Figure 2: Tsalapatas Brick and Tile Museum



Source:

[https://el.wikipedia.org/wiki/%CE%9C%CE%BF%CF%85%CF%83%CE%B5%CE%AF%CE%BF%CE%A0%CE%BB%CE%B9%CE%BD%CE%B8%CE%BF%CE%BA%CE%B5%CF%81%CE%B1%CE%BC%CE%BF%CF%80%CE%BF%CE%B9%CE%AF%CE%B1%CF%82#/media/%CE%91%CF%81%CF%87%CE%B5%CE%AF%CE%BF.%CE%A0%CE%BB%CE%B9%CE%BD%CE%B8%CE%BF%CE%BA%CE%B5%CF%81%CE%B1%CE%BC%CE%BF%CF%80%CE%BF%CE%B9%CE%AF%CE%B1.%CE%A4%CF%83%CE%B1%CE%BB%CE%B1%CF%80%CE%AC%CF%84%CE%B1\\_3743.jpg](https://el.wikipedia.org/wiki/%CE%9C%CE%BF%CF%85%CF%83%CE%B5%CE%AF%CE%BF%CE%A0%CE%BB%CE%B9%CE%BD%CE%B8%CE%BF%CE%BA%CE%B5%CF%81%CE%B1%CE%BC%CE%BF%CF%80%CE%BF%CE%B9%CE%AF%CE%B1%CF%82#/media/%CE%91%CF%81%CF%87%CE%B5%CE%AF%CE%BF.%CE%A0%CE%BB%CE%B9%CE%BD%CE%B8%CE%BF%CE%BA%CE%B5%CF%81%CE%B1%CE%BC%CE%BF%CF%80%CE%BF%CE%B9%CE%AF%CE%B1.%CE%A4%CF%83%CE%B1%CE%BB%CE%B1%CF%80%CE%AC%CF%84%CE%B1_3743.jpg)

The city also has a Municipal Theater and a Municipal Conservatory.

The most important monuments in the area are:

- The National Independence Monument, which is located on the city's coastal road. It is a sculpture that represents Winged Victory with a metal sword, inspired by the Statue of Liberty in New York and the Victory of Samothrace. It is also called the monument to the Fallen. It is the most central meeting point of the city. <https://dimosvolos.gr/el/paralia-bolou>

*Figure 3: The National Independence Monument on the beach of Volos*



Source: <https://www.kathimerini.gr/k/travel/792312/ta-diamantakia-toy-voloy/>

- The representation of the ship "Argo" in miniature, which is located at the entrance to the city's port, one of the first sights that tourists come into contact with. Its creator is Nikolas Pavlopoulos. <https://dimosvolos.gr/el/paralia-bolou>
- The statue of Rigas Feraios, which is located in the homonymous Rigas Feraios square, and shows the hero sitting on his chest, accompanied by the map of Greece named "Charta" and his tambourine. Its creator is Makris Memos. <https://dimosvolos.gr/el/plateia-riga-feraiou>

*Figure 4: The statue of Rigas Feraios in the square of the same name*



Source: <https://dimosvolos.gr/el/plateia-riga-feraiou>

The characteristic dishes of the region are:

- The dishes accompanying the drink tsipouro with anise, which consist mainly of seafood and fish. Both Volos and Nea Ionia are well-known areas for the numerous tsipouro restaurants visited by locals and tourists. <https://dimosvolos.gr/el/tsipouradika>
- Spetzofai is the quintessential Pelion food. It is made with Pelion sausage, peppers from Volos and homemade tomatoes. It has a special sweetness and characteristic aroma. It is



found in all the villages of Pelion. <https://www.pelionculture.gr/gr/Pelion-gastronomy-seven-must-eat-foods/>

Figure 5: Traditional spetzofai



Source: <https://www.andro.gr/geusi/eleni-psyxouli-speztofai/>

- Boumbari, which is essentially a sausage filled with rice and sweets and cooked in the oven with potatoes. It can be enjoyed in the villages Drakeia and Saint George in Pelion. (Ministry of Tourism, 2004) <https://www.pelionculture.gr/gr/Pelion-gastronomy-seven-must-eat-foods/>  
The characteristic events of the region are:

- The Music Village-Saint Lawrence is one of the most important and largest European music communities. It was founded in 2006 and every August it is organized by the company arTREE with the help of the Ministry of Culture, the Holy Metropolis of Demetrias, etc., a festival in the village of Saint Lawrence in Pelion, where artists from all over the world meet to attend educational seminars, exchange material, present various projects, etc. <https://www.music-village.gr/the-music-village/>

The event "Volos enchants us", is the Christmas illumination of the city and related events, has become a trademark of the city over the last ten years, and there are many who choose to spend their Christmas holidays in the city of Volos because of these events. Its main points are the characteristic blue lighting of the city center, the Christmas Village and the Ice Rink in Rigas Feraios Square, the Christmas Theme Park for children as well as a multitude of entertainment events for young and old. <https://www.ovolosmasmagevei.gr/>

The most important sports clubs in the area are:

- The Athletic Club of Olympiacos Volos is located in Nea Dimitriada. It was founded in 1937 with the red and white colors to characterize it. The name comes from Olympiacos Piraeus as the local teams of the neighborhoods of Saint Constantine of Volos admired the team, where the club originated. It supports football, basketball, volleyball, weightlifting, swimming, wrestling and judo departments. The men's football team OLYMPIACOS of VOLOS, the most popular team of the club, is based at the EAK stadium. The team has previously won a place in the First National League. <https://www.asolympiakosvolou1937.gr/%ce%b9%cf%83%cf%84%ce%bf%cf%81%ce%af%ce%b1/>

- The Volos Gymnastics Club "Niki" is located in Nea Ionia of Volos. It was founded in 1924 with the blue and white colors characterizing it. The Asia Minor refugees who arrived in the Nea Ionia area of Volos brought with them their intense athletic character. Thus, they immediately organized themselves and created Niki the Refugee. Niki was granted a plot of land as its headquarters, which is today called Pantelis Magoulas in Nea Ionia, which is the team's stadium. Today, it includes men's football, men's and women's basketball, women's volleyball, track and field, rhythmic gymnastics, cycling, water polo and swimming. <https://nikivolousc.gr/%ce%b9%cf%83%cf%84%ce%bf%cf%81%ce%b9%ce%b1/>

Figure 6: Badge of the Victory of Volos



Source: <https://nikifc.gr/>

At this point it should be mentioned that Volos and Nea Ionia were Olympic cities of Greece for the 2004 Games. On the occasion of the football tournament, the imposing Panthessalian stadium was built in 2004, with a capacity of 22,700 seats. Today it is also used as the base of the Niki Volos football team. (Thessalian Research Society, General Secretariat of the Olympic Games, Ministry of Culture, 2004)

### 5. *The architectural heritage of the city of Volos*

From 1881 onwards, the major infrastructure projects of the railway and the port were entrusted to experienced foreign technicians, who transferred European know-how to the region. Modern Greek architecture and the trends of neoclassicism, historicism and eclecticism characterize the new city of Volos. The houses were usually two-storey, stone-built with tiled roofs with large courtyards, flower beds, fountains and pergolas.

At the same time, the Municipal Theatre and the Archaeological Museum were built and at the same time the construction of industrial buildings experienced a huge boom. The first industrial buildings were ground-floor/two-storey/three-storey warehouses built of stone and with pitched roofs. When the manufacturing industries began to be established, they had great differences in their morphology and layout, as the design of each building was shaped according to its needs.

Eclecticism continues to characterize the buildings and during the interwar period with the most important work being the "Achilleion" cinema. The construction of public buildings at that time such as the Courthouse and the Bank of Greece follow the abstract neoclassicism. With the influx of Asia Minor refugees in 1922, workers' housing began to be integrated into the urban fabric for the first time and the so-called cement houses were built in the area of Nea Ionia, consisting of ground-floor, tiled-roofed duplex houses, and later stone houses were also constructed, with better quality with two rooms and a private bathroom.

Figure 7: Achilleion Cinema



Source: <https://www.taxydromos.gr/events/688817/itan-to-kinimatheatro-achilleion/>



Figure 8: The Bank of Greece building



Source: <https://www.thenewspaper.gr/2022/05/25/volos-kleinei-to-katastima-tis-trapezas-tis-ellados/>

When studying the architecture of Volos, we have to mention the church of Saint Nicholas, the temple of the Metropolis of Volos, which is located on the commercial street of Ermou, was inaugurated in 1932 and is covered with carved brickwork with elaborate parapets, columns, stone reliefs, etc. The bell tower of Saint Nicholas was designed by Evaristo de Chirico and is a work of art.

Figure 9: The church of Saint Nicholas and the bell tower



Source: <https://proseuxi.gr/iera-mitropoli-dimitriados-almirou/>

After the earthquakes of the period 55-57, the city began to be rebuilt and the construction of apartment buildings appeared, initially to house the earthquake victims. (Thessalian Research Society, General Secretariat of the Olympic Games, Ministry of Culture, 2004)

In relation to the industrial buildings, the city of Volos took advantage of the heritage they left it and proceeded to restore many of these buildings and change their use. We mention, for example:

- ✓ The Spirer tobacco warehouse, the construction of which was completed in 1926, which today houses in the restored building, the Municipal Center for History and Documentation of the Municipality of Volos, the Central Library of the Municipality of Volos and the Directorate of Technical Services of the Municipality.
- ✓ The warehouses of Matsaggos, which were built in 1967 in Phytoko of Nea Ionia and today belong to the University of Thessaly where the School of Agriculture is housed.
- ✓ The Electric Power Building built in 1911, which is today called the Old Electric and operates as a theater.
- ✓ The Papastratos tobacco warehouse, also from 1926. The building was purchased by the University of Thessaly, its Rectorate was moved there, and this building also houses the pedagogical schools. It has an imposing appearance and is one of the most characteristic buildings of the city.

- ✓ The Tsalapatas brick and tile factory, also from 1926, which belongs to the Municipality of Volos today and operates as a modern cultural center with a museum, showrooms, exhibition spaces, recreation areas, etc.
- ✓ The Loulis flour mill from 1914, today belongs to the technical company G.E.K. and operates as a multi-purpose recreation center with cinemas, entertainment centers, underground parking, etc. (Adamakis K., 2009)

*Figure 10: The Papastratos Tobacco Warehouse building on the coastal road of Volos*



Source: <https://istigmes.com/odi-sta-viomichanika-ktiria-tou-volou/>

## 6. Personalities of the city

- Rigas Feraios or Veletinlis

Born in 1757 in Velestino of Magnesia, Rigas Feraios or Rigas Veletinlis, is the most characteristic personality of the city of Volos. He came from a wealthy family, which is why he went as a student to Pelion, specifically to Zagora of Pelion, where the best school in the area operated, in order to study. He also served as a teacher for a year in the Pelion village of Kissos. After 1774, i.e. the signing of the Treaty of Koutsuk-Kainartzis, he settled in Constantinople where he received more knowledge alongside the Phanariotes. Rigas Feraios was the political mind of the Greek Revolution against the Turkish yoke, but he also studied the next steps in the organization of the now free Greek state. With his most important work, anthem *Thurios*, as well as his map named “Charta” and Constitution, he showed the Greek people the way and the path to the Revolution, which is why he is described as an internationalist. The square where the City Hall and the Municipal Theater in Volos are located is called Rigas Feraios Square. Also a characteristic street in the city center, has been named after him. <http://www.library-zagora.gr/feraios/>

- The painter Giorgio de Chirico

Born in Volos in 1888. His father came from Florence and his mother from Genoa. They came in the city of Volos as his engineer father supervised the construction of the Thessalian railway. A graduate of the School of Fine Arts, he gained worldwide fame for Metaphysical Painting and for the surrealism movement that characterizes his works. His work is considered important in the history of modern art. <https://www.ertnews.gr/arxeio-afierwmata/tzortzio-nte-kiriko-10-iolylioy-1888-2/> In the city center there is a three-story building named in his honor, the Giorgio De Chirico Art Center, which hosts various exhibitions of cultural interest. <https://dimosvolos.gr/el/mouseia>

- Composer Vangelis Papathanasiou

Composer Vangelis Papathanasiou was born in Agria of Volos, in 1943, and from an early age showed his calling in composition. His work is enormous as a musician and composer of electronic, jazz and orchestral music. He was awarded an Oscar for the music of the film “The Roads of Fire”. We specifically mention that the music of his work “Mythodia” accompanied the NASA space mission “2001: A Mars Odyssey”. He passed away in 2022. In his honor, the recently renovated Volos Municipal Theater was dedicated to him, which also took his name. <https://www.kathimerini.gr/culture/music/561867892/vaggelis-papathanasiou-o-monos-ellinas-poy-i-moysiki-toy-akoystike-sto-diastrima/>  
<https://elculture.gr/vangelis-papathanasiou-efyge-apo-ti-zoi-o-megalos-mousikosynthetis-se-ilikia-79-eton/>

## 7. The characteristic features of the city of Volos

- ✓ The church of Saint Constantine and the park on the coast; road of Volos

In 1936, the church of Saint Constantine was built on the coastal road of Volos by the architect Aristotle Zachos. The elaborate church together with the park of the same name, which was transformed into a recreational park in the 1920s according to the designs of the architect N. Kitsikis, constitute a point of reference for the city due to their key location along the city's beach. <https://dimosvolos.gr/el/aksiotheata> In addition to green spaces, the park also hosts several monuments such as the bust of the famous writer Alexandros Papadiamantis and the full-length statue of Eleftherios Venizelos. <https://dimosvolos.gr/el/parko-agiou-konstantinou>

Figure 11: The church of Saint Constantine from a panoramic view



Source: <https://www.volosinfo.gr/churches/>

Figure 12: The church of Saint Constantine from the front



Source: <https://magnesianews.gr/volos/panigyryzei-o-naos-agiou-konstantinou-ston-volo-2.html>



- ✓ The traditional villages of Pelion with their unique architecture and cobblestone streets

As mentioned above, Volos is inextricably linked to Pelion, a fact that makes the villages of Makrinitisa, Portaria, Milies, Vizitsa, Pinakata, Tsagarada, Saint Lawrence, Zagora, etc. characterize the city of Volos. These villages have common characteristics, the special architecture as both the mansions and the churches are built with Pelion stone or slab with large wooden front doors made of Pelion wood, they have skylights inside and marble stairs. The villages also have beautiful cobblestone streets, preserving the traditional character. Also, many of them have imposing squares, surrounding centuries-old plane trees. <https://www.aroundpelion.com/el/architecture>

*Figure 13: The square of the village of Makrinitisa, Pelion*



*Source:*

<https://www.visitpilio.gr/pilio/%CF%86%CF%89%CF%84%CE%BF%CE%B3%CF%81%CE%B1%CF%86%CE%AF%CE%B5%CF%82-%CE%B1%CF%80%CF%8C-%CF%84%CE%B7%CE%BC%CE%B1%CE%BA%CF%81%CE%B9%CE%BD%CE%AF%CF%84%CF%83%CE%B1/>

*Figure 14: Traditional houses in Pelion*



*Source:* <https://www.iliaoikonomia.gr/christougenna-sto-pilio-fotografies/>

## 8. *Surrounding city space*

As we head towards the city of Volos either by road or by sea, what we see in the distance is the imposing Mount Pelion, which undoubtedly constitutes the surrounding area of the city. Its western slopes overlook the Thessalian plain and the Pagasetic Gulf while the eastern slopes drop steeply towards the North Aegean. Pelion has abundant water and is covered with rich vegetation consisting of beech forests, chestnut forests and Macedonian firs. We also encounter the cultivation of fruit trees such as apple, cherry, orange trees and lower olive trees. Also, grasses such as tsitsiravla, kritamo etc. are often found in various areas of the mountain, mainly in coastal areas. Regarding the fauna, Pelion is also home to several species of birds of prey such as the golden eagle and the white-tailed eagle. During the night, one can encounter mammals such as fox, badger, ferret, weasel, bats and wild boar. Pelion has been included in the Natura 2000 Network of the European Union. At the highest peak, in Chania Pelion, there is a ski resort which is a winter tourist attraction. Finally, the mountain of the Centaurs has a multitude of paths that connect the villages to each other, some of which the residents had paved with stone and created the so-called cobblestones. Today, many people explore the particularly beautiful paths. (Ministry of Tourism, 2004)

## 9. *Institutional framework for the protection of the city of Volos*

In accordance with the principles of sustainable development, Volos set as the main axis of its planning the "spatial and residential organization of the area and especially its coastal front, as well as the protection of the environment" (<http://epoleodomia.volos.gr>). At the beginning of the 20th century, the city's urban plan was submitted, which set such building conditions as well as avoiding intervention in critical zones in order to ensure satisfactory living conditions in the city center. Of utmost importance was the intervention in the road and railway network of the area. It was decided to strengthen the operation and importance of the city's port. In addition, the city had to comply with the concept of Integrated Coastal Zone Management, as defined in Chapter 17 of Rio Agenda 21 (1992). Specifically, for the protection of coastal areas, it participated in a European LIFE program entitled "Awareness, cooperation and conditions for the sustainable development of coastal areas of Magnesia. (Xanthou D., 2019) Also, the reduction of pollution sources (atmospheric pollution, marine pollution) was one of the main objectives of the region. In addition, since the region has a large ecological and cultural reserve, efforts were made to protect and preserve it. (Aichoros, 2023) Indicatively, we mention that many buildings in the city of Volos have been declared listed, especially old industrial buildings which were restored and their use changed, such as the Yellow Warehouse, the Tsalapatas brick and tile factory, etc. Also, we would like to mention that the villages of Makrinitza and Vyzitsa in Pelion have been declared protected, while numerous villages in Pelion have been declared Landscapes of Outstanding Natural Beauty, such as Portaria, Tsagarada, Milies, Saint Vlassis, etc. <http://www.elladosperiigisis.gr/index.php/2006/198-taxidia-stin-alli-ellada-h-200/451-449-perioxes-elladas> It is worth mentioning that a number of areas near the city of Volos have been included in the NATURA 2000 network, for the protection of nature and biodiversity. Indicatively, we mention the areas with GR1430002 Kouri Almyrou-Saint Seraphim and GR1430001 Mount Pelion and Coastal Marine Zone-Malaki and Skeponi Caves. [http://www.fdkarlas.gr/Main\\_Info.aspx](http://www.fdkarlas.gr/Main_Info.aspx) Finally, the main goal was to distribute responsibilities differently at local, regional and national levels, in order to make the governance of the Volos region more effective. In this context, the city of Volos and the wider region are trying to both preserve its environmental and cultural identity and to shield itself against the global climate crisis, making it a sustainable city. (Aichoros, 2023)

- The economy of the city of Volos

#### Primary sector

The fact that the western side of Volos faces the fertile Thessaly plain has contributed to the development of the primary sector through the cultivation of mainly wheat, corn, cotton and almonds <https://tee-kdth.gr/wp-content/uploads/2019/09/markatou.pdf>. On the eastern side, in the areas of Agria, Lechonia, etc., we have significant production of olives, vegetable and fruit trees. (Marou Th., 2023). Pelion also holds a prominent position in the production and export of apples and pears, peaches, chestnuts, tsitsiravla greens, etc. and oil is produced from the olive groves. (Ministry of Tourism, 2004) Regarding livestock farming, in the Thessalian plain of the region there are pastures mainly with sheep, goats and cattle, while in Pelion sheep called the Pelion breed, cows and goats are raised. [https://www.minagric.gr/images/stories/docs/agrotis/Aigoprobata/Files\\_Aigoprobato/fili\\_piliou.pdf](https://www.minagric.gr/images/stories/docs/agrotis/Aigoprobata/Files_Aigoprobato/fili_piliou.pdf). And finally, fishing and the processing of fishing products play an important role in the economy of the region. The fish market in combination with the fish market in the area of Palea, channel fresh products to the market of the region. (Marou Th., 2023)

#### Secondary sector

The Secondary Production Sector, until the time of the 2014 crisis, was an important element in the economy of the region. Having two industrial areas around the urban fabric, with factories related to metal processing, beverage and food factories, the wood industry, etc., the secondary sector offered jobs to a large number of the residents, strengthening the productive activity of the region. There are also factories producing oils, olive oil, flour and milk. (Marou Th., 2023) Here we should mention that outside the city of Volos, on the eastern side of Agria, there is the AGET-Iraklis cement factory, a factory which provided jobs to residents in the past, but due to the burning of garbage it carries out, it greatly burdens the city's air pollution. <https://www.thessaliaeconomy.gr/blog/viomixania/o-volos-kai-i-tsiminiera-tis-aget-lafarge> In recent years, many of these factories have ceased operation, which has led to the degradation of the industrial zone and led a large part of the population to unemployment. It is auspicious that investments are starting to be made again in the area. (Marou Th., 2023)

#### Tertiary sector

The most important branch of the tertiary sector in the region is tourism. A city with a port that connects it with the Northern Sporades islands of Skiathos, Skopelos and Alonissos, it is logical to attract visitors, especially in the summer. Also, the passage of tourists from Volos throughout the year to visit Pelion increases the number of visitors to the city. According to data from the Volos Municipality Business Plan (Phase I, 2015-2019), there are a number of tourist accommodations, restaurants and other services. Finally, the city has a number of wholesale and retail trade services, transport, health, design and consulting support.

### ***10. Projects funded by the European Union in the city of Volos***

“Expansion of the Network of Pedestrians and Light Traffic Roads in the Central Urban Area”, which was included in the P.E.P. of Thessaly 2014-2020 and is one of the largest EU-funded projects. It concerns the expansion of the pedestrian network in the central urban area of the city of Volos and the transformation of the city's central streets from traffic roads to light traffic roads. It also concerned interventions such as increasing the width of sidewalks and reducing the width of roads, installing signage and lighting, planting and creating blind lane zones and ramps to facilitate accessibility for people with disabilities. The project aimed to benefit the natural and urban environment, improve the quality of life of citizens and



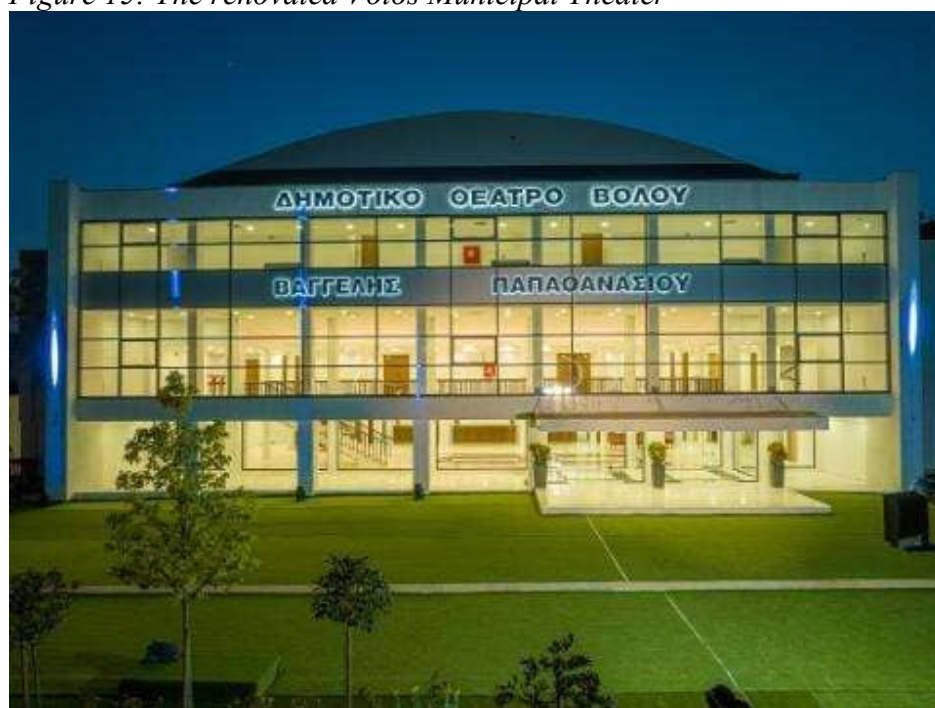
facilitate accessibility and mobility of citizens in the area. The project budget was €1,085,000.00.

<https://dimosvolos.gr/sites/default/files/%CE%A0%CE%95%CE%96%CE%9F%CE%94%CE%A1%CE%9F%CE%9C%CE%9F%CE%99.pdf>

“Repair - Reinforcement of the load-bearing structure and renovation of the Municipal Theater”, which was included in the P.E.P. of Thessaly 2014-2020 with a budget of €5,000,000.00. It is one of the largest projects in recent years in the city of Volos and concerns the renovation of the Municipal Theater, which is located in Riga Feraios Square and aims to upgrade the urban and cultural environment, enhance sustainable development and preserve the historical and cultural heritage.

<https://dimosvolos.gr/sites/default/files/%CE%98%CE%95%CE%91%CE%A4%CE%A1%CE%9F1.pdf>

*Figure 15: The renovated Volos Municipal Theater*



Source:

<https://i0.wp.com/ethessalia.gr/wpcontent/uploads/2023/06/theater00015.jpg?fit=553%2C414&ssl=1>

Some important social projects were also carried out, such as the “Social Grocery Store and Social Pharmacy of the Municipality of Volos” and the project concerning the “Continuation of the operation of a Shelter for Women Victims of Violence in the Municipality of Volos”

[https://dimosvolos.gr/sites/default/files/%CE%9A%CE%9F%CE%99%CE%9D%CE%A9%CE%9D%CE%99%CE%9A%CE%9F-%CE%A6%CE%91%CE%A1%CE%9C%CE%91%CE%9A%CE%95%CE%99%CE%9F\\_%CE%A0%CE%91%CE%9D%CE%A4%CE%9F%CE%A0%CE%A9%CE%9B%CE%95%CE%99%CE%9F1.pdf](https://dimosvolos.gr/sites/default/files/%CE%9A%CE%9F%CE%99%CE%9D%CE%A9%CE%9D%CE%99%CE%9A%CE%9F-%CE%A6%CE%91%CE%A1%CE%9C%CE%91%CE%9A%CE%95%CE%99%CE%9F_%CE%A0%CE%91%CE%9D%CE%A4%CE%9F%CE%A0%CE%A9%CE%9B%CE%95%CE%99%CE%9F1.pdf)

[https://dimosvolos.gr/sites/default/files/%CE%A0%CE%99%CE%9D%CE%91%CE%9A%CE%91%CE%A3\\_portal\\_4.pdf](https://dimosvolos.gr/sites/default/files/%CE%A0%CE%99%CE%9D%CE%91%CE%9A%CE%91%CE%A3_portal_4.pdf)

[https://dimosvolos.gr/sites/default/files/%CE%A0%CE%99%CE%9D%CE%91%CE%9A%CE%91%CE%A3\\_portal\\_4.pdf](https://dimosvolos.gr/sites/default/files/%CE%A0%CE%99%CE%9D%CE%91%CE%9A%CE%91%CE%A3_portal_4.pdf)

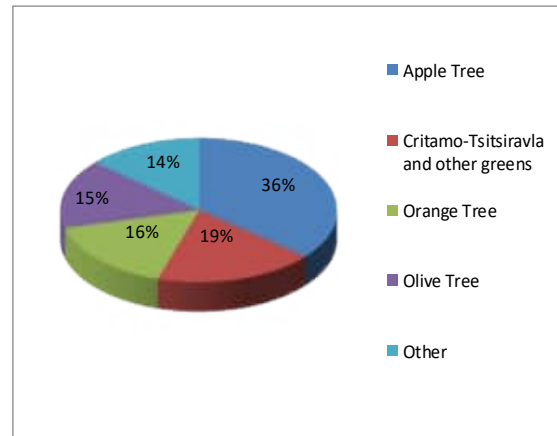
PART B: Survey on a sample of one hundred and fifty-five (155) individuals. Analysis using the method of descriptive statistics

**Question 1: What is the characteristic plant of the region?**

Table 2

| Options                           | Number of Answers |
|-----------------------------------|-------------------|
| Apple tree                        | 56                |
| Kritamo-Tsitsiravla e.t.c. greens | 29                |
| Sour Orange tree                  | 25                |
| Olive tree                        | 24                |
| Other                             | 21                |

Figure 16



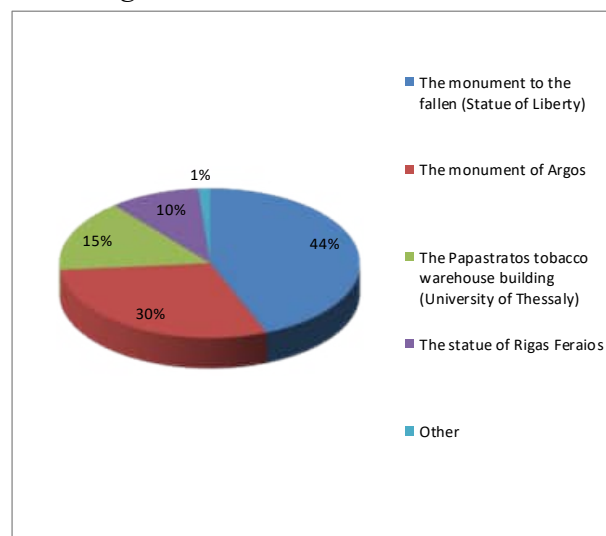
As mentioned above, although the apple tree is not a plant that one encounters in the city of Volos, the respondents nevertheless chose it as the most characteristic plant of the region with a percentage of 36% due to the famous apples of the village Zagora of Pelion. This is followed by the greens of Pelion such as tsitsiravla greens, with a percentage of 19%. In third place we see the sour orange tree with a percentage of 16%, which is a purely plant of urban Volos, as we encounter sour orange trees in many streets and alleys of the city both in the center and in the neighbourhoods. Finally, the olive tree follows with a percentage of 14% due to the olive groves that are mainly located in villages close to the city.

**Question 2: What is the most characteristic monument of the city?**

Table 3

| Options                                                             | Number of Answers |
|---------------------------------------------------------------------|-------------------|
| The Monument to the Fallen (Statue of Liberty)                      | 68                |
| The monument of Argos                                               | 46                |
| The Papastratos tobacco warehouse building (University of Thessaly) | 24                |
| The statue of Rigas Feraios                                         | 15                |
| Other                                                               | 2                 |

Figure 17



It is expected that in this question 44% of respondents consider the most characteristic monument of the city, the Monument of Independence, the Statue of Liberty located on the beach of Volos. The Argos Monument follows with a percentage of 30%, which is surprising since it is a small monument. The third choice is the Papastratos tobacco warehouse building with a percentage of 15%. The Statue of Liberty with the Papastratos tobacco warehouse building located directly opposite, it could also have the role of a condenser of physiognomy

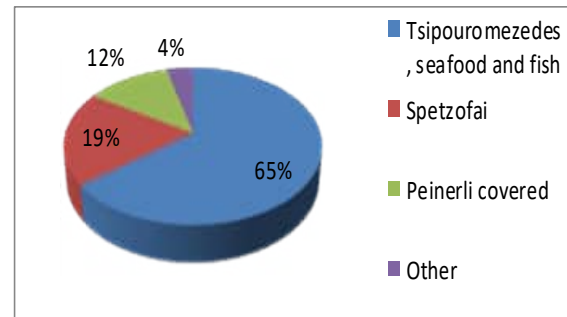
for the city. Finally, with a percentage of 10% the statue of Rigas Feraios has the last place as this statue, although imposing, is located at some distance from the city center.

**Question 3: What is the typical food of the region?**

Table 4

| Options                                      | Number of Answers |
|----------------------------------------------|-------------------|
| Tsipouro appetizers, seafood and fish dishes | 100               |
| Spetzofai                                    | 30                |
| Covered Peinerli                             | 19                |
| Other                                        | 6                 |

Figure 18



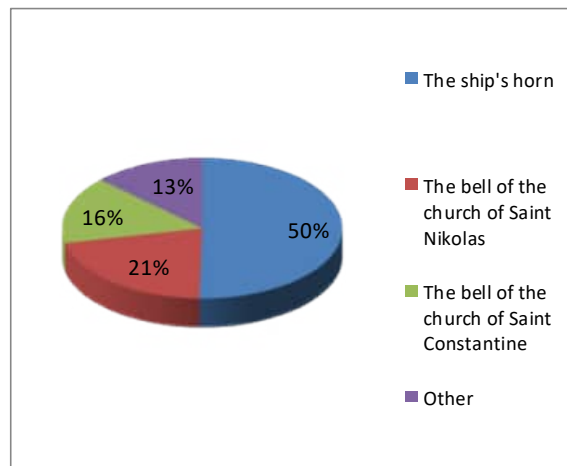
The overwhelming majority voted the food accompanying tsipouro drink, with a percentage of 65%. It is logical that as Volos is famous for its tsipouro restaurants, they are preferred by both locals, who have incorporated them into their lifestyle, and visitors to the city. Spetzofai follows with a percentage of 19%, which is special, more traditional and many visitors visit Pelion to try it. In third place comes the covered peinerli with a percentage of 12%. It is a delicacy of the city that consists of a special dough filled with cheese, cold cuts and tomato sauce. In general, it is preferred by the city's young people, so the respondents, mainly in the 18-30 age group, have chosen it as the most typical.

**Question 4: What is the characteristic sound of the city?**

Table 5

| Options                                     | Number of Answers |
|---------------------------------------------|-------------------|
| The ship's horn                             | 78                |
| The bell of the church of Saint Nicholas    | 33                |
| The bell of the church of Saint Constantine | 24                |
| Other                                       | 20                |

Figure 19



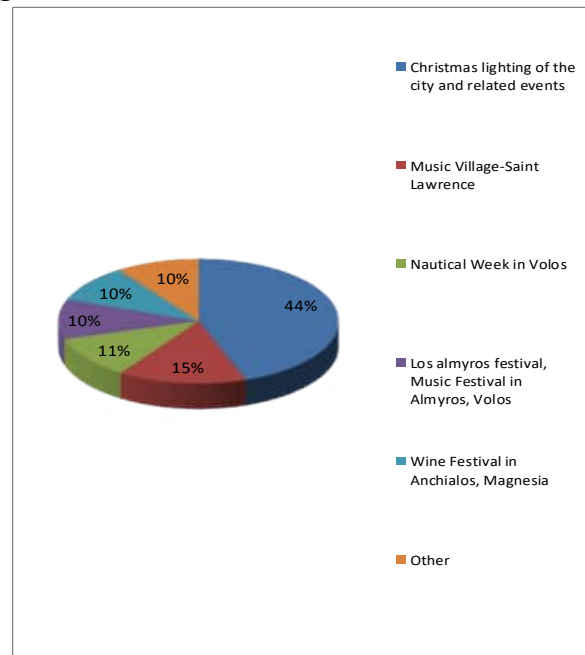
Volos is a city with a port and a developed coastal front, so 50% of respondents consider the most characteristic sound of the city to be the horn of ships when they approach the port, as it is the sound they hear on their coastal walk. This is followed by the bell of Saint Nicholas with a percentage of 21%, which is in the center of the city's commercial center, and the bell of Saint Constantine with a percentage of 16%, which we would expect to be higher since this church is a capacitor of the city's physiognomy.

**Question 5: What is the most characteristic event of the region?**

Table 6

| Options                                                | Number of Answers |
|--------------------------------------------------------|-------------------|
| Christmas lighting of the city and related events      | 69                |
| Music Village-Saint Lawrence                           | 23                |
| Nautical Week in Volos                                 | 17                |
| Los almyros festival, Music Festival in Almyros, Volos | 16                |
| Wine Festival in Anchialos, Magnesia                   | 15                |
| Other                                                  | 15                |

Figure 20



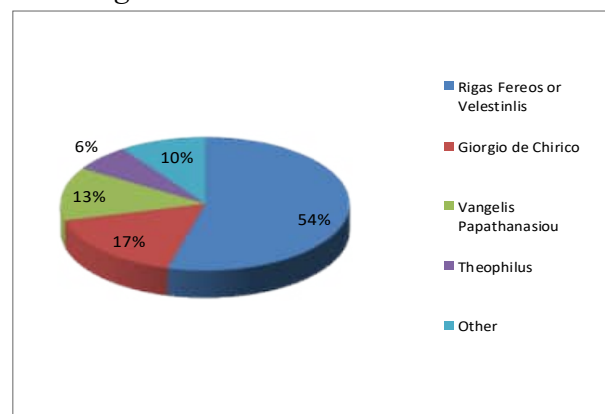
The majority of respondents, with a percentage of 44%, consider the Christmas lighting and related events to be the most characteristic event of the city. In the last decade, the Municipality of Volos has given particular importance to extroversion and attracting tourism in the context of sustainable development, the imprint of which is clearly visible in the answers. The Musical Village-Saint Lawrence follows, with a percentage of 15%, which is expected if we take into account that it is an event of European and global fame. The third place is occupied by the Volos Nautical Week with a percentage of 11%, which is not expected as it is an event that is not particularly popular among the people of Volos, although in recent years various bodies have participated in the organization (such as the Municipality of Volos, the Region of Thessaly, the Holy Metropolis of Demetrias, etc.) and it has gained ground in people's preferences. In fourth place are the Los Almyros Music Festival and the wine festival in Anchialos, Magnesia, with a percentage of 10%. One would expect the wine festival to be considered a more characteristic event as it is particularly well-known among all ages. The Los Almyros Festival, a festival supported mainly by teenagers and young people, initially had a local character but gained fame and won visitors from all over Greece.

**Question 6: Who is the most characteristic personality of the city of Volos?**

Table 7

| Options                      | Number of Answers |
|------------------------------|-------------------|
| Rigas Feraios or Velestinlis | 84                |
| Giorgio de Chirico           | 26                |
| Vangelis Papathanasiou       | 20                |
| Theophilus                   | 10                |
| Other                        | 15                |

Figure 21



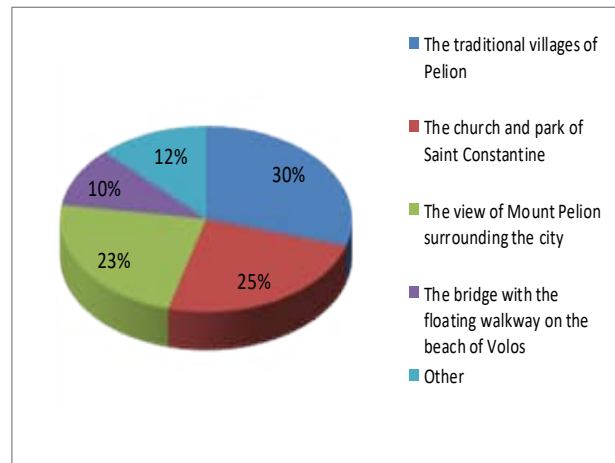
Rigas Feraios/Velestinlis is with a percentage of 54% the most characteristic personality of the city and it is logical because he was a historical and revolutionary figure with a pan-Hellenic reach. The painter Giorgio de Chirico follows with a percentage of 17%, Vangelis Papathanasiou with a percentage of 13% and with a much smaller percentage of 6%, the painter Theofilos.

**Question 7: What is the most characteristic physiognomy capacitor, i.e. an element inextricably linked to the sense we have of the city of Volos and the wider region?**

Table 8

| Options                                                    | Number of Answers |
|------------------------------------------------------------|-------------------|
| The traditional villages of Pelion                         | 46                |
| The church and park of Saint Constantine                   | 36                |
| The view of Mount Pelion surrounding the city              | 38                |
| The bridge with the floating walkway on the beach of Volos | 16                |
| Other                                                      | 19                |

Figure 22



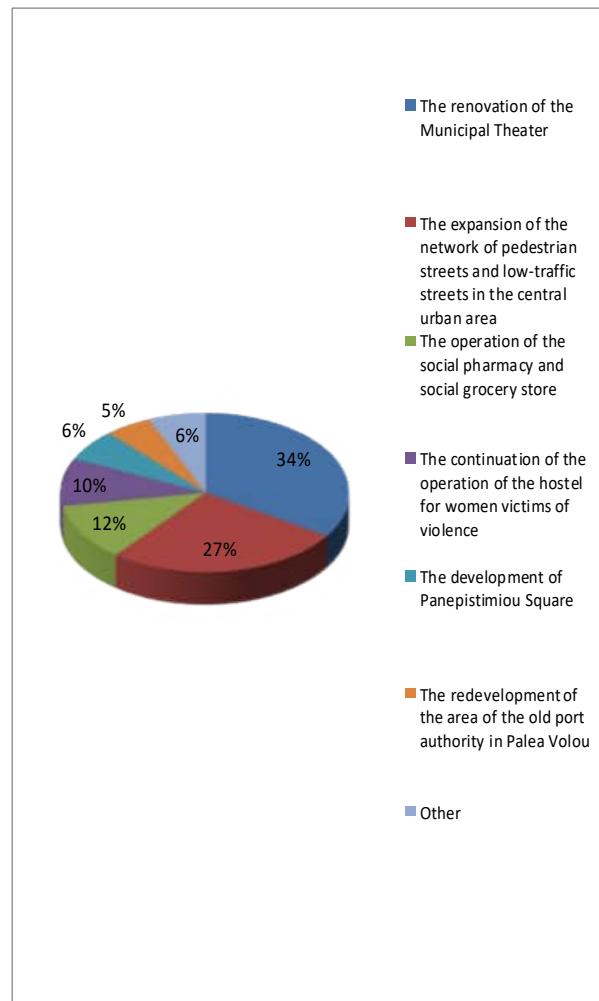
The traditional villages of Pelion with their unique architecture and cobblestone streets are the most characteristic feature of the landscape, as 30% of respondents gave this answer. Pelion again wins in second place, as 25% of respondents answered the view of Mount Pelion surrounds the city. From almost all points in the city of Volos, one can see the mountain. The church and park of Saint Constantine on the beach of Volos follow with a percentage of 23%, which is expected since walking on the beach is an almost daily habit of the locals. Finally, the bridge with the long breakwater, on the city's beach received 10% of the answers. It is striking that the largest percentages were given to answers that had to do with Pelion and not purely with Volos, which testifies to how the respondents consider Pelion an integral part of Volos.

**Question 8: Which of the recent projects in the city of Volos funded by the European Union is considered to be the most important?**

Table 9

| Options                                                                                              | Number of Answers |
|------------------------------------------------------------------------------------------------------|-------------------|
| The renovation of the Municipal Theater                                                              | 41                |
| The expansion of the network of pedestrian streets and low-traffic streets in the central urban area | 53                |
| The operation of the social pharmacy and social grocery store                                        | 18                |
| The continuation of the operation of the hostel for women victims of violence                        | 15                |
| The development of Panepistimiou Square                                                              | 10                |
| The redevelopment of the area of the old port authority in Palea Volou                               | 8                 |
| Other                                                                                                | 10                |

Figure 23



In this question, the sample considers the most important project with a percentage of 34% to be the expansion of the network of pedestrian streets and low-traffic streets in the central urban fabric, a very important project related to the sustainable development of the city and with a large budget. In second place, with a percentage of 27% comes the renovation of the Municipal Theater, which shows the importance that respondents give to the promotion of culture and the infrastructure needed for its promotion. This project also had the largest budget of the city's latest projects funded by the European Union. Next are projects related to social structures, with the operation of the social pharmacy and the social grocery store having a percentage of 12% and the continuation of the operation of a hostel for women victims of violence with a percentage of 10%. In the last positions are two regeneration projects, the one for the development of Panepistimiou Square with a percentage of 6% and the one for the regeneration of the area of the old port authority in Old Volos with a percentage of 5%, which creates concern as the city needs such regeneration areas in its center, in order to maintain its sustainability.

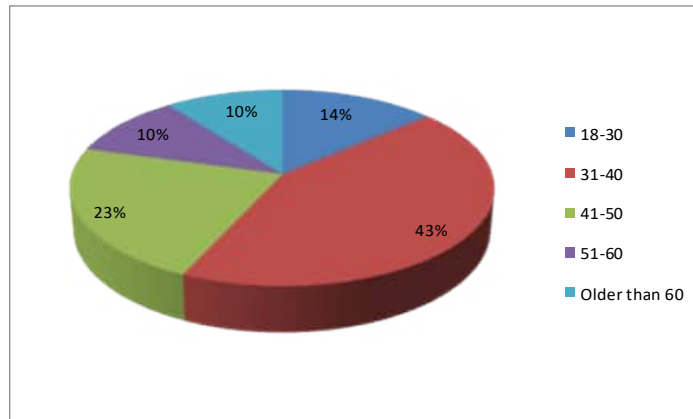


**Question 9: What age group do you belong to?**

Table 10

| Options       | Number of Answers |
|---------------|-------------------|
| 18-30         | 21                |
| 31-40         | 67                |
| 41-50         | 35                |
| 51-60         | 16                |
| Older than 60 | 16                |

Figure 24



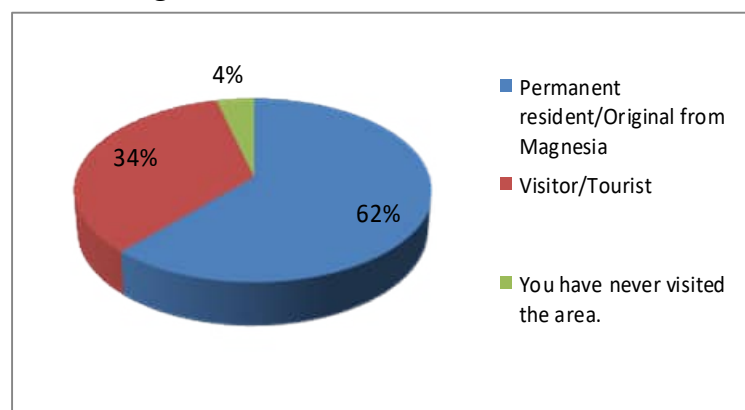
The 31-40 age group gave 43% of the answers, the 41-50 age group gave 23% of the answers, the 18-30 age group gave 14% of the answers, the 51-60 age group gave 10% of the answers as well as the 60 age group. Most respondents are middle-aged, but the sample also includes people of younger and older ages.

**Question 10: Which category do you belong to?**

Table 1

| Options                                   | Number of Answers |
|-------------------------------------------|-------------------|
| Permanent resident/Original from Magnesia | 95                |
| Visitor/Tourist                           | 53                |
| You have never visited the area.          | 6                 |

Figure 25

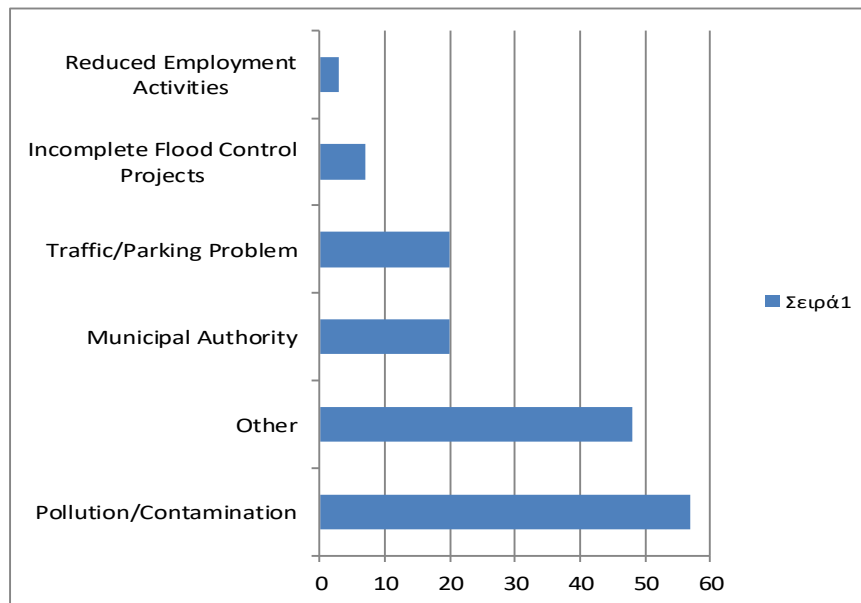


62% of the sample consists of permanent residents or people originating from the Regional Unit of Magnesia. 34% have visited the city for tourism while 4% have never visited the area. The overwhelming majority of locals gives us a relative certainty that the respondents chose among a series of answers that they knew. And the fact that a significant percentage consists of tourists is very important as visitors understand better the physiognomy of the city.

**Question 11 (open-ended question): What is the most negative characteristic of the city?**

An attempt was made to group the answers, as the question is open-ended. The chart shows the number of answers and not the percentage. The overwhelming negative priority is given to air pollution, which is mainly due to the city's two large factories, the AGET and the Steelworks, the pollution of the city's port and the smog that is created during the winter months. The current municipal authority of the city of Volos and the traffic problem/lack of parking spaces follow in a tie. Incomplete flood control projects follow, surprisingly, with a small percentage, if we also consider the recent floods that hit the Thessaly region in September 2023. Finally, some answers had to do with the lack of employment opportunities.

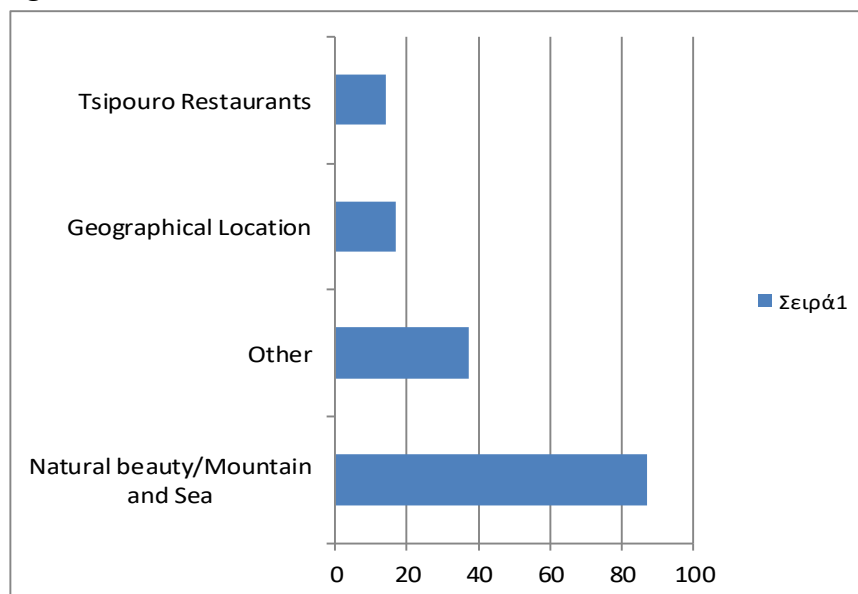
Figure 26



**Question 12 (open-ended question): What is the most positive feature of the city?**

An attempt was made to group the answers as the question is open-ended. The chart shows the number of answers and not the percentage. The overwhelmingly positive first place goes to the natural landscape of the area and Pelion which provides the combination of mountain and sea. The geographical location of the area follows and immediately after the tsipouro restaurants of the city.

Figure 27



## Conclusions

So what is the physiognomy of the city of Volos?

It is a city with a strong character due initially to its geographical location and geophysical situation. The accessibility, the direct contact with the sea and rivers, the existence of the

liquid element in many degrees at the foot of Pelion, the altitudinal constants, the mild temperatures it has, the biorhythms determined by all these climatic conditions, the plants, the animals, etc., determine its physiognomy and maintain a stable image of the city over time. (Stefanou I., Mitoula R., 2003). Initially, the city offers quality of life. The city also has a very high degree of sociability and extroversion, a walk on the city's coastal road can take you on a journey. Pedestrianized coastal front, with monuments of unparalleled beauty and special architecture such as the statue of the fallen, the former Papastratos tobacco warehouse, the church of Saint Constantine, the monument of Argos, the modern art sculpture park, etc. throughout its entire area and with many tsipouro restaurants and cafes which are visited by locals and tourists for enjoyable moments. The city has also strongly developed the element of culture as evidenced by the infrastructures that support it. The Municipal Theater, the Municipal Conservatory, the Museums, sports infrastructures, etc. Also, the special architecture and mainly industrial heritage which it has exploited contributes to the shaping of the city's physiognomy. (Stefanou I., Mitoula R., 2003). The city's physiognomy capacitors could be many: the church of Saint Constantine, the church of Saint Nicholas, the traditional villages of Pelion, the Pagasetic Gulf with the monument to the fallen in the background and the former Papastratos tobacco warehouse. We could say that the city is "endowed", as it has all those elements that contribute to the development of the primary, secondary and tertiary sectors of the economy. It is a city that tries to maintain its physiognomy through funded projects that are implemented and aim at the sustainability of the city.

Regarding the results of the research as analyzed in the previous section, a fairly large percentage were expected and in line with the bibliographic research that was carried out. It would be appropriate to make a more extensive reference to the negative characteristics of the city and to mention that the city should protect the atmosphere and the health of its residents as due to the location of the city, due to humidity and wind direction in combination with the existence of heavy industry in the area (e.g. the two large factories the cement factory of AGET-Iraklis and the steel factory of Halyvourgia), the air pollutants of the city are in high levels. (Operational Program Municipality of Volos, 2020-2023)

Factories should operate but within an absolutely strict institutional framework in order not to endanger the health of citizens. Also, in the city of Volos that has many potentials, the sectors of the economy should be developed in such a way that the city is self-sufficient, offering new jobs to its citizens. Finally, the green spaces within the central urban fabric should be increased through funded projects as the city must breathe in all its parts.

By following the aforementioned policies, the city will maintain its physiognomy and will have sustainable development as it will manage its natural resources sensibly and protect its urban and suburban environment. After all, Volos has all the elements that can characterize a sustainable city. Sun, sea and fertile soil!

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## **ENVIRONMENTAL PROFILE A REGION KARDITSA**

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### **Abstract**

The region of Karditsa, rich in natural resources and with a strong agricultural focus, serves as an ideal case for implementing the principles of a "smart city" with a focus on sustainability. This paper explores how smart technologies can contribute to sustainable natural resource management, reduce environmental impact, and enhance residents' quality of life.

Particular attention is given to water resource management, as the area includes significant aquatic ecosystems, such as Lake Plastiras and the Smokovo Dam. The use of technologies like sensors for continuous monitoring of water quality and quantity, as well as smart irrigation systems to reduce waste and improve agricultural efficiency, is analyzed. Additionally, interventions in infrastructure are examined, including the development of green spaces and the promotion of sustainable mobility through bike paths and electric transportation solutions.

The thesis highlights the importance of local community involvement and collaboration among local authorities, businesses, and research organizations for the successful implementation of these initiatives. The proposed actions aim to strengthen the region's economic resilience, promote eco-tourism, and establish Karditsa as a model for sustainable agricultural and tourism development.

In conclusion, transforming Karditsa into a "smart" and environmentally conscious region offers significant opportunities to improve quality of life, protect the natural environment, and preserve natural resources for future generations.

**Keywords:** smart city, sustainability, natural environment, water resources, Lake Plastiras, green development, eco-tourism.



Session:

**“Entrepreneurship and Local Sustainability -  
ESG Criteria”**

## **THE APPLICATION AND EFFECTIVENESS OF ESG CRITERIA IN GREEK COMPANIES**

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### **Abstract**

The application of ESG criteria in Greek companies is steadily evolving, supported by international trends and European regulatory requirements. The purpose of this research is to investigate the application of ESG criteria by Greek companies and to assess their impact on their profitability. A quantitative survey was carried out using a questionnaire to a sample of 130 employees who were employed in companies in the Attica region. According to the results, most participants consider the adoption of ESG criteria essential for the long-term sustainable development of Greek companies and believe that the incorporation of ESG criteria enhances the relationship of the company with its investors. Employees identified corporate reputation and competitive advantage as the main benefits of adopting ESG criteria. Furthermore, it was found that larger companies are more likely to integrate ESG criteria into their strategies. In conclusion, this paper highlights the growing importance of ESG criteria in shaping the future of business in Greece.

**Key words:** Greek companies, ESG criteria, economic efficiency, sustainable development

## **THE EFFECT OF ESG CRITERIA ON CONSUMER PREFERENCES REGARDING THE CHOICE OF A COMPANY’S PRODUCTS AND SERVICES**

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### **Abstract**

ESG (Environmental, Social, and Governance) criteria are increasingly becoming key factors in modern business practices, affecting both the reputation of companies and the purchasing decisions of consumers. The growing emphasis on sustainability and the increasing awareness of environmental and social issues have prompted companies to adopt these practices to align with their costumers’ values, a practice that is now a requirement rather than just an option.

The purpose of this study was to investigate the effect of ESG criteria on consumer purchasing behavior, focusing on a sample of 141 residents from Athens, Greece. A survey was conducted using a closed-ended type questionnaire. The collected data was analyzed to identify correlations between consumers’ perceptions of ESG factors and their purchasing preferences. The analysis focused on the relationships between environmental sustainability, governance practices, and corporate social responsibility (CSR) with consumer preferences, highlighting the significance of these factors in shaping attitudes towards companies that adopt sustainable practices.

The results of the study underlined the important role of environmental and governance factors in shaping consumer preferences. The respondents prioritized sustainable practices, such as waste management and climate change policies, demonstrating a strong preference for companies that align with their values. Furthermore, perceptions of corporate social responsibility emerged as a critical determinant, with the participants showing reduced support for companies involved in unethical practices.

These findings provide valuable insights into the growing importance of ESG criteria in shaping consumer behavior, highlighting the need for companies to be transparent and responsive to the evolving expectations of their customers. Future research may include a

larger sample size and a more detailed analysis of demographic variables to provide a deeper understanding of the factors affecting consumer attitudes towards sustainability and corporate responsibility, further emphasizing the importance of ESG criteria.

**Key words:** ESG Criteria, Consumer Preferences, Corporate Practices, Sustainability

## 1. Introduction

In today's business world, the concept of sustainable development is becoming increasingly important, encouraging companies to include ESG (Environmental, Social, and Governance) criteria in their strategies. ESG criteria have become a key part of how companies are evaluated, as they are directly linked to responsibility and sustainability. By incorporating these criteria, companies may build consumer trust and improve their reputation.

The adoption of ESG criteria not only affects companies but also affects consumer preferences. Consumers are increasingly aware of the environmental and social practices of companies, and their choices are shaped by the values promoted by companies that follow sustainable practices. However, despite this growing awareness, there is still uncertainty about how willing consumers are to support these companies, especially when it means paying higher prices for environmentally friendly products and services.

This study is one of the first in Greece to examine the impact of ESG criteria on consumer preferences. While previous research has extensively analyzed the relationship between sustainability, corporate performance, and consumer behavior in other countries, no study has specifically addressed this issue within the Greek market.

This research aims to explore Greek consumers' perceptions of ESG criteria and how these perceptions affect their behavior. Specifically, the current study examines the effect of sustainability practices and company policies on consumers' decisions when purchasing products and services, as well as their attitudes towards certified environmentally products.

## 2. Literature Review

### *2.1. The Role of ESG Criteria in Shaping Business Strategy and Consumer Preferences*

Incorporating Environmental, Social, and Governance (ESG) criteria into business strategy has become an integral part of modern enterprises, as it combines the need for sustainability with the creation of economic value. This approach seeks to achieve strong business performance through social benefits and environmental policies, while simultaneously mitigating external pressures that may affect corporate reputation and success (Alsayegh et al., 2020). ESG criteria provide companies with the necessary tools to enhance their performance and increase their competitiveness, as their adoption allows organizations to develop strategies that affect both consumer and investor relations (Habib, 2023).

Specifically, the implementation of ESG criteria involves incorporating a management system that improves internal business processes and aligns the organization with the growing preferences of consumers, who are increasingly aware of sustainability and responsible consumption (Habib, 2023). Today, consumers are seeking companies that not only provide high-quality products and services, but also embrace values that promote environmental protection, social responsibility, and effective governance. The loyalty and commitment to organizations that adopt these strategies are notably stronger, thus fostering the development of long-term consumer trust and loyalty. Companies that incorporate these values into their strategies can distinguish themselves in the competitive market, enhancing not only their

social image but also their financial performance, thereby creating a sustainable and credible model of growth. Companies that incorporate ESG criteria into the core of their strategies are not solely focused on improving operational performance, but also project a positive public image (Alsayegh et al., 2020).

The integration of ESG criteria directly links corporate reputation to business success, enabling companies to differentiate themselves in the marketplace while simultaneously delivering value to the communities in which they operate. Organizations that invest in implement ESG criteria see positive impacts not only on their sales but also on their overall image, thereby strengthening customer loyalty. This makes the adoption of ESG strategies vital for enhancing competitiveness and achieving long-term success in the market (Habib, 2023).

## ***2.2. Corporate Social Responsibility and Consumer Preferences: Effects and Business Responsibility Strategies***

Corporate Social Responsibility (CSR) has emerged as a central factor in business development strategies, as companies recognize the need to balance economic growth with social welfare and environmental responsibility. CSR refers to a company's commitment to achieving a positive social impact through voluntary actions that integrate social and environmental needs into their business activities (Boufounou et al., 2023). Specifically, the social dimension of CSR focuses on improving working conditions, protecting employees' rights, and strengthening corporate relationships with the community.

Despite the lack of a unified and definitive form, CSR has been shown to have a significant effect on consumers' attitudes towards companies. In particular, the strong promotion of social values by companies enhances consumer positivity towards them and fosters long-term loyalty (Kim & Park, 2020). Moreover, CSR practices can mitigate the negative effects of poor business practices, ensuring a more stable social and economic environment for companies (Oh et al., 2024).

In this context, ESG criteria become a critical tool for evaluating the sustainability of businesses. CSR can be considered an integral part of these criteria, as it contributes to strengthening responsible governance and improving social conditions, thus laying the foundation for the development of a more sustainable and responsible business model.

According to the research by Kim & Park (2020), consumers highly value the gratitude and reliability of companies that undertake social initiatives, which has a positive effect on avoiding retaliatory behaviors towards them. In the case of these companies, consumers' preferences increase, while negative reactions decrease, strengthening their willingness to recommend and repurchase their products or services.

## ***2.3. Business Activity and Governance: Key Drivers of Corporate Responsibility***

Governance is an integral component of ESG criteria and plays a crucial role in the operation of a business and its impact on stakeholders. Governance mechanisms characterized by transparency, stakeholder participation, and board diversity strengthen decision-making processes and risk management. In this way, they contribute to improving the company's financial performance and reputation.

However, a company that seeks high profits while claiming to promote social and environmental responsibility may face conflicts if its strategies do not align with its statements. According to the study by Wu et al. (2023), such contradictory practices may lead to conflicts that negatively affect the company's value. Nevertheless, strong governance can mitigate these negative effects, as shown by a research on Chinese companies. Effective

governance mechanisms could play a critical role in balancing contradictions and protecting the company's value from the adverse effects of ESG-related conflicts.

Furthermore, an effective corporate governance, when combined with environmental and social strategies, does not conflict with the pursuit of financial profit, as noted by Alsayegh et al. (2020). In fact, governance criteria that include the establishment of transparent mechanisms and reporting processes are fundamental tools for managing risk and enhancing accountability.

Companies that adopt such strategies are better positioned to strengthen their resilience, effectively manage ESG risks, and improve their long-term sustainability (Wu et al., 2023). Thus, promoting good governance practices is a critical factor in enhancing social responsibility and sustainability.

#### ***2.4. Consumer Perceptions and Challenges in ESG Adoption***

In recent years, consumers have become increasingly aware of the environmental effects of the products and services they prefer. This change has directly affected purchasing preferences, as more and more people are prioritizing products produced using ethical and environmentally friendly practices. Companies that adopt sustainable marketing practices gain a significant competitive advantage in this changing environment (Pranta et al., 2024).

Implementing environmentally responsible practices allows companies to gain consumers' trust and preference, enhancing both their corporate image and sales. Consumers who are aware of a company's social efforts show greater leniency during crises, as the gratitude generated by socially responsible practices reduces harsh criticism.

Corporate governance also plays a key role in shaping consumer perceptions. Transparent, ethical and responsible business practices not only prevent scandals and crises but also enhance investor, consumer and stakeholder trust. Companies that integrate governance criteria into their practices significantly affect consumers' purchasing decisions, as demonstrated by the study by Rastogi et al. (2024). Research in the electronics sector showed that sustainable marketing practices improve positively corporate image and customer loyalty. Moreover, companies that incorporate sustainability in their products and communication strategy are perceived by consumers as socially responsible and ethical, which strengthen their trust and loyalty.

Another crucial factor affecting sustainable consumption is income. Consumers with higher incomes prefer products that promote sustainability, while those with lower incomes prefer cheaper options. The study by Szulc-Obłóza&Żurek (2024) highlighted the importance of economic opportunity in shaping sustainable consumption intentions and practices. According to the findings, higher income consumers are more willing to invest in sustainable products, while lower income consumers prefer sustainable practices that do not require significant financial expenditure.

These findings underline the need for companies to adapt their strategies to meet the needs of consumers in different income brackets. By addressing these economic differences, promoting transparency and integrating ESG criteria into business practices, businesses can enhance consumer trust and loyalty while promoting sustainable consumption. This holistic approach not only strengthens a company's market position, but also contributes to broader social and environmental goals.



### **2.5. Effect of ESG Criteria on Branding and Communication: Consumer Perceptions and Corporate Identity**

The effect of ESG criteria on branding and communication has been recognized as a key factor in the development of strong corporate brands. Incorporating sustainable practices and social responsibility into branding may improve a company's image and enhance consumer trust, and potentially lead to positive changes in consumer behavior. Research examining the application of ESG in the communications sector shows that incorporating these criteria strengthens the relationship between the organization and consumers, as it promotes a strong corporate identity. The more well-formed a brand is, the more likely it is to influence consumer decisions in a fairly positive way (Lee et al., 2022).

Understanding how consumers evaluate the sustainability and social responsibility of companies is critical to the success of branding strategies. Consumers are more sensitive to environmental and social performance issues and are more likely to support companies that implement ESG practices. Consumers take into account a company's environmental and social performance, as well as its governance, when evaluating the value of a brand (Lee et al., 2022).

Communication strategies (i.e. advertising and social media) enhance the company's reputation while creating a solid connection with consumers. Organizations that invest in ESG practices and promote them through branding may reap significant benefits, as consumers may prefer products that support their values and promote sustainability (Lee et al., 2022).

## **3. Research Hypotheses**

This study aims to examine the relationship between consumers' perceptions of sustainability and their environmental behaviors, their attitudes towards corporate social responsibility (CSR), and the role of governance practices in shaping these perceptions. Based on the literature review and the research objectives, the following hypotheses are formulated.

According to Lee et al. (2022), higher level of consumers' environmental awareness lead to stronger engagement in sustainable behaviors. Consumers who consider sustainability as an important factor are more likely to engage in environmentally friendly behaviors such as buying recyclable products and recycling at home. Thus, the paper aims to examine the following hypothesis (H):

**H1:** The perceived importance of sustainability has a positive effect on consumers' environmental behaviors.

In addition, consumers' willingness to pay more for environmentally friendly products may be affected by economic factors. According Lee et al. (2022), economic constraints are often a barrier to purchasing sustainable products, even when consumers recognize their environmental value. Thus, the second hypothesis is as follows:

**H2:** The perceived importance of sustainability negatively affects consumers' willingness to pay more for environmentally friendly products.

As Lee et al, (2022) argue, aligning corporate strategies with consumer values, particularly in sustainability efforts, enhances consumer trust and loyalty. Consumers who consider sustainability an important issue are more likely to support companies that have strong environmental policies. This paper aims to examine the following hypothesis:

**H3:** Sustainability perceptions are positively associated with consumer support for company's environmental policies.

The greater importance attached to corporate social responsibility (CSR) is associated with reduced consumer support for companies that adopt unethical business practices, as shown in the research by Lee et al. (2022), which highlights the crucial role of CSR in

affecting consumer behavior and companies' acceptance of ethical and responsible practices. Thus, the current paper aims to examine the following hypothesis:

**H4:** Consumers' perception of social responsibility is negatively associated with supporting companies that engage in poor business practices.

Furthermore, good corporate governance positively affects consumers' perception of the value of sustainable business practices. The literature argues that transparent and accountable governance mechanisms play a critical role in the successful implementation of sustainability strategies (Lee et al., 2022). This paper examines the following hypothesis:

**H5:** Consumers' perception of the importance of good corporate governance has a positive effect on the evaluation of sustainable business policies and practices.

Finally, a research by Lee et al. (2022), suggested that despite the variety of information sources for ESG data, their reliability often remains uncertain. Thus, the sixth hypothesis is as follows:

**H6:** The perceived reliability of ESG data is not significantly affected by the source of information.

## **4. Methodology**

### **4.1. Subject and Procedure**

The purpose of this study is to examine the effect of ESG criteria on consumer preferences regarding the choice of products and services by companies. The research focuses on investigating how consumers are affected by the sustainable practices of companies, with a sample of 141 residents of Athens, Greece. In order to achieve the objectives of the research, data was collected through a specially designed questionnaire, which was distributed electronically during the period from 20/04/2024 to 16/07/2024.

### **4.2. The Questionnaire**

Following a thorough review of the literature (Koh, Burnasheva, & Suh, 2022), a closed-type questionnaire was designed for the purpose of the study. The questionnaire consisted of five sections. The first section gathered information about the demographic, social, and economic profile of the respondents. The second section included questions assessing the importance consumers attribute to environmental criteria. The third section examined the influence of social criteria and corporate social practices on consumer preferences. The fourth section explored the impact of corporate governance criteria on consumer preferences. Finally, the fifth section assessed public awareness of ESG criteria and the extent to which individuals are informed about their influence on corporate practices.

In an effort to record consumer perceptions of ESG factors, the respondents were asked to rate how important the following factors were in their decision-making: environmental sustainability, corporate social responsibility, and governance practices. Respondent attitudes were measured using statements based on responses to a five-point Likert scale, ranging from 1 (Not important at all) to 5 (Very important).

### **4.3. Data Analysis**

The statistical package SPSS was used for the analysis of the survey data. The relationships between consumer preferences and various variables, such as the importance of the sustainability criterion, willingness to pay for environmentally friendly products and perceptions of ESG criteria, were examined using the correlation analysis method. This

method was chosen in order to assess the strength and direction of the relationships between variables and to identify significant patterns or trends in consumer behavior regarding ESG parameters.

Correlation analysis was conducted to establish the correlations between different perceptions of ESG and consumer behavior. The level of significance (Sig.) was set at 0.05. Pearson's correlation coefficient ( $r$ ) was calculated to determine the strength of linear relationships between variables. This allowed exploration of how factors such as the importance of the sustainable criterion and willingness to pay for environmentally friendly products were associated with the perceived reliability of ESG data.

## 5. Results

### 5.1. The profile of participants

The majority of the participants who took part in the study were females (69.5%). The respondents were 18-25 years old (39.7%), had attended university (44.7%) and had an annual personal income up to €10,000 (41.8%). The demographic characteristics of the sample are shown in Table 1.

**Table 6. Demographic characteristics of the sample**

| Demographic Factors                    | Total (N= 141)<br>% |
|----------------------------------------|---------------------|
| <b>Gender</b>                          |                     |
| Male                                   | 29.8                |
| Female                                 | 69.5                |
| Prefer not to say                      | 0.7                 |
| <b>Age (years)</b>                     |                     |
| 18 – 25                                | 39.7                |
| 26 – 35                                | 16.3                |
| 36 – 45                                | 7.8                 |
| 46 – 55                                | 21.3                |
| 56 – 65                                | 12.8                |
| >66                                    | 2.1                 |
| <b>Educational level</b>               |                     |
| No high school                         | 2.8                 |
| High school                            | 19.1                |
| Apprenticeship / technical certificate | 7.8                 |
| University                             | 44.7                |
| Postgraduate studies                   | 25.5                |

| Annual personal income (€) |      |
|----------------------------|------|
| <10,000                    | 41.8 |
| 10,001 – 18,000            | 34.0 |
| 18,001 – 25,000            | 16.3 |
| 25,001 – 30,000            | 4.3  |
| >30,001                    | 3.5  |

### 5.2. Reliability analysis

To assess the reliability of the questionnaire variables, Cronbach's alpha coefficient was used. The variables examined include perceptions of sustainability, environmental behaviors, Corporate Social Responsibility (CSR), governance practices, and trust in information sources.

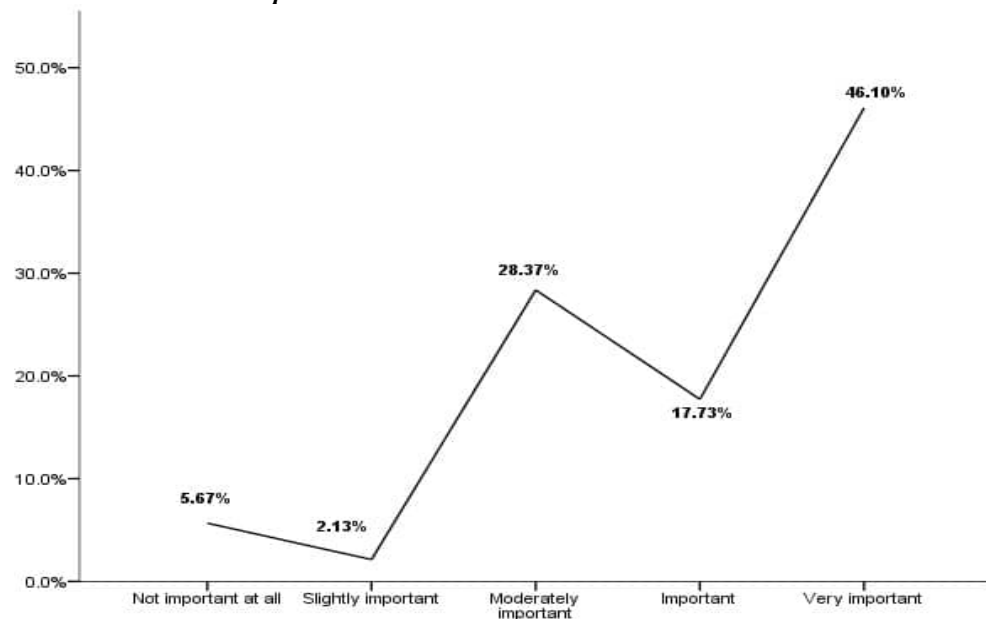
Cronbach's alpha reliability coefficients are summarized in the table below. Values above 0.6 are considered acceptable.

**Table 7. Cronbach's Alpha reliability coefficient**

| Variable                        | Cronbach's Alpha |
|---------------------------------|------------------|
| Environmental Awareness         | 0.839            |
| Corporate Social Responsibility | 0.636            |
| Governance Practices            | 0.605            |
| Information Sources (ESG)       | 0.634            |

### 5.3. Exploring the Correlation Between Sustainability Awareness and Eco-Friendly Behaviors

Based on the responses regarding the perceived importance of sustainable criteria, the data shows a clear distribution of attitudes among participants (Figure 1). Specifically, 5.67% of respondents indicated that sustainable criteria were "Not important at all," while a small percentage (2.13%) viewed them as "Slightly important". A larger group, accounting for 28.37%, rated the importance of sustainability as "Moderately important". Furthermore, 17.73% of participants considered sustainable criteria to be "Important" and the highest proportion, 46.10%, rated them as "Very important". These findings suggest that a significant majority of participants acknowledge the relevance of sustainable criteria to varying degrees, with nearly half considering them to be a central factor in their decision-making processes. This emphasizes the growing significance of sustainability in consumer decision-making and underscores the importance of integrating sustainability into organizational practices and product offerings.

**Figure 7. Sustainable Criteria Importance**

The diagram presented above complements the analysis of the correlation between sustainability awareness and eco-friendly behaviors. As shown in the survey results, the perceived importance of sustainability directly impacts consumers' environmental attitudes and behaviors. The data, summarized in Table 3, illustrates the significant positive relationship between the importance placed on sustainability and two key eco-friendly behaviors: choosing recyclable products and recycling at home.

**Table 8. The Relationship Between Sustainability Importance and Environmental Behavior Patterns**

|                           |                     | Environmental Criteria Integration Importance | Recycle Product Choice | Recycle at Home | Willingness to pay for Environmental Friendly Products |
|---------------------------|---------------------|-----------------------------------------------|------------------------|-----------------|--------------------------------------------------------|
| Sustainability Importance | Pearson Correlation | .112                                          | .380**                 | .270**          | -.005                                                  |
|                           | Sig. (2-tailed)     | .187                                          | .000                   | .001            | .955                                                   |
|                           | N                   | 141                                           | 141                    | 141             | 141                                                    |

Consumers who consider sustainability important are more likely to choose recyclable products ( $r=0.380$ ,  $\text{Sig.}<0.01$ ) and to recycle at home ( $r=0.270$ ,  $\text{Sig.}<0.01$ ). These findings suggest that sustainability awareness positively influences environmental habits. However, willingness to pay more for environmentally friendly products is not significantly correlated with sustainability ( $r=-0.005$ ,  $\text{Sig.}>0.01$ ), suggesting that economic parameters play a key role in purchasing decisions.

**Table 9. Relationship Between the Importance of Sustainability and Corporate Environmental Policies**

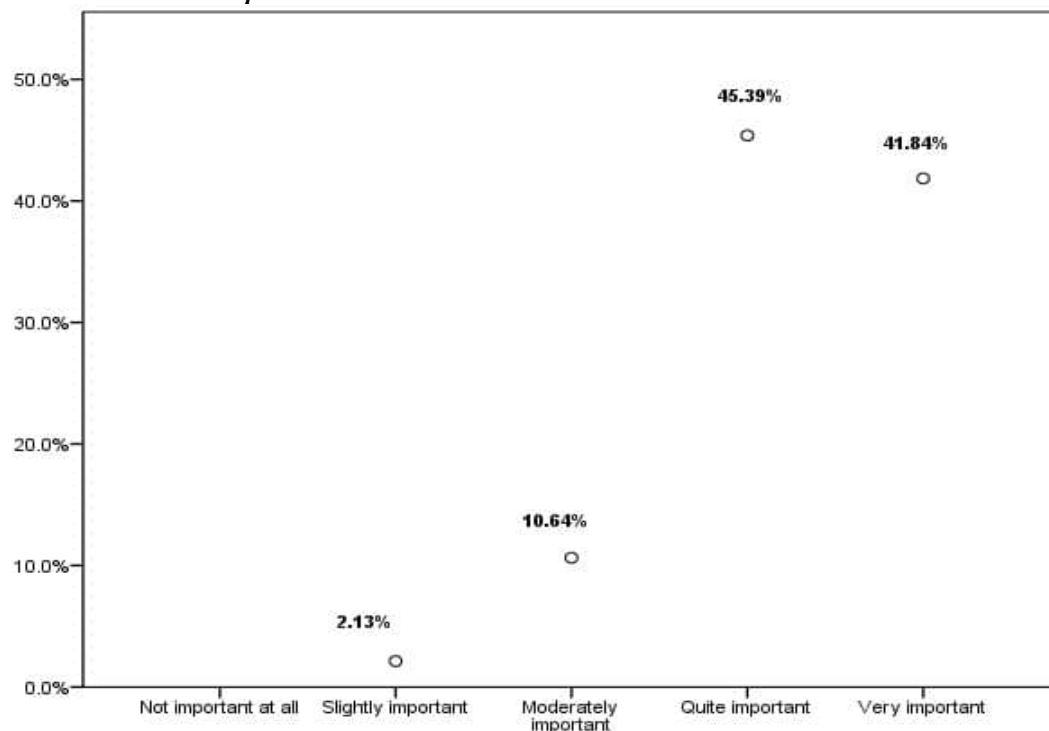
|                           |                     | Air Pollution Policy | Climate Change Policy | Sustainable Energy Consumption | Sustainable Water Consumption | Waste Management |
|---------------------------|---------------------|----------------------|-----------------------|--------------------------------|-------------------------------|------------------|
| Sustainability Importance | Pearson Correlation | .451**               | .464**                | .450**                         | .425**                        | .482**           |
|                           | Sig. (2-tailed)     | .000                 | .000                  | .000                           | .000                          | .000             |
|                           | N                   | 141                  | 141                   | 141                            | 141                           | 141              |

The perception of the importance of sustainability is positively and significantly associated with all the environmental policies considered. The analysis of the relationship between sustainability awareness and key environmental practices reveals statistically significant positive correlations across all variables. The perceived importance of sustainability is positively correlated with air pollution policy ( $r=0.451$ ,  $\text{Sig}.<0.01$ ), climate change policy ( $r=0.464$ ,  $\text{Sig}.<0.01$ ), sustainable energy consumption ( $r=0.450$ ,  $\text{Sig}.<0.01$ ), sustainable water consumption ( $r=0.425$ ,  $\text{Sig}.<0.01$ ), and waste management ( $r=0.482$ ,  $\text{Sig}.<0.01$ ). These findings suggest that individuals who place greater importance on sustainability are more likely to recognize and value various environmental initiatives. These findings underscore the importance of aligning corporate strategies with consumer values to enhance trust and loyalty (Table 4).

#### 5.4. The effect of Corporate Social Responsibility on Unethical Business Practices

The data regarding the perceived importance of social criteria is illustrated in the following chart (Figure 2). The majority of respondents consider social criteria to be of significant importance, with 45.39% rating them as "quite important" and 41.84% considering them "very important". A smaller percentage of 10.64% rated the importance as "moderately important", while only 2.13% found them "slightly important". These findings underscore that social criteria are generally viewed as essential by respondents, reflecting their importance in shaping sustainable practices and corporate decision-making.

Figure 8. Social Criteria Importance



The relationship between CSR and poor business practices is a critical area of analysis. Table 5 presents the link between consumers' perceptions of CSR and their support for companies with poor business practices.



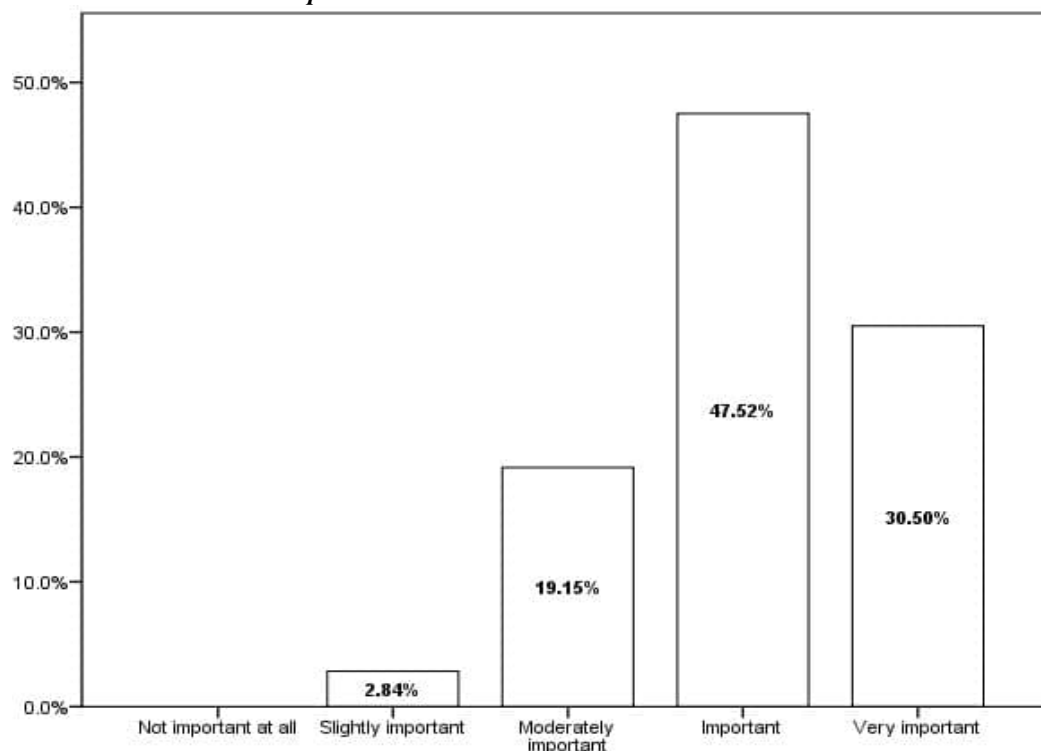
**Table 10. Relationship between Social Responsibility and Poor Corporate Practices**

|                                  |                     | WorkingConditions | Women in Management | Health Policy | Supplier Certification |
|----------------------------------|---------------------|-------------------|---------------------|---------------|------------------------|
| Social Responsibility Importance | Pearson Correlation | -.178*            | .297**              | .313**        | .215*                  |
|                                  | Sig. (2-tailed)     | .035              | .000                | .000          | .010                   |
|                                  | N                   | 141               | 141                 | 141           | 141                    |

A negative but statistically significant correlation was found between the perceived importance of social responsibility and working conditions ( $r=-0.178$ ,  $\text{Sig.}=0.035$ ), suggesting that as the importance of social responsibility increases, the perceived importance of working conditions decreases, though this association is relatively weak. In contrast, significant positive correlations were observed between social responsibility and women in management ( $r=0.297$ ,  $\text{Sig.}<0.01$ ), health policy ( $r=0.313$ ,  $\text{Sig.}<0.01$ ), and supplier certification ( $r=0.215$ ,  $\text{Sig.}=0.010$ ). These findings indicate that a higher emphasis on social responsibility is linked to more favorable views towards these corporate practices. Among the three, health policy showed the strongest positive correlation with social responsibility.

### **5.5. The effect of Corporate Governance on Consumer Perceptions of Sustainability Practices**

Corporate governance is one of the key factors affecting consumer perception of sustainable business practices, as it reflects a company's commitment to ethical operations and transparency. The following chart (Figure 3) presents the significance consumers attribute to governance criteria in their purchasing decisions.

**Figure 9. Governance Criteria Importance**

The findings reveal that nearly half of the respondents (47.52%) consider governance criteria as “Important” with an additional 30.50% rating them as “Very important”. Together, these results demonstrate that a significant majority of consumers’ value corporate governance highly when evaluating the sustainability of a company. Meanwhile, 19.15% of respondents regard these criteria as “Moderately important” and only 2.84% rate them as “Slightly important” with no respondents indicating they are “Not important at all”. This analysis emphasizes the significant role of corporate governance in fostering consumer trust and improving the sustainability image of businesses. Companies that adopt strong governance practices are better positioned to meet consumer expectations and strengthen their reputation in the marketplace.

In order to examine the relationship between governance criteria and the perceived importance of sustainability practices, a further analysis was performed. According to the Table 6, the importance attached to governance has a positive correlation with consumers' perception of the value of sustainable policies and practices ( $r=0.470$ ,  $\text{Sig.}<0.001$ ). Moreover, the results indicate that governance criteria are moderately correlated with consumer willingness to choose companies with poor governance practices ( $r=0.244$ ,  $\text{Sig.}<0.05$ ).

**Table 11. Relationship Between Governance Criteria and the Perceived Importance of Sustainability Practices**

|                                         |                     | Choice Despite Poor Governance | Importance of Sustainability Policies |
|-----------------------------------------|---------------------|--------------------------------|---------------------------------------|
| Importance of Good Corporate Governance | Pearson Correlation | .244**                         | .470**                                |
|                                         | Sig. (2-tailed)     | .004                           | .000                                  |
|                                         | N                   | 141                            | 141                                   |

This strong correlation with the implementation of sustainable policies underlines the crucial role that governance plays for businesses wishing to align with consumer expectations and enhance their reputation as responsible and sustainable.

### 5.6. Consumer Willingness to Pay for ESG-Compliant Products

Table 7 shows the relationship between the perceived importance of ESG integration and consumers' willingness to pay more for products that comply with ESG criteria.

**Table 12. Relationship between the Importance of ESG Integration and Willingness to Pay More for ESG-Compliant Products**

|                            |                     | ESG Willingness to pay |
|----------------------------|---------------------|------------------------|
| ESG Integration Importance | Pearson Correlation | -.084                  |
|                            | Sig. (2-tailed)     | .324                   |
|                            | N                   | 141                    |

Pearson analysis showed a negative correlation ( $r=-0.084$ ), which is not statistically significant ( $\text{Sig.}=0.324$ ). This suggests that, despite consumers' recognition of the importance of ESG criteria, the economic dimension remains a limiting factor in the decision to purchase products with such features.

The negative correlation suggests that recognition of the value of sustainable products does not always lead to a greater willingness to pay more, which is consistent with the idea that, despite awareness, consumers may be constrained by financial incentives and views on pricing products that comply with ESG practices. In particular, consumers seem to prefer products that meet ESG criteria only if they are economical.

### 5.7. Investigating Information Sources and Trustworthiness in Consumer Perception

The reliability of ESG data is a key issue for businesses, as consumers often base their purchasing decisions on information available from various sources. The data analysis showed that, despite the variety of information sources used by consumers, no statistically significant relationship was found between the source of information and the perceived reliability of ESG data.

**Table 13. Relationship between Information Source and Perceived Credibility of ESG Data**

|                 |                     | ESG Info Reliability |
|-----------------|---------------------|----------------------|
| ESG Info Source | Pearson Correlation | .001                 |
|                 | Sig. (2-tailed)     | .991                 |
|                 | N                   | 141                  |

Despite the variety of sources from which consumers obtain ESG data, there is no statistically significant relationship between the source of information and the perceived reliability of ESG data (Table 8). According to Pearson correlation coefficient ( $r=0.001$ , Sig. $>0.05$ ), the results suggest that different sources of information do not significantly affect consumers' perception of the reliability of ESG data, which may highlight a general uncertainty or lack of clarity about the quality of this information.

Specifically, regarding the sources of information on the progress of Greek companies on ESG issues, Social Media seems to come first, with 58.9% of respondents supporting this option. Analyses and surveys account for 24.8%, while meetings and events as well as other information channels have lower percentages (2.8% and 13.5% respectively).

The lack of statistical significance in the perceived reliability of these sources suggests that consumers may not fully trust any one source more than another, indicating a potential trust gap in terms of the quality and reliability of ESG data.

## 6. Discussion

The findings of the survey are in line with Hypothesis H1. Specifically, the positive correlation between sustainability perceptions and environmental behaviors, such as recycling and preference for recyclable products, is consistent with the findings of Lee et al. (2022), which show that consumers with high environmental awareness tend to adopt environmentally friendly practices.

Another factor that could affect purchasing decisions was economic constraints (Hypothesis H2). According to Szulc-Obłóza & Żurek (2024), financial limitations often prevent consumers from choosing environmentally friendly products, even when they recognize their sustainability benefits. This hypothesis is not supported by the study, as willingness to pay more for such products did not show a statistically significant correlation with sustainability perceptions. This suggests that, despite consumers' awareness of sustainability issues, economic factors remain a major barrier to purchasing decisions.

In line with Hypothesis H3, the study confirms that sustainability perceptions are positively associated with consumer support for corporate environmental policies. The strongest correlations were observed in waste management and climate change policies, indicating that consumers value companies that actively address these environmental concerns. This finding is consistent with the research of Alsayegh et al. (2020), which highlights the importance of aligning corporate strategies with consumer values to enhance trust and loyalty.

Moreover, the results also support Hypothesis H4, as a greater emphasis on corporate social responsibility (CSR) is negatively associated with consumer support for companies engaged in poor business practices. Specifically, social responsibility perceptions were significantly linked to attitudes toward women in management, health policies, and supplier certification. These findings align with Kim & Park's (2020) study, which emphasizes the role of CSR in mitigating negative consumer perceptions of unethical corporate behavior. The importance of good corporate governance in promoting sustainable strategies is also confirmed by the research of Wu et al. (2023), which highlights the role of governance in ensuring the implementation of sustainable policies.

Hypothesis H5 is also supported, as the findings indicate that good corporate governance positively influences consumers' perceptions of sustainable business practices. The results reveal a strong correlation between the perceived importance of governance and sustainability policies, reinforcing the argument that transparency and accountability are crucial for fostering consumer trust (Wu et al., 2023).

Finally, Hypothesis H6 is not supported, as the study found no significant relationship between the source of ESG information and its perceived reliability. This suggests a general lack of trust in ESG data sources, regardless of their origin, highlighting the need for greater transparency and clarity in ESG reporting (Rastogi et al., 2024).

## **7. Conclusion**

The results of the current study reveal that integrating ESG criteria into business strategies can act as a critical factor in enhancing consumer trust and corporate reputation. Consumers, especially those who recognize the importance of sustainability, show a higher propensity to engage in environmentally responsible behaviors, such as choosing recyclable products and recycling at home. However, the economic dimension remains a key factor in purchasing decisions, as the willingness to pay more for ESG-compliant products is not significantly associated with perceptions of sustainability.

The research showed that consumers who consider sustainability as an important criterion have a positive perception of companies' environmental policies, with the strongest correlations observed in waste management and climate change policies. At the same time, a positive perception of corporate social responsibility is linked to reduced support for companies that do not follow responsible practices, while good corporate governance positively affects consumers' perceptions of sustainable business practices.

The negative relationship between consumers' perception of ESG criteria and their willingness to pay more for such products (although not statistically significant) suggests that despite the growing awareness of sustainability, economic conditions constrain consumer choices. The reliability of ESG criteria is an important issue for companies highlighting the need for transparency and clarity in ESG information, as well as strengthening consumer trust through reliable and clear communication strategies.

The findings of the study highlight the importance of a sustainability strategy for companies, not only from an environmental perspective but also as a factor in attracting consumers who value companies with strong environmental and social policies. The

successful implementation of these policies, combined with effective communication, can serve as a significant competitive advantage in the marketplace.

However, similar future research may include a larger sample size to increase the generalizability of the findings and a more detailed analysis of demographic variables to provide a deeper understanding of the factors affecting consumer attitudes towards sustainability and corporate responsibility. One could also mention that a study of various stakeholders (e.g. owners, investors, consumers) would give insight into how different stakeholders perceive the importance of ESG criteria in shaping consumer behavior. Finally, developing new questionnaires and methods may be an avenue of future research.

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## SUSTAINABLE DEVELOPMENT AND ENTREPRENEURSHIP IN MOUNTAIN COMMUNITIES. METSOVO CASE STUDY

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### **Abstract**

This paper attempts to map the space of local development and entrepreneurship as well as to outline the course they have taken in the historical mountain community of "Metsovo". "Metsovo" is located in the north-western part of Greece, at an altitude of 1160 m. The paper raises questions concerning epistemological issues, focusing on the relationship between sustainable local development and entrepreneurship in this mountain community.

An attempt is made to document the longitudinal entrepreneurial activities and through this, the interdisciplinary nature of this field of knowledge is documented. The research orientations and research interests, with the help of a simple mathematical model, of sustainable local development are demonstrated. At the same time, with a field survey, the present situation of the mountain community and the future perspectives towards sustainable development and entrepreneurship are traced.

**Key words:** Metsovo, sustainable development, entrepreneurship, Mathematical model, field research, mountain communities, local development.



Session:

**“Urban Regeneration and Environment”**

## **THE IMPACT OF ENVIRONMENTAL EDUCATION ON SUSTAINABLE DEVELOPMENT, ENVIRONMENTAL CONSCIOUSNESS AND PRO-ENVIRONMENTAL BEHAVIOUR**

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Human societies, throughout the world, face challenges such as climate change, biodiversity loss, pollution and resource depletion, making environmental education and awareness imperative. In this context, environmental education serves to promote an understanding of the interconnections between individuals and nature and to inspire actions, aiming on creating a sustainable future for the next generations.

The aim of this quantitative survey research is to identify whether environmental education and participation in environmental programs or actions strengthen the pro-environmental attitude and behaviour of individuals.

The sample involved 2,687 Greek consumers aged 18 to 29 years. The non-parametric Mann Whitney test to explore possible differences in the environmental consciousness of the research participants in relation to whether they have been taught environmental education at school and whether they have participated in an environmental program or action in the past. The survey participants were asked to respond regarding the frequency of specific actions and daily habits, which frame their environmental consciousness and awareness.

The results of this survey showed that the people who have been taught about environmental education at school are more likely to consider the environmental impact of the products they buy, and people who have participated in environmental programs or actions adopt more pro-environmental behaviours. Furthermore, through the multiple linear regression analysis, it was found that the participants aged 26-29 have an increased environmental consciousness compared to the participants aged 18-21. This survey adds to the existing literature on environmental education and sustainability by highlighting the importance of environmental education and participation in environmental programs or actions towards increasing environmental consciousness and awareness and building a sustainable society.

**Keywords** Environmental education, Educational environmental programs, Pro-environmental behaviour, Environmental consciousness.

## THE ‘ELLINIKON’ RENOVATION PROJECT: BALANCING ECONOMIC DEVELOPMENT AND SOCIAL EQUITY IN ATHENS

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### **Abstract**

While the economic and environmental performance of construction projects has been extensively studied, their social performance—a critical dimension of sustainable development and project success—has received comparatively less attention. In Greece, the social dimension of urban development projects has historically been undervalued compared to their economic and environmental impacts. This study examines Athenian citizens' perceptions of the social impacts of the Ellinikon urban development project. Social Impact Assessment (SIA) is essential for enabling planners, project promoters, affected communities, and policymakers to anticipate and evaluate the social consequences of proposed developments. To ensure comprehensive data collection, a questionnaire comprising 49 items was distributed to approximately 2,500 residents across various municipalities in the Athens metropolitan area.

The findings highlight the crucial role of public perceptions of the social performance of construction projects in shaping public approval and project success. Participants expressed significant concerns regarding the social impact of the Ellinikon project, optimism about its potential economic benefits, and skepticism regarding the equitable distribution of its effects. Particular emphasis was placed on perceptions of fairness in the allocation of benefits and burdens among different community groups, disparities in access to project resources, and the extent of participatory community engagement in the planning process. Furthermore, the results contribute to broader research on urban "vulnerability" to crises, such as the COVID-19 pandemic, and the assessment of the social impacts of large-scale urban redevelopment projects. This study underscores the importance of sustainably managing open urban spaces and ensuring equitable access to these resources as fundamental components of providing resilient and inclusive urban development.

**Keywords:** urban renovation projects; social sustainability; social impacts; impact *assessment*; *Ellinikon urban project*; *Athens*

## 1. Introduction

Achieving sustainable urban development is a primary objective of European urban policy (Martinelli, 2024; Salama et al., 2024). The implementation of urban regeneration projects in degraded areas of urban centres’ can significantly contribute to their sustainable renewal, as urban regeneration is inherently linked to development and progress. According to the International Union for Conservation (IUCN, 1991), sustainable development ensures the improvement of the quality of human life while fully respecting the carrying capacity of ecosystems. However, misinterpretations of this definition have led to the assumption that any development intervention in urban areas necessarily results in improved quality of life for urban populations. Consequently, the social dimension of sustainable development has received less attention compared to its environmental aspects (Anselmi et al., 2024; Sharifi et al., 2024).

To attain a more balanced approach to the various dimensions of development, European development strategies formulated since 2014 have adopted a more holistic and integrated approach to the concept of urban regeneration. As a result, physical regeneration measures are now combined with initiatives that promote education, economic development, social inclusion, and environmental protection. The successful implementation of these strategies requires strong partnerships involving residents, civil society, the local economy, and multiple levels of governance. Urban regeneration is no longer confined to the preservation and restoration of historic sites and infrastructure, architectural interventions in heritage buildings, or the introduction of new uses and functions. Instead, European policies now emphasize a holistic approach to addressing the economic, social, and environmental challenges facing degraded urban areas (European Commission, 2014; Shamaee et al., 2024).

Developing new methodological tools for assessing the sustainability of urban regeneration projects—particularly those that emphasize the social dimension of development—is imperative in contemporary urban planning. The social dimension of development is inherently multidimensional, encompassing subjective factors that make its measurement and assessment complex (Isgren et al., 2024). Specifically, it involves a range of social values influenced by multiple stakeholders, including investors, developers, public and private property owners, civil society, local communities, and public opinion. This complexity underscores the need for multidisciplinary approaches and assessment tools that integrate diverse perspectives and social values into decision-making processes.

This study aimed to:

A) Identify and assess the social impacts of the large-scale urban regeneration project at the former Ellinikon airport. The research records the perceptions of citizens living and working in Elliniko and neighbouring municipalities, as well as residents of other municipalities within the Attica region, regarding the potential social impacts of the redevelopment. Specifically, the study examines how this project may affect residents’ health and social well-being, the quality of the residential environment, economic conditions, social welfare, and family and community dynamics.

B) Highlight the need for an appropriate framework for assessing the social impacts of major urban interventions and evaluating their social acceptance.

The paper is structured as follows: Section 2 explores the relationship between urban regeneration projects and social sustainability, while Section 3 examines their social impacts. Section 4 presents the Social Impact Assessment (SIA) methodology and summarizes its key characteristics. Section 5 introduces the case study, followed by Section 6, which outlines the

research methodology. Section 7 focuses on data analysis and interpretation, and finally, Section 8 provides concluding remarks and discusses future research directions.

## **2. Urban regeneration projects and social sustainability**

Urban regeneration projects play a crucial role in advancing sustainability, with Sustainable Urban Development (SUD) remaining a key policy objective for many nations (Abbas, 2015). The construction sector, in particular, significantly influences the sustainability of development (Xiahou et al., 2018; Jaradat et al., 2024). Social sustainability, a fundamental aspect of urban regeneration, is shaped by interventions that address both physical and psychological human needs (Irfan et al., 2024). Physical needs can be met through the realization of "hard infrastructure", which ensures greater accessibility, adequate water resources, a high sense of safety and security, better education services and more employment opportunities. Conversely, psychological needs are supported by "soft infrastructure," which strengthens community engagement, preserves cultural heritage and identity—like heritage conservation programs and local museums—facilitates social interactions, and elevates social capital (Hollis et al., 2023; Komak et al., 2023; Baporikar, 2024).

For an urban regeneration project to contribute effectively to social sustainability, it must be designed with inclusivity in mind, ensuring accessibility for vulnerable groups such as people with disabilities, the elderly, and children. Careful planning is essential to create functional, well-maintained, and user-friendly spaces that accommodate all community members. Throughout the lifecycle of construction projects, economic, environmental, and social impacts profoundly affect local communities (Kustova et al., 2024). Compared to economic and environmental factors, social impacts are often less tangible and more challenging to quantify (Sha et al., 2024; Vijayakumar et al., 2024). Briefly, these impacts influence residents' lifestyles, employment conditions, social interactions, community relationships, and overall well-being (Wang et al., 2016; Hussain et al., 2024). Urban regeneration projects can lead to both positive and negative social outcomes—such as improved public spaces and economic growth or displacement and social inequality—depending on their scale, intensity, and level of community engagement (Rohman et al., 2024).

For instance, in some cases, urban development projects may trigger social conflicts, particularly if they are not managed effectively (Halder et al., 2024). In regions with lower economic development, investment in construction does not always translate into increased employment opportunities, skill development, or positive economic impacts. Instead, such projects may exacerbate social inequalities and intensify tensions within local communities (Iroha et al., 2024). Recent studies suggest that urban development initiatives lacking participatory planning and equitable benefit distribution are more likely to deepen social disparities and undermine long-term sustainability (Arar et al., 2024; Wang et al., 2024). Therefore, integrating social impact assessment and management into the planning and implementation of urban regeneration projects is essential to promoting inclusive and sustainable urban development.

## **3. Social impact of urban regeneration projects**

Urban regeneration projects often generate significant social impacts, making Social Impact Assessment (SIA) a critical prerequisite for their implementation. The primary objective of SIA is to minimize potential negative consequences while maximizing positive outcomes for the affected communities. Positive social impacts may include poverty reduction,

strengthened community relationships, the promotion of gender equality, improved health and well-being, and the adoption of environmentally sustainable practices (Bartoll-Roca et al., 2024; Samolej et al., 2024; Shen et al., 2024). However, it is equally important to assess these impacts immediately after project completion and throughout its operational phase to ensure the continued relevance and benefits of the intervention.

Achieving meaningful social progress necessitates profound structural changes rather than superficial solutions (Isgren et al., 2024). In the context of urban regeneration, this requires innovative approaches that address fundamental societal challenges rather than merely alleviating surface-level symptoms. A well-planned redevelopment should prioritize meeting specific social needs, ensuring that projects serve as long-term solutions rather than temporary interventions (Orieno et al., 2024). To mitigate potential adverse social impacts, Social Impact Assessment (SIA) has been widely employed at various stages of the project life cycle (Maharana, 2024; Vijayakumar et al., 2024). The International Association for Impact Assessment (IAIA) defines SIA as a process of analyzing, monitoring, and managing both the anticipated and unanticipated social consequences—whether positive or negative—of planned interventions, including policies, programs, and development projects. Additionally, SIA examines the broader social changes induced by such interventions (IAIA, 2018). One of the key challenges in managing social impacts within construction projects is navigating the intersection of technical risks and social structures, as well as addressing the lack of public engagement in decision-making processes.

The social acceptance of urban design interventions—whether large-scale projects that significantly transform the urban environment or smaller-scale initiatives—is closely linked to their positive spatial, socio-economic, and environmental impacts, as well as to the way these transformations evolve over time. Equally crucial is the relationship between social acceptability and the degree of co-design in such interventions, particularly the involvement of local communities and civil society in the planning and implementation processes. Social acceptability plays a key role in the success of urban interventions, as it directly influences how redeveloped spaces are used and integrated into daily life.

Although social analysis has become an essential component of integrated urban regeneration planning, further methodological advancements are necessary to deepen this analysis, as Social Impact Assessment (SIA) is inherently complex. Unlike environmental impact assessments, which focus on quantifiable biophysical changes, SIA evaluates the broader societal implications of a project, encompassing a multitude of variables related to human lifestyles, social dynamics, and community well-being. The failure to anticipate and address potential risks—including social impacts—is a key driver of social conflict. Such challenges, however, can be mitigated through rigorous social impact assessments, which enable planners and policymakers to identify potential sources of discontent and incorporate strategies that promote community engagement, equity, and long-term social cohesion. The emergence of social conflict and unrest is often closely linked to the underestimation of societal challenges and the failure to address social concerns proactively. As noted by Larsen et al. (2015) and Leonardi (2024), the escalation of complex social issues frequently triggers public resistance and opposition to development interventions. If inclusive and participatory planning mechanisms are not established prior to the implementation of an urban regeneration project, the likelihood of intense conflicts among stakeholders increases (Halder et al., 2024).

In Greece, the social dimension of urban regeneration projects has historically been underestimated or even overlooked in official spatial planning, with greater emphasis placed on the economic and environmental aspects. The existing legal framework does not mandate social impact assessments before, during, or after the implementation of urban interventions. While participatory planning is theoretically included in the urban planning framework, it has not been effectively implemented in practice. The absence of a culture of governance and



participation in urban planning processes has hindered the realization of provisions aimed at advancing participatory approaches (e.g., the Neighborhood Planning Committees under Law 1337/83). Despite the ongoing discourse on the necessity of coordinating urban interventions over recent decades, even the most recent spatial and urban planning reforms (Law 4269/2014) fail to incorporate participatory planning processes. The redevelopment projects in Elliniko area serve as a typical example, where issues such as the proposed construction of skyscrapers and casinos have sparked concerns and become subjects of debate—issues that this paper aims to explore. In such cases, social impact measurement tools could prove invaluable in assessing and addressing the potential implications of these projects on local communities.

#### **4. Social impact assessment of urban regeneration projects**

According to the International Association for Impact Assessment (IAIA), Social Impact Assessment (SIA) is defined as "the process of identifying the future consequences of a current or proposed action that affect individuals, institutions, organizations, and social macro-systems." SIA refers to the "processes of analysing, monitoring, and managing the intended and unintended social impacts, both positive and negative, of development projects" (Chan et al., 2016; Bachnik et al., 2024). Urban planners have adopted SIA to evaluate the socio-economic impacts of development projects on communities. This process helps capture the perceptions of all stakeholders and promotes social justice. Stakeholders can be categorized into two broad groups: the first group consists of active stakeholders, such as operators and producers, while the second group includes passive actors, such as consumers who use goods and services (Dell' Anna and Dell' Ovo, 2022).

Anticipating the social problems that may arise during the design phase of a project is often the most challenging aspect, as these issues frequently surface only after the work has been completed. Developing scenarios and alternative strategies is a key element of the strategic planning process to mitigate potential negative consequences. For example, it is important to note that continuous monitoring of statistical data and forecasts is essential throughout the project's duration. Corporate Social Responsibility (CSR) should not cease upon the completion of the project but must extend to account for the future impact, addressing any unpredictable factors that may arise later. A significant body of evidence suggests that urban regeneration projects have a limited chance of success if they disregard or contradict the local traditions, values, and social structures of the area in which they are implemented (Jokar et al., 2024). Similarly, projects that set overly ambitious goals or fail to address the everyday concerns and needs of citizens are likely to struggle (Amati et al., 2024; Janssen et al., 2024). While social analysis has become an integral part of urban regeneration planning, further development of appropriate techniques is essential, as SIA involves assessing a much broader range of variables, making it a highly dynamic and multidimensional task.

A particularly informative example of the use of Social Impact Assessment (SIA) is found in Nigeria through several studies conducted over the years (Akpofure and Ojile, 2002; Nzeadibe et al., 2015; Ukhurebo et al., 2023; Ogbu et al., 2024), which illustrate the process of reconciling the various parties involved. In the economically distressed Niger Delta region, two oil and gas extraction projects were planned in Bayelsa State, alongside a third case study focusing on the rehabilitation and strengthening of buildings in seismic zones. The project timeline coincided with a period of severe communal conflict, necessitating the presence of armed personnel to safeguard the projects and surrounding areas. The process of gathering socio-economic data proved challenging, as external researchers struggled to gain the trust of the local community, which ultimately favoured the construction companies. Rather than

collecting information directly from residents, communication was channelled through local community delegations. These delegations received the data but were not provided with further explanations or opportunities for interactive presentations regarding the projects. Consultants from the companies were advised to avoid direct contact with the communities and refrain from engaging in discussions with local residents, further limiting the effectiveness of the engagement process.

Awareness of the challenges posed by geographical characteristics, insufficient information, and the heightened sensitivity of local populations—stemming from feelings of neglect and abandonment—led to the development of strategies that used existing knowledge and experience to ease tensions and reach a compromise. Following the completion of the social impact assessments, project developers have recognized that a well-executed SIA process can serve as a powerful tool for preparing local populations for the impacts of development projects. The SIA process, as applied and documented in the case of the Niger Delta projects, includes the following steps:

- A team consisting of a company representative, site manager (CLO), the EIA team leader, and an SIA consultant conducts a comprehensive mapping of the project area.
- The various tribes or communities involved are identified, including elders, chiefs, youth, and women. These groups are then invited to scheduled meetings with stakeholders from all sides.
- In order to provide a positive atmosphere, local food is offered during the meeting, facilitating an environment of mutual respect and cultural understanding.
- At the meeting, community representatives are informed about the proposed project and the studies carried out, with all necessary legal support provided. The SIA consultant serves as the liaison between the community and stakeholders, while a community consultant is available to interpret and clarify any points raised.
- A cooperative and friendly atmosphere is emphasized throughout the meeting to ensure effective communication and collaboration.
- Intractable issues such as the number of employees to be hired, salaries, and other labor-related concerns are addressed. This stage is crucial for both sides to converge and reach agreements, with the use of videos and interactive materials for documentation and clarity.
- Once permission is granted by the community, the SIA process moves to the second stage, which involves gathering further data through interviews and questionnaires. Key informants—community members with significant knowledge of local affairs—are selected first.
- Questionnaire surveys are the final step, conducted in communities that are more accessible. However, in communities that are difficult to reach or where there is mistrust of staff, the process can be challenging. Low education levels in certain regions, such as Niger, further complicate the process. Despite these challenges, personal responses provide valuable insights into local attitudes and perspectives regarding the proposed projects, and these responses should be collected carefully.

Finally, the sequential findings underscore that effective socio-economic data collection and impact prediction can be accomplished through a combination of interactive and participatory activities. Examining the current framework for assessing environmental impacts in urban regeneration projects reveals that the outcomes could be significantly improved through the implementation of a comprehensive social analysis. This analysis should prioritize understanding the characteristics of the local population and ensure their active participation in the study process. In conclusion, the application of Social Impact Assessment (SIA) tools not only facilitates the resolution of discrepancies between stakeholders but also strengthens the environmental dimension of the project, thereby strengthening its unity and acceptance within society.

## 5. An empirical study

The redevelopment project of the former Ellinikon Airport stands as a landmark construction initiative in Greece, representing a significant urban regeneration effort aimed at transforming the Ellinikon seafront into a prominent hub for commercial and residential activities (The Ellinikon, 2022; Integrated Development Plan - Hellenikon, 2018; Approved Urban Planning Studies - Hellenikon, 2019).

For over six decades, the Ellinikon International Airport was the largest in Greece, located in the area of Ellinikon, to the south of Athens. Despite undergoing expansion work, it became increasingly evident by 1976 that the airport could no longer serve as the capital's primary airport. Following its replacement by the "Eleftherios Venizelos" Airport, Ellinikon International Airport ceased operations in 2001. Since then, various development proposals have been put forward, and, in the context of the 2004 Olympic Games, the site was repurposed as an Olympic Park (Hellenikon Olympic Complex), featuring numerous stadiums that supported the sporting events. Simultaneously, the site housed various services, including the National Meteorological Service (E.M.Y.), the tram depot, and civil aviation facilities. However, its post-Olympic use remained uncertain, and the redevelopment plans eventually envisioned a combination of a metropolitan park and a cutting-edge urban area. In 2014, the Hellenic Republic Asset Development Fund (HRADF) selected Lamda Development as the investor responsible for overseeing the comprehensive planning and development of the site. According to Lamda Development's official website, the project involves the creation of a Metropolitan Park of international significance, spanning a total area of 2,000,000 square meters.

The project aims to serve as a model for urban development, blending the region's natural beauty and distinctive features with landmark buildings of exceptional architectural design. The sustainable design approach to the project aims to provide world-class services and infrastructure, thereby improving the quality of life for the citizens of Attica. The investment includes extensive residential developments, hotels, commercial units, family-friendly areas, entertainment and cultural centres', museums, health and wellness facilities, sports complexes, and recreational spaces. It also envisions a state-of-the-art business park dedicated to education, research, and entrepreneurship. Additionally, the project plans to fully develop the existing marina and upgrade and promote the entire coastal front, which, alongside the metropolitan park, will form the project's primary attraction.

The available information regarding the social and environmental impact study is provided by the company itself. The Environmental and Social Study (ESDD) was conducted by the European Bank for Reconstruction and Development (EBRD) with the assistance of a consultant. The study included a site visit, discussions with the company, a review of the completed environmental and social questionnaire (ESDD Questionnaire), as well as the Social and Environmental Impact Assessment (SEIA) and Environmental Impact Assessment (EIA). The project in question was "Certified as Category B (No significant impact on the environment) based on the ESP 2014," and it was demonstrated that any environmental and social (E&S) impacts affect the project exclusively and/or are easily identified and addressed with effective mitigation measures. Also, an Environmental and Social Action Plan (ESAP) will be implemented for the project. Additionally, an Environmental Impact Assessment (EIA) study was developed, covering the demolition of existing buildings, site infrastructure, and parks, which was approved in the second quarter of 2019. These studies assessed the impacts and included mitigation measures related to human health, flora, fauna, biodiversity, soil, water, air, climate, and cultural heritage.

The potential for pollution associated with the former airport or the demolition of existing facilities was not assessed as a significant issue in the Social and Environmental

Impact Assessment (SEIA) or Environmental Impact Assessment (EIA). Any potential pollution will be considered on a project-by-project basis, with mitigation measures implemented to address any issues that may arise. Noise, dust, vibration, construction waste, hazardous substances, and traffic impacts related to construction will be addressed in the Environmental and Social Due Diligence (ESDD) of each individual project, as well as in any project-specific Environmental and Social Management System (ESMS). On-site monitoring of air, water, and noise during construction is anticipated as part of the project's Environmental and Social Action Plan (ESAP). No ecologically sensitive areas are present in the region, and impacts on biodiversity are expected to be limited. Three churches, an archaeological site, and several listed buildings are located within the development site boundaries, with their restoration and protection included in the general development plan. The Archaeological Authority of Greece will oversee construction on-site, and both the company and contractors will be required to develop a chance finds process as part of the project's ESAP. The Environmental and Social Action Plan (ESAP) focuses on conducting a thorough environmental and social assessment of individual projects, as well as developing and implementing appropriate policies, plans, systems, and capabilities to manage the environmental, health, safety, and social (EHSS) aspects of the project. The client will also be required to comply with the European Bank for Reconstruction and Development's (EBRD) Performance Requirements (PRs) and submit an Annual Environmental and Social Report. This information is extracted directly from the report prepared by the European Investment Bank and the European Bank for Reconstruction and Development (EBRD), as it is crucial for understanding every aspect of the project's environmental and social implications.

However, a notable limitation in the report is the imbalance in addressing environmental versus social concerns. While the environmental aspects are comprehensively covered, the social dimension is only briefly mentioned at the end of the report in reference to the annual Social Report following project completion. This oversight raises significant concerns, as the lack of a robust Corporate Social Responsibility (CSR) framework could lead to negative long-term effects once the construction phase is completed, especially in terms of the social implications for the local community.

From the outset, the implementation of the project has been met with enthusiasm by those who see the potential economic benefits it could bring. However, there has also been significant concern from residents of Attica regarding the availability, accessibility, and use of public open spaces, which is a critical issue for local communities. The proper integration of these spaces into the development is essential for ensuring that the benefits of the project are felt broadly across the population and that it does not exacerbate social inequalities or reduce the quality of life for local residents. According to Greek legislation, public spaces encompass various areas such as roads, parks, squares, wooded areas (or groves), and any other open spaces designated for communal use. These spaces are determined by the approved urban plan or have been allocated for common use through other legal means (Mitoula and Economou, 2020). In the urban region of Attica, particularly, free public spaces occupy a very limited area. Several factors contribute to this scarcity, including natural, historical, and social influences. However, the most significant reason is that many of the free public spaces that do exist arose inadvertently—often as surplus areas from urban reconstruction efforts rather than through deliberate urban planning or traffic management. The COVID-19 pandemic has highlighted the critical importance of quality outdoor public spaces in urban areas, particularly in Attica. According to Mitoula and Economou (2020), the pandemic underscored the value of free public spaces, as they provided a safe refuge for large segments of the population during times when access to natural environments within the city became essential for public health and well-being. These spaces serve as crucial areas for physical activity,

mental health, and social interaction, especially in urban environments with limited access to nature.

## **6. Methodology**

The interaction between the built environment and its surrounding ecosystem—both physical and social—must be carefully considered when planning reuse activities. The influence of the building stock on the environment is reciprocal, with the surrounding environment exerting a portion of its prior impact on new constructions. A particularly complex case of built environment reuse involves the redevelopment of former airports. These large-scale redevelopment projects necessitate comprehensive environmental and social impact assessments, which require substantial resources for the collection of essential documentation and measured data.

This study presents a methodology for conducting social impact assessments (SIA) for the redevelopment projects at former Greek airports. While specifically developed and applied to the case of the former Ellinikon Airport in Athens, the methodology is adaptable for use in other large-area redevelopment projects. The goal of this approach is to ensure that both social and environmental considerations are integrated into the redevelopment process, promoting more sustainable and socially responsible urban regeneration. The primary aim of this paper is to estimate Athenian citizens' perception of the social impact of the Ellinikon urban development project. Social Impact Assessment (SIA) plays a crucial role in helping planners, project promoters, the impacted population, and decision-makers evaluate and predict the potential social effects—both positive and negative—on human populations and communities affected by proposed developments. Due to the multifaceted nature of social impacts, the scope of the inquiry extended to various municipalities in the Athens periphery, enabling a more detailed and comprehensive interpretation of the data collected.

A questionnaire, consisting of 49 items, was administered to approximately 2,500 citizens in these areas. The questionnaire focused on social aspects such as safety, health, social impacts, and social conflicts. It was based on SIA and EIA (Environmental Impact Assessment) studies, along with a revised list of indicative social impacts based on Frank Vanclay's framework (2002) and other studies (Burdett, 2024), adapted to the specific national and local context. The redevelopment of the former Ellinikon airport is an emblematic construction project in Greece, aiming to transform the area into a significant urban hub (The Ellinikon, 2022; Integrated Development Plan - Hellenikon, 2018; Approved Urban Planning Studies – Hellenikon, 2019). Assessing the social impact of large-scale projects, such as those involving former airports, is a complex undertaking that requires a comprehensive methodological approach. This approach must facilitate a representative analysis of the current social conditions, identify prevailing social burdens, and examine mechanisms of social evolution. This process combines newly acquired data with existing information, ensuring that the methodology is both effective and accurate.

## **7. Data analysis**

In order to analyse the social impact of the Ellinikon redevelopment project, we utilized a survey consisting of 56 questions, which we refer to as the "Social Universe." This questionnaire was designed based on Social Impact Assessment (SIA) and Environmental Impact Assessment (EIA) studies. Out of the 56 questions, 37 are directly related to social impact, while the remaining questions address economic and other dimensions. To facilitate analysis, we constructed a "Market Index," which is the equal-weighted summation of all questions. Additionally, we developed two key subindices: the first subindex includes only

the equal-weighted summation of the "social impact" questions, while the second subindex aggregates the rest of the questions. Our survey includes a complete set of qualitative variables, such as age, gender, educational level, occupation, and place of residence. Data was collected randomly across all major municipalities, with the assumption that individual responses are cross-sectionally uncorrelated—meaning that each individual's answers are independent of others' responses.

Based on the mean and standard deviation of responses to each question, we found that there was no significant difference in results when comparing responses from the neighbouring municipalities of Ellinikon to those from all municipalities combined. This suggests that the opinions of citizens from neighbouring municipalities have a strong influence on the overall results, and aggregating the opinions from the more distant municipalities does not significantly alter the outcome. As a result, we focused our analysis on the municipalities closest to Ellinikon, as their views provide a more accurate representation of the local social impact. We categorize the answers from 1 to 5 considering the 1 as the less satisfying answer and the 5 as the strongest satisfying answer. The scale may be different if we have a no/yes claims which is from 1 to 2.

In Figure 1, we present some descriptive results based on gender and educational level of each participant. To analyse the distribution of responses, we take the 30th and 70th percentiles for each question. We then categorize how many men and women fall below the 30th percentile and how many fall above the 70th percentile. The same process is applied for individuals with higher and lower educational levels. This method provides a descriptive view of the "extreme" responses, allowing us to observe the dispersion in how more and less educated people, as well as men and women, responded to the questions.

From the results, we observe that, on average, women and individuals with lower educational levels tend to provide the most extreme answers—both those below the 30th percentile and those above the 70th percentile. This indicates that these groups are more likely to express stronger opinions, either in favour or against the development. One notable finding is that the question concerning increasing residential prices has the highest mean response, suggesting that this is a particularly concerning or impactful issue for respondents. Conversely, the question with the largest standard deviation refers to ethics and religion changes in the Ellinikon area, indicating a wider divergence in opinions on this topic.

**Figure 1** Cross-sectional Regression Analysis (means, betas, alphas, and t-statistics of alphas for each question).

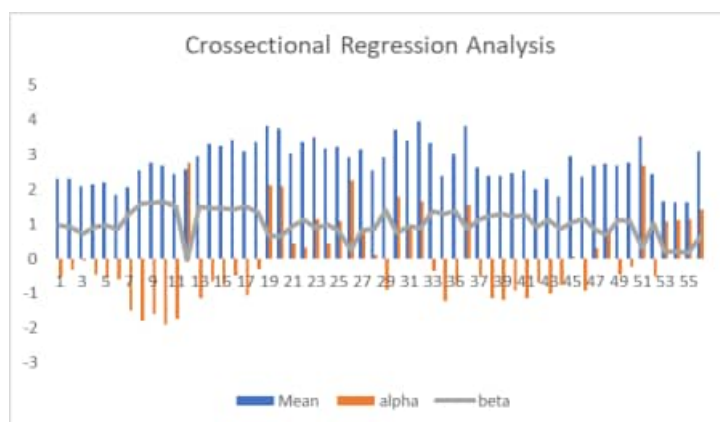


Figure 1 presents the means, betas, alphas, and the t-statistic of alphas across the different questions.



As the next step in our analysis, we conduct Ordinary Least Squares (OLS) regressions for each question and the Market Index, applying a market model approach. In these regressions, we compute two key values: alpha and beta.

**Beta ( $\beta$ )** represents the systemic changes in the responses to each individual question based on the changes in the Market Index. Essentially, the beta coefficient indicates how the response to each question correlates with the overall trends captured by the Market Index.

**Alpha ( $\alpha$ )** represents the extra mean of each question after accounting for its systemic relationship with the Index. It reflects the additional effect of the question that is not explained by its exposure to the Market Index. A positive alpha would suggest that the question has a larger positive mean beyond the overall trends captured by the Market Index, while a negative alpha indicates that, after adjusting for exposure to the Index, the question's response has a negative mean. If a question has a zero alpha, this suggests that the question's response is entirely driven by its exposure to the Market Index. In this case, the question does not add any unique information beyond what is already explained by the general Market Index, meaning that it is fully aligned with the systemic trends observed in the Index.

**Figure 2** Overview of key findings, including means, betas, and alphas for each question.

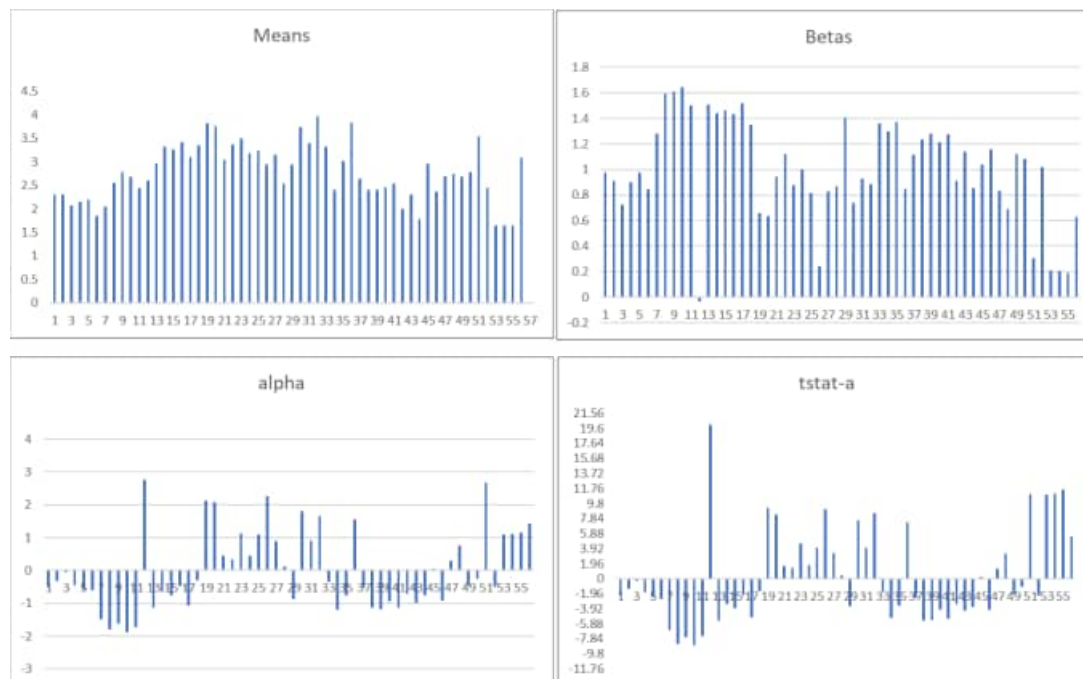


Figure 2 provides an overview of the key findings

In the figure presented, we observe the means, betas, and alphas for each question, providing insight into the social impact of the Ellinikon redevelopment project. As the mean of a question increases, it is typically accompanied by an increase in either beta or alpha. This indicates that questions with higher means tend to align with broader systemic trends (captured by beta) or provide additional unique insights (captured by alpha). In cases where the mean of a question increases without a corresponding increase in beta, the alpha of the question increases. This suggests that the impact of the question cannot be explained by the Market Index. In such cases, the alpha component captures the unique impact not accounted for by the broader trends of the Market Index. For example, the 12th question, which concerns the initial impression of the announcement about the regeneration of the Ellinikon area, cannot be explained by the Market Index, and its impact is captured in the alpha component,

reflecting insights unique to this question. Based on the t-statistics of each question, we conclude that 46 questions have statistically significant alpha values. Among these, 26 questions belong to the social universe, while 18 come from other categories, such as economic or environmental factors.

Furthermore, we conducted two regressions to examine the relationship between the two subindices and the Market Index. Our objective was to determine whether the social impact of the general project has a negative effect when adjusted for the Market Index. To do this, we equally weighted the questions related to social impact and created a "social" subindex. Similarly, we equally weighted all other questions, excluding those related to social impact, and formed a "rest" subindex. The results revealed that the "social" subindex exhibited statistically significant values for both alpha and beta. This indicates that social impact has a distinct and significant effect, which is both systemic (as captured by beta) and independent (as captured by alpha). In contrast, the "rest" subindex showed positive values for both alpha and beta, suggesting that non-social aspects of the project have a generally positive impact. Ultimately, these findings suggest that, when adjusting for the broader Market Index, the social impact of the Ellinikon redevelopment project is negative. This implies that, while other aspects of the project may be perceived positively, the social dimensions, when considered independently, may have a less favourable impact on the community.

## **8. Conclusions**

Overall, our findings underscore the critical role of citizens' perceptions regarding the social performance—whether positive or negative—of construction projects, as these perceptions significantly influence public approval and the successful implementation of such developments. Notably, the results highlight profound concerns among participants regarding the social impact of the Ellinikon urban development project. These concerns varied depending on factors such as educational level, gender, and other demographic variables. While respondents expressed optimism about the anticipated positive economic effects of the project—not only for the neighboring municipalities but also for the broader Athens metropolitan area—they simultaneously exhibited considerable skepticism regarding the equitable distribution of these benefits. Specifically, participants raised concerns about fairness in the allocation of both positive and adverse impacts across different community groups and disparities in access to project-related resources. Moreover, respondents emphasized the perceived lack of participatory community engagement in the planning and decision-making processes of the Ellinikon redevelopment, highlighting the need for more inclusive and transparent governance mechanisms. Although the majority of participants initially express a positive outlook on the proposed regeneration project, their optimism becomes more measured when asked to evaluate specific aspects, such as job creation and the project's contribution to strengthening social structures.

More specifically, participants responded favourably to aspects of the project related to urban regeneration, the expansion of entertainment options, the development of high-quality residential infrastructure, the improvement of public safety, and the improvement of natural infrastructure. However, a notable discrepancy emerges in the economic expectations of the respondents. While 63% agree that the project will contribute to the economic revitalization of the area, only 27% anticipate an increase in family incomes as a direct outcome. Regarding potential demographic shifts in the area, opinions are evenly divided, with 50% of participants expressing concern over possible changes, while the remaining 50% consider such changes unlikely. Additionally, the majority of respondents do not foresee significant opposition or disruptions to the traditional structure of the Greek family as a result of the project. Gender plays a significant role in shaping attitudes toward the social impact of the project.

Specifically, men tend to express scepticism regarding most of the anticipated benefits, whereas women are more concerned with household financial implications and hold greater hope for potential economic improvements resulting from the intervention. Additionally, women place particular emphasis on preserving the cultural value of the area. Educational background also influences perceptions of the project. Individuals with postgraduate degrees generally evaluate the redevelopment positively, while those with lower educational attainment, such as a high school diploma, exhibit greater caution and scepticism.

Furthermore, age is a critical factor in shaping opinions. Older participants express concerns regarding accessibility, particularly the ease of movement for the elderly and their unrestricted access to public spaces. A significant issue emerging from the study is the widespread distrust among participants regarding the transparency of the project's planning and awarding processes. Concerns extend to the overall assessment of positive versus negative impacts and the fairness of their distribution among different social groups.

A considerable portion of respondents indicated a lack of clear and comprehensive information on key aspects of the project, often encountering conflicting reports about essential details such as the extent of the metropolitan park and public concessions. Additionally, contentious topics—including the presence and scale of skyscrapers, the inclusion of a casino, and the architectural style of the buildings—have sparked public debate and disagreement. This lack of sufficient consultation in the public sphere has hindered consensus-building, highlighting the need for greater transparency and communication. Conducting social impact assessments at each phase of development could significantly elevate the project's social acceptance by addressing concerns in real-time and ensuring that public interests are taken into account. The state must play a decisive role by officially defining and institutionalizing the areas designated for public access, as well as clarifying the total area of the metropolitan park—issues that have recently drawn heightened interest and concern.

Furthermore, many respondents stressed the importance of using sustainable materials and ensuring accessibility for individuals with disabilities, areas where government oversight is essential. The role of the state is also crucial in determining the number of jobs generated by the project, which emerged as a key issue in the study's findings. The promotion and communication of the overall impact of the Ellinikon redevelopment project emerged as a critical issue in this study. The majority of participants expressed the belief that there has been no significant effort by the responsible bodies to adequately highlight the project's positive impacts or to thoroughly assess and address its potential negative consequences. To bridge this gap, the establishment of a monitoring and information forum is recommended. Such a platform would not only provide transparent updates on each stage of implementation but also facilitate direct communication with citizens, allowing them to submit questions, voice concerns, and receive official responses.

The Ellinikon redevelopment represents a significant opportunity for both the local area and Athens as a whole. Failure to meet expectations would not only be a missed opportunity for Athenian citizens but also a setback for the state, which has the chance to demonstrate its credibility in managing large-scale urban projects. To ensure the project's success and broad social acceptance, a multi-faceted approach is required. Exhaustive public dialogue, the systematic implementation of Social Impact Assessments, transparent and extensive information sharing, and ongoing investment monitoring are essential steps. Establishing a structured framework for assessing social impacts and ensuring social acceptance at each stage of urban development is crucial. Additionally, institutionalizing participatory processes for co-developing urban interventions can help maximize local community engagement and consensus. These elements serve as critical prerequisites for the successful completion of the

Ellinikon project, ensuring that it delivers sustainable and equitable benefits for all stakeholders.

The existing research gap in the systematic evaluation of social impacts highlights the need for further exploration and the development of standardized tools. The original questionnaire employed in this study serves as a model for future research, offering a standardized and weighted survey instrument that can be utilized by researchers worldwide to gather valuable insights into public perceptions of urban projects. Given the profound effect of social impact on citizens' quality of life, it is imperative to institutionalize a framework for its investigation and assessment. Such a framework will ensure that social acceptance is actively considered in urban regeneration efforts, ultimately leading to more inclusive and sustainable urban development.

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## **THE USE OF NEW TECHNOLOGIES IN THE PRIMARY PRODUCTION SECTOR**

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### **Abstract**

The use of new technologies in the primary production sector is a crucial tool for addressing the challenges of climate change and enhancing sustainable development. The primary sector both impacts and is impacted by the climate crisis, as agricultural activities contribute to greenhouse gas emissions while simultaneously facing the consequences of climate variability. Integrating technologies such as smart agriculture, the Internet of Things (IoT), and automation enables increased productivity, improved crop resilience, and reduced environmental footprint. At the same time, issues like access to technology, data security, and the need to support small-scale farmers are critical to ensuring no one is left behind in this technological transition. In various regions of Greece, new technologies can support the production of traditional products, contributing to the local economy and environmental protection. However, their full potential requires investments, education, and comprehensive strategies tailored to local needs and characteristics.

The present paper documents the aforementioned challenges and suggests strategies to address them.

**Key words:** New technologies, primary sector, sustainable development, climate change, smart agriculture, Internet of Things (IoT), productivity, resilience, traditional products, local development, environmental footprint, small-scale farmers, education, infrastructure, data security.

## **SUSTAINABLE DEVELOPMENT, HUMAN HEALTH AND QUALITY OF LIFE - CASE STUDY: REGIONAL UNIT OF PIRAEUS, GREECE**

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### **Abstract**

The purpose of this paper is to investigate the effect of the urban environment on human health through the lens of the perceived quality of life of the residents. The regional unit of Piraeus Attica in Greece was chosen as a case study.

A bibliographic study was conducted on the human health burden in large urban centers as well as a practical approach - field research. For the needs of the research, a questionnaire was created, which included twenty-nine (29) closed-type structured response questions, was anonymous and distributed to 302 people. The survey was conducted in the months from March to June 2022.

The questionnaire aimed to record the opinions of the residents of the regional unit of Piraeus Attica in Greece, focusing on the perceived quality of life in the urban environment where they live, in order to identify the variables that affect the quality of life and human health in the urban environment.

The research draws interesting conclusions regarding the living conditions of the residents that have an impact on their quality of life as well as their health status. It also highlights the parameters that could be changed in the urban environment they live in to improve the perceived quality of life of the residents.

In addition to the main conclusions, the paper proposes ways to improve the environmental conditions and living conditions, in order to improve the daily life of the residents of the Regional unit of Piraeus Attica in Greece and to minimize the possible effects on their health in the context of the creative nature of the quality of life which is built on sustainable development.

**Keywords:** Piraeus Attica Regional Unit, human health, large urban centers, quality of life, sustainable development

## **CONTRIBUTION OF URBAN REGENERATION TO SUSTAINABLE DEVELOPMENT: THE CASE OF PIRAEUS**

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### **Abstract**

This study examines the pivotal role of urban regeneration in advancing sustainable development, focusing on the 2nd Municipal Community of Piraeus as a case study. Through a multidisciplinary approach—including bibliographic research, personal observation, statistical analysis, and a survey of 345 participants—the research highlights urban regeneration's ability to address environmental, socio-economic, and infrastructural challenges. Key findings reveal significant public support for initiatives promoting green spaces, pedestrian paths, renewable energy, and inclusive urban design. Statistical analyses emphasize broad agreement across demographic groups regarding the benefits of regeneration, with priorities centered on ecological sustainability, accessibility, and social cohesion. Drawing from exemplary international practices and public perceptions, the study demonstrates that urban regeneration can reduce pollution, enhance socio-economic resilience, and foster inclusivity in Piraeus. This research underscores urban regeneration as a vital contributor to transforming Piraeus into a sustainable, resilient, and inclusive urban environment, connecting local needs with global sustainability standards.

**Keywords:** redevelopment; sustainability; urban environment; urban regeneration Piraeus

### **Introduction**

Exemplary cities worldwide offer transformative approaches to urban regeneration, providing valuable insights into sustainable urban development. Copenhagen, Denmark, is recognized as one of the most environmentally progressive cities, boasting 546 kilometers of cycling infrastructure and extensive investments in bicycle-friendly initiatives. In 2021, 35 percent of residents commuted daily by bicycle, supported by an annual infrastructure investment of 84

million Danish kroner. The city operates a fully electric public transport system, with electric buses and water taxis introduced in 2020. Copenhagen's former industrial harbor has undergone significant regeneration, transforming into a recreational area featuring ten designated swimming zones and an innovative rainwater storage system. Furthermore, 98 percent of households are connected to a district heating system that supplies thermal energy. Its vast green spaces cover 25 percent of the city, reducing summer temperatures by up to 2°C while reinforcing biodiversity protection through mandatory integration of green infrastructure into urban planning (Butler et al, 2024; Wonderful Copenhagen, "Sustainability in Copenhagen, 2024).

Barcelona, Spain, exemplifies a people-centered urban mobility model through its Superblocks initiative, which reshapes urban areas by prioritizing pedestrian-friendly spaces and restricting vehicular access. These interventions have significantly reduced noise pollution by up to 9 dB, enhanced air quality, and strengthened local economies through increased foot traffic. By 2024, Barcelona aims for 80 percent of transportation to rely on walking, cycling, or public transit, with plans to convert one in every three streets into green corridors by 2030 (European Commission, 2022).

Medellín, Colombia, presents another model of urban transformation, shifting from a city marked by social inequality and violence to an exemplary case of urban resilience. Through targeted regeneration initiatives such as cable car systems connecting marginalized neighborhoods to economic centers, enhanced public spaces, and innovative transportation infrastructure, Medellín has achieved socio-economic revitalization while fostering community engagement in redevelopment efforts (Esteves, 2012; Naef, 2020).

Singapore stands out as a densely populated yet efficiently designed urban environment, integrating vertical greening, advanced water management systems, and smart-city technologies to address sustainability challenges. By blending nature with urban density, Singapore has developed biophilic spaces, adaptive reuse policies, and water recycling initiatives that ensure resource efficiency while promoting a high quality of life (Webb, 2012).

Urban regeneration in Greece has evolved over several decades, from early reconstruction efforts following natural disasters in the 1970s to more comprehensive renewal projects influenced by European sustainability directives in the 1990s. Initial redevelopment strategies primarily focused on pedestrianization and aesthetic enhancements, while recent efforts aim to integrate resilience, accessibility, and green infrastructure more effectively. Major urban projects such as "The Ellinikon," which seeks to create a smart, inclusive, and sustainable urban hub along the Athenian Riviera, signal a shift toward more holistic urban regeneration models.

Aligned with global sustainability efforts, the research is structured within the framework of the Sustainable Development Goals (SDGs), particularly Goal 11: "Sustainable Cities and Communities." At the European level, strategies emphasize the need for resilient and innovative cities that prioritize inclusivity, economic development, and environmental protection. Nationally, urban regeneration policies aim to promote accessibility, green infrastructure, and socio-economic balance (United Nations, 2015; World Bank, 2018; European Commission, 2023).

Piraeus, Greece, presents a complex urban landscape marked by environmental, socio-economic, and infrastructural challenges. The urban ecosystem suffers from limited green spaces, reduced biodiversity, and heightened levels of air, water, noise, and light pollution. Uncoordinated industrial activity, inadequate spatial planning, and inefficient traffic networks exacerbate urban congestion, narrow streets, and deteriorating infrastructure. Disorganized waste management further intensifies public health risks and environmental degradation. Vulnerable social groups—including migrants, the homeless, and individuals with disabilities—experience social exclusion, while economic instability and high unemployment

hinder socio-economic progress. These conditions, compounded by a densely built environment and the escalating climate crisis, necessitate a comprehensive and targeted urban regeneration strategy.

By synthesizing international, European, and national priorities, this study aspires to propose a robust and context-sensitive urban regeneration framework for Piraeus, addressing its distinctive challenges while envisioning its transformation into a resilient and sustainable urban hub.

## **Methodology**

This research examines the critical role of urban regeneration in advancing sustainability, with a specific focus on the 2nd Municipal Community of Piraeus. The study aims to address the multifaceted challenges afflicting the area and develop a strategic framework for sustainable urban regeneration, aligned with international, European, and national directives.

The methodology employed in this research integrates a multifaceted approach, encompassing an extensive literature review, quantitative analysis through a structured 28-question survey administered to a randomized sample of  $N = 345$  individuals, and qualitative assessment conducted through direct observation of the study area to formulate a comprehensive urban regeneration proposal. The survey sought to evaluate the public perception, social acceptance, and awareness of sustainability principles among Greek citizens who have either visited or reside in Piraeus. Given that the total population of Piraeus in 2021 was recorded at 168,151, the sample size represents a statistically valid proportion, ensuring the reliability and generalizability of findings. The selection of respondents, which includes both residents and visitors, accounts for diverse perspectives, reinforcing the robustness of the dataset and minimizing selection bias.

Survey data were electronically collected through Google Docs, and subsequent statistical analysis was conducted using Jamovi 2.3.28, ensuring methodological rigor in processing responses. The analytical framework incorporated descriptive statistics, where relative and absolute frequencies were computed, followed by a Chi-Square ( $\chi^2$ ) test to examine statistically significant associations among qualitative categorical variables. Independent demographic factors—including gender, age group, educational level, marital status, and residency in Piraeus—were analyzed to determine disparities in perspectives regarding urban regeneration.

The regeneration proposal was systematically developed based on an integrated assessment of environmental, social, and economic conditions, aligning with international and European sustainability directives. Factors influencing urban resilience, accessibility, and sustainable urban planning were derived from global and European urban sustainability objectives, a comprehensive literature review on emerging urban design technologies and exemplary international case studies, empirical data collected through survey responses, the strategic urban regeneration plan for Piraeus under the Programming Period 2021–2027, and a SWOT analysis, identifying Piraeus’s strengths, weaknesses, future opportunities, and potential threats.

The incorporation of advanced statistical methodologies, paired with rigorous validation of the confidence interval, ensures the scientific reliability of this study's findings, reinforcing its applicability in informing sustainable urban regeneration policies for Piraeus.

## **Characteristics of the Region**

Piraeus stands as a remarkable urban and maritime hub of Greece, playing a critical role as the nation’s primary port and a central node in the Mediterranean. Its strategic location, historical



significance, and economic importance have driven its transformation into a focal point for maritime trade, cultural preservation, and socio-economic development. The municipality encompasses diverse neighborhoods, each reflecting unique socio-economic dynamics and land-use patterns. Its vibrant cultural and architectural heritage, exemplified by neoclassical structures, museums, and iconic landmarks like the Lion of Piraeus, is intricately tied to its historical evolution and serves as an asset for sustainable tourism and urban regeneration.

The region's physical and infrastructural characteristics further define its challenges and opportunities. Piraeus spans 10.9 square kilometers and features a dense urban fabric with limited green spaces, averaging 1.56 m<sup>2</sup> per capita, which is among the lowest in Greece (Municipality of Piraeus, 2024; Argyropoulos, 2020; Hellenic Statistical Authority, 2023). The city's built environment includes 25,663 buildings, predominantly residential, alongside educational institutions, industrial facilities, and healthcare centers. The extensive road network of 430 kilometers is marked by narrow streets, limited bicycle lanes, and constrained pedestrian pathways, which exacerbate mobility issues and contribute to traffic congestion (Municipality of Piraeus (n.d.-e), 2024; Ministry of Environment and Energy, 2024). Despite the addition of metro stations, tramlines, and the Sustainable Urban Mobility Plan, gaps in public transport infrastructure persist, emphasizing the need for further integration and modernization (Piraeus Chamber of Commerce and Industry, 2014).

Environmental conditions also play a significant role in shaping urban challenges. Piraeus experiences a warm semi-arid steppe climate, with recent data indicating a 1°C rise in average temperatures between 2010 and 2023 due to climate change (Hellenic National Meteorological Service, 2016). The region struggles with high levels of air pollution, with concentrations of particulate matter (PM<sub>10</sub>) and nitrogen oxides (NO<sub>x</sub>) consistently exceeding European Union limits, largely attributed to industrial activity, maritime operations, and reliance on high-sulfur fuels (United Nations, 2015; Lialios, 2024; Hellenic Ornithological Society, 2024; meteo.gr). Biodiversity and vegetation have been significantly reduced, with urban flora dominated by Mediterranean trees and shrubs. Urban fauna is limited, primarily comprising companion animals and marine birds due to the city's coastal location (Environmental Association of Municipalities of Athens-Piraeus, 2024).

These characteristics reveal a complex interplay of strengths and vulnerabilities. On one hand, the city's cultural, economic, and geographic assets position it as a dynamic hub for innovation and sustainable growth. On the other hand, challenges such as environmental degradation, inadequate infrastructure, and socio-economic inequality underscore the urgent need for coordinated urban regeneration efforts.

## **Results of the Focus Group Survey**

The survey was conducted within urban redevelopment areas and public spaces of Piraeus, involving both residents and visitors. The goal was to evaluate public perceptions of urban regeneration initiatives, their impacts on sustainability, inclusivity, and quality of life, as well as socio-economic factors affecting the city.

### ***Participant Demographics***

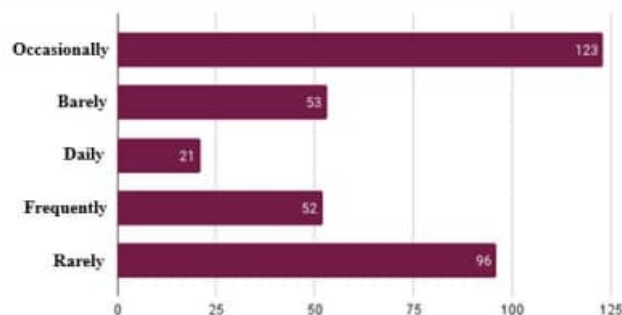
The first five questions referred to the demographics of the focus group, such as age, gender, marital status, educational status and whether the participants were residences of the area. The survey captured nearly equal gender representation, with 53.3% identifying as female, 46.1% as male, and 0.6% choosing not to disclose their gender. The majority of participants fell within the 26–65 age range, with lower participation from the 18–25 (9.9%) and over-65 (4.6%) age groups. Educational attainment levels were high: 31.6% were university graduates, 29.9% held a master's degree, 20% had secondary education, 13.3% completed vocational

programs, 4.1% held doctoral degrees, and 1.2% had primary education. Most respondents were married (51%), and only 16.8% resided in Piraeus.

Questions 6-22 focused on the urban regeneration and social acceptance:

**Question 6. How often do you visit urban redevelopment areas in Piraeus?**

The frequency of visits to urban redevelopment areas displayed a range of behaviors. Occasional visits were the most common (35.7%), followed by rare visits (27.8%), while 15.1% reported frequent visits, and only 6.1% visited daily. Residency status significantly influenced visiting patterns, with permanent residents showing a higher likelihood of frequent visits ( $p < 0.001$ ).



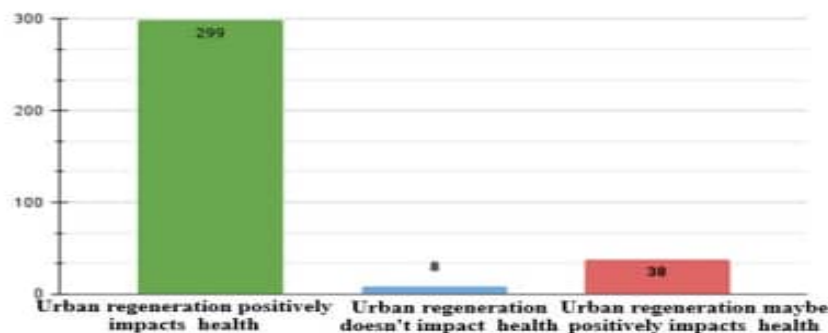
**Question 7. Were you satisfied with the urban redevelopment areas you visited?**

Respondents' satisfaction levels were distributed almost evenly, with 34.2% dissatisfied, 33% indifferent, and 32.8% satisfied. There were no significant differences between residents and non-residents ( $p = 0.061$ ). These results highlight the need for improvements to ensure functionality and aesthetic appeal that meet the expectations of diverse users.



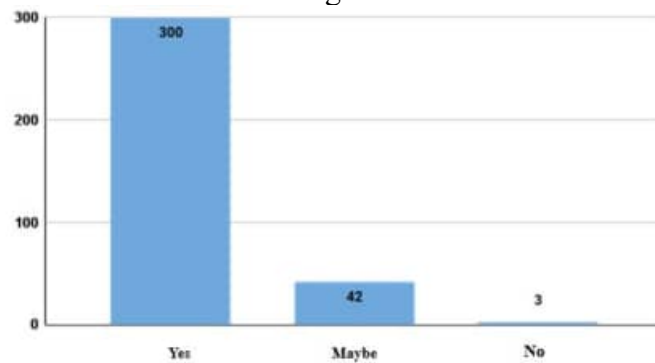
**Question 8. Do you think urban redevelopments have benefits for mental health, immune health, brain and physical development, and the health of children and adolescents?**

An overwhelming 86.7% of respondents acknowledged the positive impacts of urban redevelopment on mental health, immune health, physical and brain development, as well as benefits for children and adolescents, while only 2.3% disagreed. This reflects a strong consensus on the health-related advantages of sustainable urban planning.

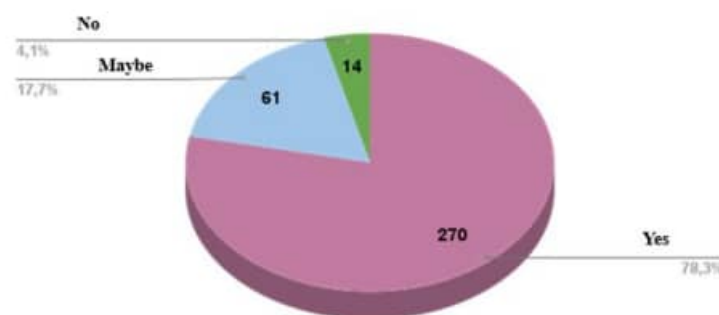


***Question 9. Do you think urban redevelopments benefit social cohesion, economic growth, and investments?***

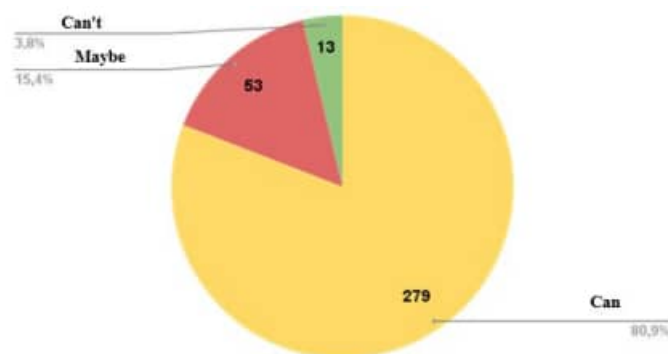
The vast majority (87%) believed that urban regeneration fosters social cohesion, economic growth, and investments. Responses were consistent across demographic groups, with no significant variations observed ( $p = 0.684$ ). This underscores the perceived economic and social benefits of urban regeneration.

***Question 10. Do urban redevelopments contribute to the increase of green spaces and biodiversity?***

Most respondents (78.3%) affirmed that urban redevelopment contributes to the increase of greenery and biodiversity. This perception was consistent across all demographic categories ( $p = 0.393$ ), reinforcing the environmental importance of redevelopment initiatives in Piraeus.

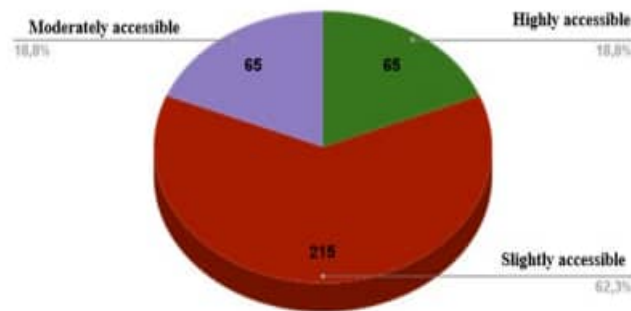
***Question 11. Do you believe urban redevelopments improve air quality, help reduce city temperatures, and reduce noise pollution?***

Approximately 80.9% of participants recognized the environmental benefits of urban redevelopment, particularly in improving air quality, mitigating urban heat, and reducing noise pollution. No significant differences were found across demographic groups ( $p = 0.990$ ), indicating wide public recognition of these benefits.

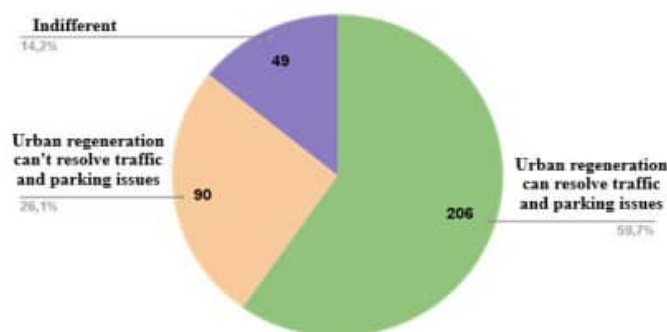
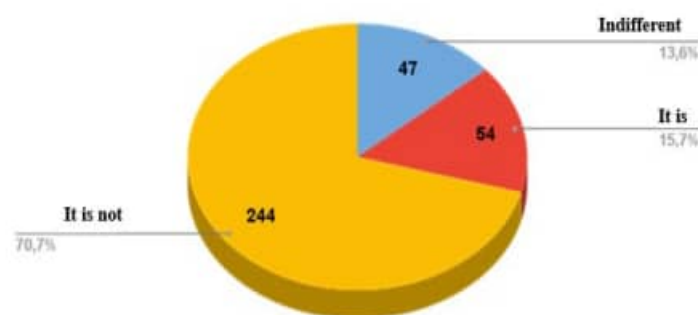


**Question 12. How accessible are the redevelopment areas in Piraeus?**

Accessibility to redevelopment areas was rated as moderate by 62.3% of respondents, while 18.8% considered them highly accessible, and another 18.8% viewed them as slightly accessible. There were no significant differences across demographic variables ( $p = 0.475$ ). This suggests that although accessibility is generally perceived as adequate, further improvements are necessary to better accommodate vulnerable groups.

**Question 13. Do you think urban redevelopments can provide solutions to traffic and parking problems in Piraeus?**

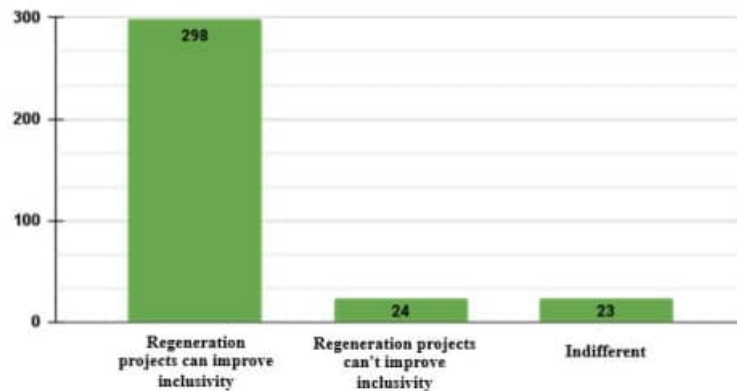
A majority (59.7%) believed urban redevelopment could address traffic and parking challenges in Piraeus, while 26.1% disagreed. No significant differences were observed between residents and non-residents ( $p = 0.268$ ). This reflects public optimism and demand for enhanced urban mobility through thoughtful planning.

**Question 14. Do you think Piraeus is inclusive, safe, and accessible for the most vulnerable social groups, such as people with disabilities, the elderly, women, children, foreigners, pedestrians?**

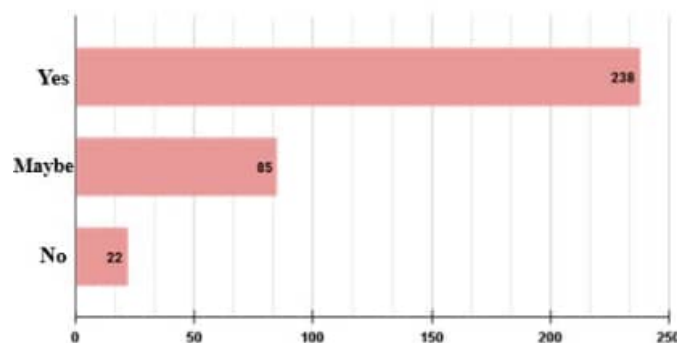
A concerning 70.7% of respondents felt that Piraeus lacks inclusivity, safety, and accessibility for vulnerable groups.

**Question 15. Do you think urban redevelopments make a city more inclusive, safe, and accessible?**

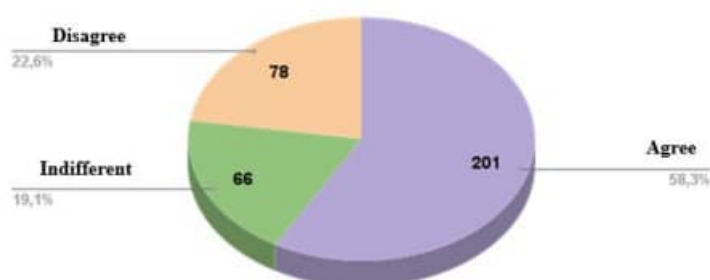
However, 86.4% believed that urban redevelopment projects have the potential to address these deficiencies. These findings highlight public expectations for regeneration efforts to prioritize inclusivity and accessibility.

**Question 16. Do you think urban redevelopments can help reduce and balance Piraeus' pollution footprint, turning it into a sustainable city?**

Approximately 69% of respondents believed that urban redevelopment projects could effectively reduce Piraeus's pollution footprint and transform it into a sustainable city. Positive views were consistent across all demographic groups ( $p = 0.950$ ), emphasizing the critical role of regeneration in achieving environmental sustainability.

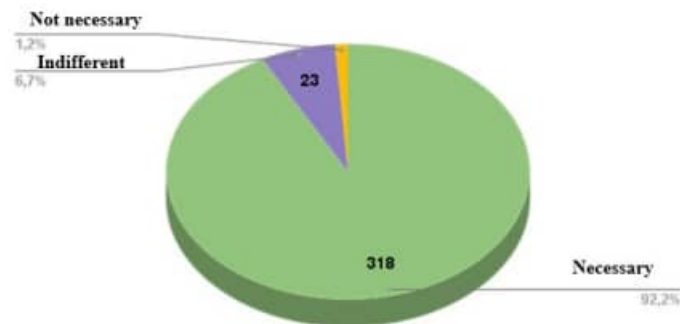
**Question 17. Do you think urban redevelopments can make a city like Piraeus socioeconomically resilient, meaning it can anticipate and quickly respond to sudden disturbances and crises caused by economic and social challenges?**

About 58.3% of respondents supported the view that urban regeneration can enhance socio-economic resilience. Gender differences in perceptions were statistically significant ( $p < 0.05$ ), suggesting a need for gender-responsive planning strategies to address diverse concerns and priorities.

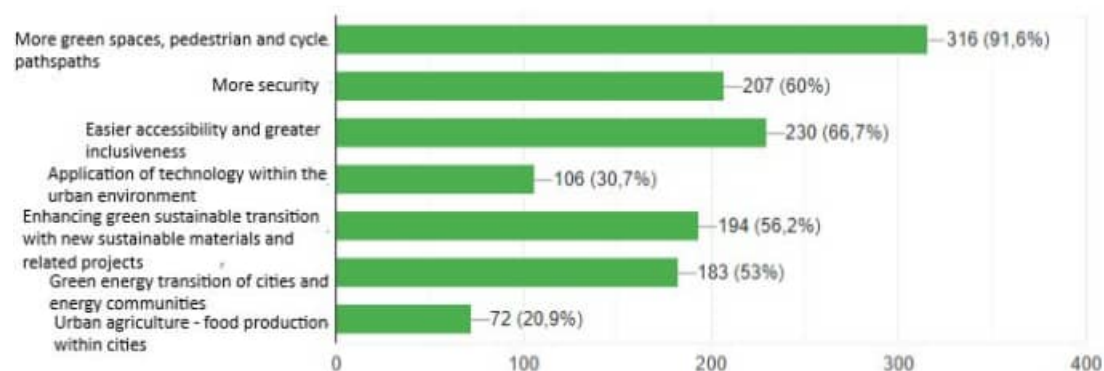


**Question 18. Do you think urban redevelopments in Piraeus are necessary?**

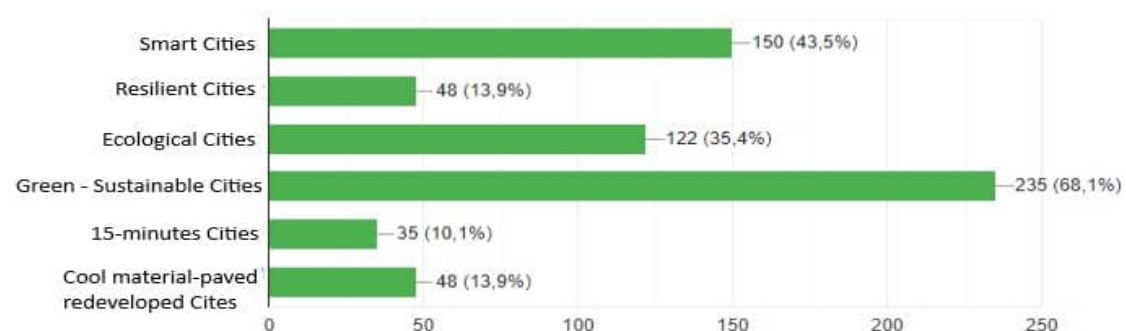
An overwhelming 92.2% of respondents affirmed the necessity of urban regeneration in Piraeus. Gender-based differences in opinions ( $p < 0.05$ ) further highlight the importance of inclusive planning that considers diverse stakeholder perspectives.

**Question 19. What would you want from an urban redevelopment?**

Respondents identified increased green spaces, pedestrian paths, and bike lanes as their top priorities (91.6%), followed by improved accessibility (66.7%), sustainable materials (56.2%), and green energy solutions (53%). These preferences demonstrate strong public demand for eco-friendly and inclusive urban design.

**Question 20. What types of redevelopment areas/cities do you like?**

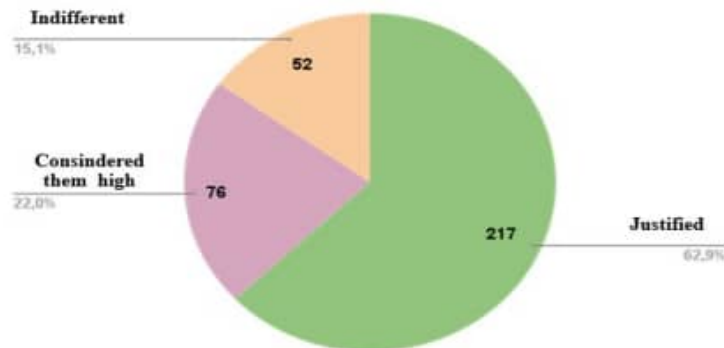
Green-sustainable cities emerged as the most preferred model (68.1%), followed by smart cities (43.5%) and ecological cities (35.4%). These preferences reflect growing environmental awareness and a desire for sustainable urban development frameworks.





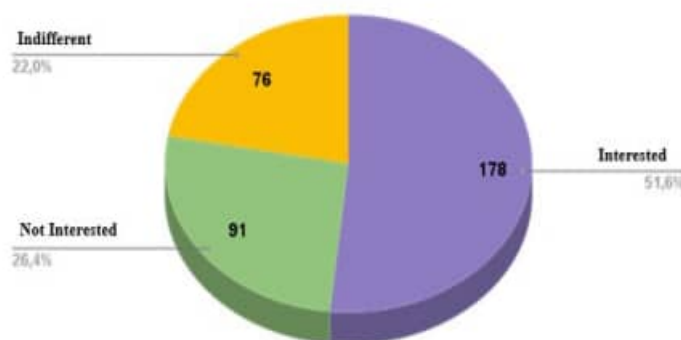
**Question 21. Do you think the cost of redevelopments is too high compared to what they offer?**

A majority (62.9%) considered the costs of urban redevelopment justified, while 22% perceived them as excessively high. Opinions varied significantly across age groups ( $p < 0.05$ ), indicating generational differences in the perception of cost-effectiveness.



**Question 22. Would you like to participate in the design of redevelopments?**

Approximately 51.6% expressed interest in participating in planning processes for urban redevelopment. No significant demographic differences were observed ( $p > 0.05$ ). These results suggest the potential for increased public engagement, provided that targeted outreach and participatory mechanisms are implemented.



**Statistical Observations**

The majority of findings indicate no statistically significant differences across demographic variables ( $p > 0.05$ ), suggesting a general consensus among respondents. However, five key variables demonstrated statistically significant differences ( $p < 0.05$ ), reinforcing nuanced perspectives on urban regeneration in Piraeus:

1. Gender and Socioeconomic Resilience: Statistically significant differences ( $p = 0.026$ ) suggest that gender influences perceptions of urban regeneration as a mechanism for socioeconomic resilience. Specifically, 80 male respondents and 120 female respondents expressed agreement that regeneration enhances the city's ability to withstand economic and social disruptions.
2. Gender and Necessity of Regeneration: Perceptions regarding the necessity of urban redevelopment varied significantly by gender ( $p = 0.050$ ). Notably, 144 male respondents and 173 female respondents affirmed the need for regeneration projects, indicating a gender-based discrepancy in prioritization.

3. **Age and Cost-Effectiveness of Regeneration:** Respondents’ assessments of whether urban redevelopment costs outweigh its benefits exhibited statistically significant variation across age groups ( $p = 0.027$ ). Agreement rates varied as follows: 18–25 years: 15, 26–35 years: 13, 36–45 years: 15, 46–55 years: 18, 56–65 years: 14, 66+ years: 1, underscoring generational disparities in perceived fiscal feasibility.
4. **Residency and Frequency of Redevelopment Space Utilization:** The frequency with which residents and non-residents visited regenerated urban spaces differed markedly ( $p < 0.001$ ). Daily visitation rates were substantially higher among residents (21 daily visitors) compared to non-residents (0 daily visitors), reinforcing the localized impact of redevelopment initiatives.
5. **Residency and Perceptions of Inclusivity:** Statistically significant differences emerged in respondents’ evaluations of Piraeus as an inclusive, accessible, and safe city for vulnerable populations ( $p = 0.032$ ). A higher proportion of non-residents (46 respondents) perceived the city as inclusive compared to residents (8 respondents), highlighting potential disparities in lived experience versus external observation.

Importantly, statistical analyses indicate that educational attainment levels did not yield significant differences in responses across any of the examined variables ( $p > 0.05$ ). This suggests that perceptions of urban resilience, regeneration necessity, cost-effectiveness, redevelopment space utilization, and inclusivity are shaped more profoundly by factors such as gender, age, and residency status than by formal educational background. The findings underscore that sustainability and urban redevelopment are broadly recognized issues across all educational levels, reaffirming the universal relevance of these concerns.

#### S.W.O.T. Analysis

| Category      | Strengths                                                                                                                                                     | Weaknesses                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
|---------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Environmental | <ul style="list-style-type: none"> <li>✓ Presence and operation of facilities in Psyttaleia conducting secondary water treatment and disinfection.</li> </ul> | <ul style="list-style-type: none"> <li>✓ Lack of green spaces and biodiversity.</li> <li>✓ High pollution levels and poor air quality.</li> <li>✓ Increased water and air pollution from industrial and maritime activities.</li> <li>✓ Problems with the underground water system due to blocked drains and issues with rainwater absorption.</li> <li>✓ Poor waste management with limited access to locked brown bins and overflowing green bins posing health risks.</li> </ul> |
| Social        | <ul style="list-style-type: none"> <li>✓ Historical and cultural heritage that attracts tourism.</li> </ul>                                                   | <ul style="list-style-type: none"> <li>✓ Social issues like accessibility, social cohesion, and safety, with vulnerable groups facing prejudice.</li> <li>✓ Low quality of the residential</li> </ul>                                                                                                                                                                                                                                                                               |

|                 |                                                                                                                                                                                                                                                                                                                                                                                            | stock.                                                                                                                                                                                                                                                                                                                     |
|-----------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Economic        | <ul style="list-style-type: none"> <li>✓ Increased investments in the blue economy and improvement of tourist infrastructure.</li> <li>✓ Strategic location of Piraeus as a major port.</li> <li>✓ Social and economic activity hub.</li> </ul>                                                                                                                                            | <ul style="list-style-type: none"> <li>✓ Economic issues like unemployment and economic adaptability.</li> </ul>                                                                                                                                                                                                           |
| Infrastructural | <ul style="list-style-type: none"> <li>✓ Recycling initiatives with various recycling and waste bins.</li> </ul>                                                                                                                                                                                                                                                                           | <ul style="list-style-type: none"> <li>✓ Traffic and spatial planning issues, chaotic traffic network, lack of arterial roads, inadequate signage, and lack of organized parking spaces.</li> <li>✓ Excessive urbanization with dense building and narrow streets.</li> <li>✓ Degraded urban infrastructure.</li> </ul>    |
| Category        | Opportunities                                                                                                                                                                                                                                                                                                                                                                              | Threats                                                                                                                                                                                                                                                                                                                    |
| Environmental   | <ul style="list-style-type: none"> <li>✓ Implementation of green policies, promoting sustainable development and creating more green spaces.</li> <li>✓ Investments in renewable energy sources and clean energy technologies.</li> <li>✓ Awareness campaigns for environmental protection.</li> <li>✓ Implementation of better waste management practices to reduce pollution.</li> </ul> | <ul style="list-style-type: none"> <li>✓ Climate crisis and worsening environmental conditions.</li> <li>✓ Continuing pollution from industrial and maritime activities, increasing toxicity and heavy metal content in the aquatic environment.</li> <li>✓ Further reduction of green spaces and biodiversity.</li> </ul> |
| Social          | <ul style="list-style-type: none"> <li>✓ Awareness campaigns for waste management and reduction.</li> <li>✓ Social inclusion programs to improve accessibility, social care, and support for vulnerable groups.</li> </ul>                                                                                                                                                                 | <ul style="list-style-type: none"> <li>✓ Social inequalities and lack of social cohesion, leading to further social exclusion and unrest.</li> <li>✓ Possible increase in crime due to social and economic problems.</li> </ul>                                                                                            |
| Economic        | <ul style="list-style-type: none"> <li>✓ Development of sustainable tourism programs utilizing historical and cultural heritage to attract investments.</li> <li>✓ Promotion and support of innovative economic</li> </ul>                                                                                                                                                                 | <ul style="list-style-type: none"> <li>✓ Ongoing economic instability, which may negatively affect development and investments in the area, along with high unemployment levels.</li> </ul>                                                                                                                                |

|                 |                                                                                                                                                                                                                                                                                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
|-----------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                 | <ul style="list-style-type: none"> <li>activities to create new jobs.</li> <li>✓ Implementation of smart city technologies for traffic management</li> </ul>                                                                                                                                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| Infrastructural | <ul style="list-style-type: none"> <li>✓ Improvement of infrastructure and waste collection mechanisms.</li> <li>✓ Implementation of new sustainable urban planning projects.</li> <li>✓ Development programs for upgrading the area, renovating and improving existing buildings.</li> </ul> | <ul style="list-style-type: none"> <li>✓ Increase in environmental impacts from vehicles, such as air and noise pollution.</li> <li>✓ Environmental impacts from further construction.</li> <li>✓ Continued increase in waste and further environmental impacts from poor management.</li> <li>✓ Increase in the number of vehicles, exacerbating traffic and parking problems.</li> <li>✓ Continuous population growth, worsening the lack of residential stock.</li> </ul> |

Table 1: The Strengths-Weaknesses-Opportunities-Threatens of Piraeus City.

This S.W.O.T. analysis conducted for Piraeus provides a comprehensive overview of its strengths, weaknesses, opportunities, and threats, offering valuable insights for sustainable urban regeneration planning. Piraeus’s strategic location, its role as a hub of social and economic activity, and its historical and cultural heritage represent significant assets. Investments in the blue economy, tourism infrastructure, and recycling initiatives further bolster its development potential. However, the analysis reveals critical weaknesses, such as insufficient green spaces, high pollution levels, social and economic disparities, poor waste management, traffic congestion, and degraded urban infrastructure. These challenges, compounded by excessive urbanization, emphasize the need for targeted interventions. Opportunities identified include the implementation of green policies, sustainable tourism programs, renewable energy investments, and smart city technologies, which can foster economic growth, environmental sustainability, and social inclusivity. Nonetheless, threats such as the climate crisis, economic instability, pollution, and social inequalities pose significant risks to Piraeus’s development. The analysis highlights the urgent need for coordinated efforts to capitalize on strengths and opportunities while mitigating weaknesses and threats, paving the way for an integrated approach to sustainable urban regeneration in line with global and European standards.

## Conclusions

This study underscores the critical role of urban regeneration in addressing the environmental, socio-economic, and accessibility challenges faced by Piraeus, in line with global and European sustainability objectives. Key urban issues include pollution, a deficiency of green spaces, urban degradation, and accessibility deficits for vulnerable groups, exacerbated by urbanization and the climate crisis. Survey findings indicate public recognition of the benefits of regeneration for mental health, social cohesion, and air quality, though only about half of respondents expressed willingness to engage in planning processes. Statistical analyses

revealed some significant differences in perceptions based on demographic variables such as gender, age, and socio-economic resilience. Despite its challenges, Piraeus benefits from strategic advantages like its historical and cultural heritage and investments in the blue economy, which present significant opportunities. The study confirms that urban regeneration can enhance sustainability in Piraeus, provided coordinated efforts address existing weaknesses and threats. Further research is recommended to refine and implement these strategies effectively.

The proposed urban regeneration strategies for Piraeus integrate targeted interventions aimed at improving environmental resilience, social inclusivity, and economic sustainability. Pedestrianization of key areas, such as Akti Koumoundourou, is essential for mitigating air and noise pollution while enhancing public safety and fostering neighborhood cohesion. Sustainable urban technologies, including solar-powered pergolas and integrated vegetation zones, contribute to ecological stability, biodiversity preservation, and efficient stormwater management. Accessibility measures, such as tactile pavement tiles and solar-powered parking facilities, address mobility challenges and improve inclusivity for vulnerable groups. Infrastructure upgrades focus on expanding bicycle networks, enhancing drainage systems, and optimizing adaptive reuse of urban spaces to support sustainable mobility and urban resilience. The study's findings demonstrate that well-planned urban regeneration serves as a key mechanism for transforming Piraeus into a more sustainable, livable, and economically dynamic city. By implementing strategic interventions informed by international best practices and emerging urban sustainability principles, Piraeus can establish itself as a model of resilience, fostering environmental integrity, social equity, and economic prosperity for residents and visitors alike.

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## **IDENTIFICATION OF BOUNDARIES OF MEASUREMENTS FOR CITY ENVIRONMENTAL QUALITY**

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### **Abstract**

Cities have become the largest consumers of resources and pollution contributors due to urbanisation. In the development process, some cities have considered factors affecting environmental quality. However, measuring quality and maintaining standards have become crucial as boundaries of measurements for environmental quality are vague. This research study was focused on verifying the factors affecting city environmental quality and identifying boundaries for measuring environmental quality taking Sri Lankan cities as a case study.

Qualitative research was conducted with a semi-structured interview guide considering city environmental quality as the dependent variable. Some factors affecting the city's environmental quality were identified from the literature as, energy consumption, water consumption, materials and resources consumption, and land utilisation. Expert interviews were conducted to explore these related factors and to identify any other additional factors available. Interviews were terminated once data saturation was reached. Data analysis was conducted using thematic analysis adhering to the qualitative nature of the research.

In addition to the four factors verified, findings revealed that three factors as resilience to disasters, education, and governance play a significant role in maintaining a city's environmental quality. Dimensions contributing to these factors and their measuring indicators were derived to investigate the boundaries of measurements of these factors in cities. It was revealed that measuring boundaries can be varied as individual units (household, industrial, or commercial buildings) or city boundaries to maintain quality standards. Identified boundaries of measurements can be used for city development purposes and in the comparison of the environmental sustainability of cities.

**Keywords:** Environmental Quality, Sustainability, Indicators, Measuring Boundary, Cities, Urbanisation, Urban Development

## FROM WASTE MANAGEMENT TO CIRCULAR ECONOMY? THE ROLE OF ENVIRONMENTAL CONFLICTS IN POLICY MAKING IN ATTICA REGION

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### **Abstract**

The role of the environmental conflicts in the evolution of policy making is often neglected when analyzing public policies. Never – the-less, the emergence of the environmental issues and the new social movements around quality of life and environmental protection, lead to the birth of new logics of local government, that question the vertical exercise of power, under the general heading of governance, which are considered integral part of sustainable management. Hence although institutional actors are the protagonists in public policies, local social movements play an important indirect role in policy making, either by shaping public discourse and hence the policy agenda setting, or by becoming an unofficial veto player, that opposes to the application of policies.

The present paper investigates, the role of civil society and social movements and it's interaction with institutional policies, around waste management and circular economy, by using a thematic and regional systemic approach of the conflicts around waste management in Attica region during 2010', in order to explore and highlight a complex system of interactions that delays the progress of policies concerning the circular economy. These interactions can be modeled and can lead us to formulate a typology of actors, discourses and strategies.

The paper presents part of the outcome of the Ph.D thesis on “Environmental Conflicts and Governance in Athens' suburban area: Macroscopic study of the environmental defence's actors and environmental policies (2005-2014)” defended in Panteion University in December 2023. The main methodological tool is the combination of the qualitative analysis of conflicts on waste management, occurred in Attica during the period 2005-2018 and the analysis of multilevel policies (regional, national and European) during the same period.

**Key words:** environmental conflicts, waste management, circular economy, Attica, environmental movement

## **THE HUMAN SIDE OF SUSTAINABILITY: THE ROLE OF LEADERSHIP IN EMPLOYEE WELLBEING**

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### **Abstract**

Sustainable leadership, a practice that integrates environmental, social, and economic considerations into organizational decision-making, has gained significant attention in recent years. While its impact on organizational performance and societal well-being is well-documented, its influence on employee well-being remains a relatively unexplored area.

This research aims to investigate the relationship between sustainable leadership and employee well-being. By examining the specific mechanisms through which sustainable leadership practices enhance employee well-being, this study seeks to contribute to a deeper understanding of how organizations can create more positive and sustainable work environments.

Through a comprehensive literature review, this study will explore the following key research questions:

1. How does sustainable leadership influence employee well-being?
2. What are the specific behaviors and practices of sustainable leaders that positively impact employee well-being?
3. How do employees perceive the impact of sustainable leadership on their overall well-being?

The findings of this research are expected to provide valuable insights for organizations seeking to adopt sustainable leadership practices and prioritize employee well-being. By understanding the intricate connections between sustainable leadership and employee well-being, organizations can cultivate more engaged, motivated, and resilient workforces.

**Key words:** sustainable leadership, workplace well-being, sustainable practices

### **Introduction**

In recent decades, sustainability has become a central theme in organizational strategy, extending beyond environmental concerns to encompass economic viability and social responsibility. The growing recognition that businesses must address the needs of multiple stakeholders has reshaped expectations of leadership and organizational behavior. Within this evolving context, the concept of sustainable leadership has emerged as an integrative approach that aligns organizational goals with long-term ecological, social, and economic

outcomes. Sustainable leadership emphasizes not only financial performance and environmental stewardship but also the creation of supportive, ethical, and people-centered workplaces.

While a substantial body of research has demonstrated the benefits of sustainable leadership for organizational performance and societal well-being, the human dimension—specifically its impact on employees—has received comparatively less attention. Employee well-being is increasingly acknowledged as a critical factor in organizational success, influencing motivation, engagement, productivity, and retention. Yet, the ways in which sustainable leadership contributes to, or shapes employee well-being remain underexplored. Addressing this gap is essential, as leaders play a pivotal role in cultivating work environments that promote both individual flourishing and sustainable organizational outcomes.

This paper aims to investigate the relationship between sustainable leadership and employee well-being by examining the specific practices and behaviors through which leaders foster positive employee experiences. Three key research questions guide this inquiry: (1) How does sustainable leadership influence employee well-being? (2) What leadership practices are most effective in supporting employee well-being? and (3) How do employees perceive the effects of sustainable leadership on their well-being? By addressing these questions, the study seeks to advance understanding of the human side of sustainability and provide actionable insights for organizations striving to balance economic performance with social and human responsibility.

### **The importance of employee well being.**

Employee well-being is increasingly recognized as a cornerstone of organizational success. It is strongly associated with higher levels of productivity, engagement, and employee retention, while neglecting it often results in burnout, absenteeism, and diminished morale. As such, organizations stand to gain significant advantages by adopting a holistic approach to well-being that addresses not only physical health but also psychological and social dimensions of work life.

Workplace well-being directly influences employee performance through its connection to human resource management practices and overall organizational effectiveness (Pagán-Castaño et al., 2020). When employee well-being is compromised, the negative consequences—such as increased burnout, absenteeism, and low motivation—can undermine both individual and organizational outcomes. Conversely, fostering well-being at work enables employees to remain “healthy,” resilient, and highly productive, thereby generating benefits that extend to the entire organization (Aryanti et al., 2020).

Moreover, employee well-being plays a central role in sustaining long-term performance by promoting mental health, vitality, and motivation. These factors are essential for ensuring that employees remain engaged and capable of contributing meaningfully to organizational goals over time (Murtaza et al., 2023). Prioritizing workplace well-being is therefore not only an ethical responsibility but also a strategic imperative for organizations striving to build resilient, sustainable, and high-performing workforces.

### **How Sustainable Leadership Impacts Employee Well-Being**

Sustainable leadership is defined by its capacity to balance the triple goals of economy, society, and environment, integrating economic performance with social responsibility and environmental stewardship (Liao, 2022). This form of leadership adopts a long-term perspective, prioritizing not only organizational success but also societal sustainability. It

emphasizes stakeholder engagement, open dialogue, and mutual interdependence between leaders and followers, thereby shifting the focus from purely financial outcomes to broader environmental and social impacts (Gérard et al., 2017).

At its core, sustainable leadership is grounded in ethical, transparent, and responsible decision-making. By fostering a positive organizational culture, it enhances job satisfaction, motivation, and resilience among employees. It encourages practices that support work-life balance and psychological safety, both of which are vital for long-term employee well-being. Research demonstrates that sustainable leadership significantly strengthens employee well-being in small and medium-sized enterprises (SMEs), particularly by boosting resilience under conditions of lower environmental turbulence (Iqbal et al., 2022). Similarly, it has been shown to enhance psychological safety and sustainable performance, with employee empowerment acting as a key moderating factor (Asad et al., 2021).

Through its holistic orientation, sustainable leadership thus contributes not only to organizational sustainability but also to the creation of healthier, more engaged, and empowered workforces.

### **Perceptions of Employees.**

Employees tend to value leaders who actively prioritize their well-being, recognizing such leadership as a source of support and stability in the workplace (Iqbal et al., 2022). Sustainable leadership has been positively associated with higher levels of trust and engagement, strengthening the relationship between employees and their organizations (Ilyas et al., 2020). Moreover, employees working under sustainable leaders report greater job satisfaction and reduced stress, further underscoring the positive psychological outcomes of this leadership style (Sulej et al., 2024).

Beyond these individual benefits, sustainable leadership fosters a supportive and empowering work environment that enhances well-being, engagement, and overall performance. It also encourages pro-environmental behaviors, aligning employee actions with broader sustainability objectives. In this way, sustainable leadership contributes not only to employee satisfaction and productivity but also to the advancement of organizational sustainability as a whole.

### **Empirical findings**

Empirical research consistently demonstrates that sustainable leadership plays a crucial role in fostering the long-term development of employees, organizations, and society. For example, Xin et al. (2024), in a study published in the *Journal of Business and Psychology*, found that sustainable leadership is positively associated with employee performance, with work engagement mediating this relationship. Their findings highlight that sustainable leadership enhances both in-role and extra-role performance by stimulating greater engagement among employees.

Sustainable leadership has also been linked to social sustainability outcomes. Lewandowska et al. (2023) show that it contributes to reduced turnover rates and strengthens long-term relationships with employees, thereby improving organizational effectiveness. Similarly, Chaudhry et al. (2020) demonstrate that sustainable leadership positively influences employee performance, with environmental, economic, and social dimensions serving as critical drivers of this effect. Iqbal et al. (2020) further highlight that sustainable leadership enhances psychological safety, which in turn amplifies its impact on sustainable organizational performance.

Beyond individual and organizational outcomes, sustainable leadership is also tied to the development of broader competencies and practices that advance inclusive growth and resilience. Suriyankietkaew et al. (2022) emphasizes the importance of value-based competencies—such as strategic thinking, systems thinking, interpersonal skills, anticipatory capacity, and ethical judgment—for leaders and entrepreneurs seeking to embed sustainability in their practices. In the context of higher education, Filho et al. (2020) find that sustainability leaders often demonstrate inclusive leadership styles, systemic thinking, innovation, long-term orientation, and the capacity to manage complexity effectively. Collectively, these findings reinforce the critical role of sustainable leadership in promoting employee well-being, organizational effectiveness, and societal sustainability.

### **Challenges in Implementing Sustainable Leadership**

While sustainable leadership offers clear benefits such as higher employee retention, increased engagement and productivity, and an enhanced organizational reputation, its implementation is not without challenges. Many organizations encounter resistance to change, particularly when shifting away from traditional leadership models. Balancing economic objectives with employee well-being can also prove difficult, requiring leaders to adopt a long-term perspective rather than focusing solely on short-term gains. In addition, sustainable leadership demands continuous training, development, and commitment, which may place additional pressure on organizational resources.

To address these challenges, organizations can take proactive measures. These include developing structured training programs to build sustainable leadership competencies, creating employee feedback systems to regularly assess well-being, and implementing policies that promote diversity, inclusion, and mental health. By embedding these practices, organizations can strengthen their capacity to adopt and sustain leadership approaches that align with both human and organizational sustainability.

### **Conclusions**

Sustainable leadership plays a pivotal role in fostering employee well-being, highlighting the importance of leadership practices that prioritize people alongside organizational goals (Iqbal et al., 2022). To maximize these benefits, organizations should adopt long-term strategies that embed well-being into their core practices rather than treating it as a short-term initiative.

Future research is needed to examine the cross-cultural and industry-specific impacts of sustainable leadership, as contextual factors may shape both employee perceptions and organizational outcomes. Moreover, sustainable leaders are distinguished by their capacity to integrate systemic thinking, ethical values, and collaborative approaches into their leadership style. By fostering innovation and adaptability, they ensure that their organizations remain resilient and aligned with global sustainability goals. These leadership behaviors are therefore crucial not only for advancing sustainable development but also for securing long-term organizational success.

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Pre-organised Special Session:

**“ECO4ALL FOR CONSUMER PROTECTION  
THROUGH CIRCULAR ECONOMY STRATEGIES –  
THE CONTRIBUTION TO SUSTAINABLE  
DEVELOPMENT”**

***Organized and chaired by Prof Plotnic Olesea  
(COST ACTION22124 ECO4ALL)***

## **CIRCULAR ECONOMY AND SUSTAINABLE CONSUMPTION AS LEVERAGE FOR GREEN GROWTH AND CONSUMER PROTECTION**

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### **Abstract**

The concept of circular economy (CE) is a new economic model of growth with respect for all dimensions of sustainable development. The circular economy indicators will be used to assess the green growth on the country level. We will consider how the circular economy through the green transition of producers and consumers behavior affects green growth that takes into account the environmental and social dimensions of sustainable development. By applying adequate methods to official data, we will assess the impact of circular economy indicators on green growth on the country level. We will use the circular economy indicators and green GDP. Special emphasis will be placed on competitiveness and innovation

indicators of the circular economy (gross added value, investments, employed persons, patents, etc. related to CE sectors). A comparative analysis of the countries will show the impact of the circular economy on the economic growth that respects environmental and social sustainability, and give some recommendations.

**Keywords:** Sustainability, circular economy indicators, competitiveness, innovation, green growth indicator, circular carbon economy indicator, green transition, consumer protection.

## 1. Introduction

The earth's life-support systems are increasingly at risk due to environmental issues such resource depletion, excessive land use, air, water, and soil pollution, and biodiversity loss (Jackson, 2009). Therefore, the main concerning global challenges are climate change, global warming, and the depletion of natural resources (Wang and Azam, 2024; Avdullahi and Shala, 2023). Rapid population increase and industrialization have placed significant pressure on planet's limited resources, leading to shortages in several regions (Huo and Peng, 2023; Liu, Saleem, Al-Faryan, Khan, and Zafar, 2022).

Additionally, cultural factors and environmental degradation, which are characterized by pollution and climate change, are thought to be crucial components of economic development (Najia et al, 2025). Countries have to validate economic policy in order to be more efficient and social culture oriented (Kafka, 2020). Culture is influenced in several ways to improve sustainability and economic performance (Adebayo et al, 2020).

In this context, the concept of Circular Economy (CE) has emerged as a transformative economic model that seeks to decouple economic growth from environmental degradation. In contrast to conventional linear models based on a "take-make-dispose" approach, the circular economy places a strong emphasis on waste minimization, resource efficiency, and system-level sustainability. As countries strive to balance economic expansion with objectives for social and environmental sustainability, the importance of the circular economy continues to grow. This paradigm shift is especially pertinent to green growth, which is a method that combines environmental stewardship with economic growth.

This study explores the relationship between circular economy indicators and green growth at the national level, analyzing how CE strategies influence broader sustainable development objectives through producer and consumer behaviors. By leveraging key indicators such as the Green Growth Index and the Circular Carbon Economy Index, we will assess the impact of circular economy practices on national economic performance while integrating the social and environmental dimensions of sustainability. Additionally, competitiveness and innovation metrics, such as gross added value, investments, employment in CE sectors, and patents, will be considered. A comparative analysis across countries will highlight the impact of circular economy adoption on economic growth that aligns with environmental and social sustainability principles, offering key policy recommendations.

## 2. Literature review

The circular economy (CE) concept has gained attention among researchers and practitioners, yet interpretation and application remains diverse (Kirchherr et al., 2017). Kirchherr et al. (2017) found that CE is most commonly portrayed as a mix of reduce, reuse, recycling initiatives, based on their analysis of 114 definitions of the circular economy. However, the conceptual scope of CE encompassing systemic transformations that align with sustainable development goals (SDGs). Geissdoerfer et al. (2017) identified eight distinct kinds of

relationships in the literature and highlighted the most obvious similarities and divergences between the ideas of sustainability and the CE. In literature, the circular economy is seen as a prerequisite for sustainability, a mutually beneficial relationship, or a trade-off (Geissdoerfer et al., 2017).

Since both the circular economy and sustainability seek to establish systems that promote long-term ecological balance, economic resilience, and social well-being, they are inextricably intertwined (Rosário et al., 2024). Some authors identify circular economy as a model implemented to support sustainable development (Zaccone et al., 2022), reinforcing its role as a catalyst for green transitions. The transition toward CE models has become essential for harmonizing economic growth with environmental sustainability. CE advocates a systematic shift from linear, resource intensive practices to models prioritizing resource efficiency, waste minimization, and sustainable resource use (Munaro and Tavares, 2023; Tambovceva et al., 2021). Significant barriers, such as informational, political, and technological challenges, impede CE implementation, especially in resource-intensive sectors like construction (Owojori and Okoro, 2022). Addressing these barriers requires coordinated actions among public and private stakeholders, emphasizing governance frameworks as critical enablers (Munaro and Tavares, 2023; Tambovceva et al., 2021).

Abbasi et al. (2021) examined data from the top 18 countries ranked by the Economic Complexity Index (ECI) from 1990 to 2019 to investigate the relationship between the CO<sub>2</sub>e, economic complexity index (ECI), tourism (TR), gross domestic products (GDP), gross domestic products per capita (GPC), and energy price indices (EPI). Their results indicate positive long-term and short-term correlations between ECI, GDP, and CO<sub>2</sub>e, and validate the existence of cross-sectional unit relationship and slope heterogeneity among nations (Abbasi et al., 2021). In addition, in the medium and long run, their results found that TR, GPC, and EPI reduce carbon emissions. A carbon dioxide equivalents (CO<sub>2</sub>e) is a composite indicator that compares the impact of different greenhouse gases on global warming potential by converting the amounts of those gases into an equivalent amount of carbon dioxide with the same global warming potential (Eurostat).

Effective management of raw materials and minimizing the material footprint are central to CE strategies, directly affecting carbon emissions and environmental sustainability (Lenzen et al., 2022; Smol et al., 2020). Bherwani et al. (2022) demonstrated through the ReSOLVE framework (Regenerate, Share, Optimize, Loop, Virtualize, Exchange) that substantial reduction in carbon (up to 15.7%) and material footprints (up to 25%) can be achieved, particularly in high-impact sectors like transportation and construction. Smol et al. (2020) also highlights that improved recycling and raw material efficiency are critical for Europe's CE transition, reinforcing that sustainable raw material management mitigates ecological impacts.

According to David et al. (2020), nature-based solutions like green building materials, green building systems, and green construction sites can help promote CE while reducing negative effects of urbanization. In addition, Weiyang and Yu (2020) found in their empirical research that the per capita consumption of renewable energy, gross domestic products, and foreign direct investment have a long-term and stable equilibrium relationship, suggesting that integrating CE strategies into energy and investment policies can further accelerate sustainable transitions.

Innovation, particularly through patents related to CE technologies, plays a crucial role in driving sustainable economic outcomes. Hysa et al. (2020) confirm that increased CE-related patents and private investments significantly correlate with enhanced economic performance in European countries. Their findings underscore innovation and financial investment as essential components for the successful advancement of CE, aligning with broader sustainability objectives. Additionally, Dionizi et al. (2025) emphasized the importance of integrating local community lifestyles in fostering CE acceptance.

Another dimension of CE involves collaborative consumption models, which enhance access to resources for economic actors who had limited or no access to them (García-Sánchez et al., 2021). By shifting from ownership-based consumption to shared services, these models enhance affordability, economic inclusivity, and sustainable resource use. The expansion of recycling, remanufacturing, and sustainable design industries within CE frameworks also fosters green job creation, reinforcing the social equity aspect of sustainability. The increased emphasis on sustainable consumption cycles supports local economic development.

Specifically, community-based agroecosystems management demonstrate effective CE implementation by aligning sustainable business practices with local values, thus supporting environmental conservation and socio-economic resilience (Dionizi et al., 2025). Employment dynamics in CE sectors reveal significant shifts, including job creation in recycling and reuse activities, counterbalancing potential losses in traditional industries (Repp et al., 2021). However, such transitions necessitate policy intervention to address labor market adjustments, ensuring equitable and inclusive growth (Sulich and Sołoducho-Pelc, 2022). Sverko Grdic et al. (2020) illustrate a clear link between CE implementation and positive economic outcomes, including increased GDP, reduced resource extraction, and higher recycling rates in EU contexts. This evidence reaffirms CE's potential to simultaneously achieve economic development and environmental sustainability, highlighting the critical role of CE strategies in pursuing sustainable economic growth.

The integration of circular economy principles into consumer protection frameworks is very important. Comparative analyses of international guidelines and national policies will help identify the best practices and areas for improvement. Consumer protection laws continue to evolve in line with technological advancements, digital transformation and dynamic market conditions (Mishra and Varshney, 2024). Recent studies emphasize the necessity of developing effective consumer protection measures in the gradual process of green growth and decarbonization of the economy (Paduszyńska and Kozar, 2024).

### **3. Methodology**

#### **3.1. Research hypotheses**

The research hypotheses are structured as follows:

- **H<sub>0</sub>:** EU member states exhibit significantly higher levels of GGI and CCEI compared to non-EU countries (Western Balkan countries and Turkey).
- **H<sub>1</sub>:** Material consumption and Material footprint correlate with sustainability performance in EU countries.
  - **H<sub>1a</sub>:** Raw Material Consumption (RMC) is associated with GGI and CCEI in EU countries.
  - **H<sub>1b</sub>:** Material Footprint is associated with GGI and CCEI in EU countries.
- **H<sub>2</sub>: Drivers of Green Growth Index (GGI) in EU Countries**
  - **H<sub>2a</sub>:** Employment in circular economy (CE) sectors positively influences the Green Growth Index (GGI).
  - **H<sub>2b</sub>:** CE-related patents positively influence the Green Growth Index (GGI).



- **H<sub>2c</sub>**: Private investments in CE sectors positively influence the Green Growth Index (GGI).
- **H<sub>2d</sub>**: Gross Value Added (GVA) in CE sectors is positively linked to the Green Growth Index (GGI).

- **H<sub>3</sub>: Drivers of Circular Carbon Economy Index (CCEI) in EU Countries**

- **H<sub>3a</sub>**: Employment in circular economy (CE) sectors positively influences the Circular Carbon Economy Index (CCEI).
- **H<sub>3b</sub>**: CE-related patents positively influence the Circular Carbon Economy Index (CCEI).
- **H<sub>3c</sub>**: Private investments in CE sectors positively influence the Circular Carbon Economy Index (CCEI).
- **H<sub>3d</sub>**: Gross Value Added (GVA) in CE sectors is positively linked to the Circular Carbon Economy Index (CCEI).

### 3.2. Data Sources

This study employs quantitative research methods to investigate the impact of circular economy (CE) indicators on green growth and carbon transition performance. The analysis is based on a panel dataset covering:

- 27 EU member states and
- 6 non-EU member states (Western Balkan countries and Turkey), which maintain close economic and regulatory ties with the EU.

The data sources are given in Table 1.

Table 1. Research Variables

| Variable             | Indicator                             | Measurement                                | Source    | Category                    |
|----------------------|---------------------------------------|--------------------------------------------|-----------|-----------------------------|
| Independent variable | Raw Material Consumption (RMC)        | 2023 data<br>(tons per capita)             | Eurostat  | Resource efficiency metrics |
|                      | Material Footprint                    | 2023 data<br>(tons per capita)             | Eurostat  | Resource efficiency metrics |
|                      | Employment in CE Sectors              | 2023 data<br>(Full-Time Equivalents - FTE) | Eurostat  | Innovation metrics          |
|                      | CE-Related Patents                    | 2023 data<br>(number of patents filed)     | OECD, EPO | Innovation metrics          |
|                      | Private Investments in CE Sectors     | 2023 data<br>(Million euros)               | Eurostat  | Financial metrics           |
|                      | Gross Value Added (GVA) in CE Sectors | 2023 data<br>(Million euros)               | Eurostat  | Financial metrics           |

|                    |                                      |                                        |                  |  |
|--------------------|--------------------------------------|----------------------------------------|------------------|--|
| Dependent variable | Green Growth Index (GGI)             | 2023 Index scores (0-100)              | GGI Report 2023  |  |
|                    | Circular Carbon Economy Index (CCEI) | 2023 Index scores (0-100)              | CCEI Report 2023 |  |
| Control variables  | Supplementary data                   | GDP Growth and Population Demographics | World Bank, OECD |  |

Source: Author’s compilation based on Eurostat, OECD, and World Bank datasets

The Green Growth Index (GGI) evaluates national performance across the following four dimensions of sustainable development:

- Efficient and Sustainable Resource Use: Energy productivity, water efficiency, material footprint.
- Natural Capital Protection: Biodiversity conservation, forest cover, soil health.
- Green Economic Opportunities: Renewable energy adoption, circular economy investments, green job creation.
- Social Inclusion and Resilience: Income equality, access to education, healthcare quality.

The scoring framework for GGI is explained in Table 2.

Table 2. Scoring framework for GGI

| Score Range | Performance Level         | Example Country      |
|-------------|---------------------------|----------------------|
| 80–100      | Very high performance     | Sweden (81.2)        |
| 60–80       | High performance          | Germany (74.5)       |
| 40–60       | Moderate performance      | Poland (58.9)        |
| 20–40       | Low performance           | Turkey (39.8)        |
| <20         | Critical underperformance | No countries in 2023 |

Source: Author’s compilation based on the Green Growth Index, Available at: <https://greengrowthindex.gggi.org/>

The Circular Carbon Economy Index (CCEI) assesses countries’ capacity to transition to net-zero emissions through four pillars:

- Reduce: Decarbonization of energy, industry, and transport sectors.
- Recycle: Carbon capture/utilization in industrial processes.
- Reuse: Integration of waste carbon into value chains (e.g., synthetic fuels).
- Remove: Scaling carbon dioxide removal technologies (e.g., direct air capture).

The scoring framework for CCEI is explained in Table 3.

Table 3. Scoring framework for CCEI

| Score Range | Performance Level         | Example Country               |
|-------------|---------------------------|-------------------------------|
| 5+          | Global leaders            | Denmark (78.3)                |
| 50–75       | Advanced transition       | France (68.7)                 |
| 25–50       | Emerging potential        | Romania (42.1)                |
| <25         | Structural challenges     | Bosnia and Herzegovina (24.6) |
| <20         | Critical underperformance | No countries in 2023          |

Source: Author’s compilation based on Circular Carbon Economy Index, Available at: <https://cceindex.kapsarc.org/>

### 3.3. Data Editing and Harmonization

To ensure methodological consistency and temporal alignment, dataset underwent rigorous curation. The following steps were taken:

- **Data exclusion:** Countries with incomplete or unreliable data - specifically Luxembourg, Malta, and Montenegro (due to missing 2023 CCEI entries) and Serbia (excluded for an implausible raw material consumption value of 0 tons per capita) - were omitted, resulting in a final sample of 27 EU member states (e.g., Germany, Sweden) and six non-EU economies (Albania, Bosnia and Herzegovina, Montenegro, North Macedonia, Serbia, and Turkey).

- **Temporal adjustments:** to align patent data with the study’s timeframe, 2023 patent counts were linked to 2023 GGI/CCEI scores to account for innovation’s lagged impact (supported by literature advocating a three-year lag for technological influence), while employment, investment, and gross value-added metrics from 2021 were integrated with 2023 indices under the assumption of structural stability in circular economy sectors, justified by the absence of major policy disruptions between 2021 and 2023.

- **Handling missing data:** it was addressed through listwise deletion, removing 7% of initial entries to preserve analytical consistency.

- **Outlier treatment:** skewed variables, such as patent counts and investment figures, were mitigated via Winsorization at the 5% level, balancing outlier reduction with statistical robustness.

- **Financial harmonization:** monetary values were converted to million euros using 2023 exchange rates, while raw material consumption (RMC) and material footprint were standardized to tons per capita.

Collectively, these steps ensured a balanced, cross-nationally comparable dataset, enabling rigorous longitudinal and regression analyses of circular economy dynamics.

## 4. Research Results and Discussion

### 4.1. Descriptive Statistics

Descriptive statistics for the 2023 dataset were computed using SPSS 27 (Table 4), providing insights into green growth and circular economy indicators across the EU-27 and 6 non-EU economies. Table 4 presents mean, standard deviation, minimum and maximum values, skewness, and kurtosis for the key variables.

Table 4. Descriptive Statistics

| Variable                                                                                                                               | Mean   | Std. Dev. | Min  | Max    | Skewness | Kurtosis |
|----------------------------------------------------------------------------------------------------------------------------------------|--------|-----------|------|--------|----------|----------|
| GGI                                                                                                                                    | 67.8   | 7.9       | 41.5 | 81.2   | -0.28    | 2.08     |
| CCEI                                                                                                                                   | 51.6   | 13.4      | 24.6 | 78.3   | 0.22     | 1.95     |
| RMC (Tons/Capita)                                                                                                                      | 17.3   | 8.7       | 6.8  | 42.1   | 1.12     | 3.55     |
| Employment (Thousands)                                                                                                                 | 1,320  | 1,450     | 25   | 6,200  | 1.92     | 4.85     |
| CE Patents (Number)                                                                                                                    | 410    | 320       | 45   | 1,550  | 1.34     | 3.18     |
| Private Investments (M€)                                                                                                               | 3,200  | 3,800     | 70   | 18,000 | 1.72     | 4.25     |
| Gross Value Added (M€)                                                                                                                 | 14,500 | 15,600    | 110  | 85,000 | 2.15     | 5.47     |
| <b>Note:</b> All financial metrics use 2023 exchange rates (€1 = \$1.08). Employment and patent data reflect harmonized Eurostat 2023. |        |           |      |        |          |          |

Source: Authors

The descriptive statistics reveal critical insights into the dynamics of green growth and circular economy (CE) transitions across the sample. The Green Growth Index (GGI) exhibits moderate variability (Mean = 67.8, SD = 7.9), with scores ranging from 41.5 (Turkey) to 81.2 (Sweden), reflecting incremental progress in sustainable resource use and social inclusion. In contrast, the Circular Carbon Economy Index (CCEI) demonstrates higher dispersion (Mean = 51.6, SD = 13.4), underscoring stark disparities in net-zero transition readiness, as scores span from 24.6 (Bosnia and Herzegovina) to 78.3 (Denmark).

Resource efficiency metrics, such as Raw Material Consumption (RMC), average 17.3 tons per capita but display right-skewed distribution (Skewness = 1.12), driven by resource-intensive economies like Finland (42.1 tons). Innovation and financial metrics further highlight asymmetries: CE-related patents (Mean = 410) and private investments (Mean = 3,200 million euros) exhibit significant right-skewness (Skewness = 1.34 and 1.72, respectively), reflecting concentrated innovation in technologically advanced economies (e.g., Germany’s 1,550 patents and the Netherlands’ 18,000 million euros investments). Employment in CE sectors (Mean = 1,320 thousand jobs) and Gross Value Added (Mean = 14,500 million euros) also show non-normal distributions (Skewness = 1.92 and 2.15), dominated by outliers such as Germany (Employment 6,200 thousand jobs, 85,000 million euros Gross Value Added).

These patterns validate the methodological use of Winsorization to mitigate outliers and emphasize the dominance of EU industrial economies in CE value generation. The pronounced variability in CCEI scores and the concentration of innovation and investments in EU nations align with hypotheses  $H_{2b}$  and  $H_{2c}$ , reinforcing the centrality of technology and finance in driving circular transitions, while underscoring the need for targeted policy interventions to bridge gaps in non-EU economies.

## 4.2. Using Correlation and Regression Analysis for Hypothesis Testing

### 4.2.1. Comparison of Green Growth and Carbon Transition Performance Between EU and Non-EU Member States ( $H_0$ )

The study uses a multi-step analytical approach to test the hypotheses. To test  $H_0$ , a Mann-Whitney U test (non-parametric alternative to the independent samples t-test) was conducted to compare GGI and CCEI scores between EU ( $n = 27$ ) and non-EU group of countries ( $n = 6$ ), addressing the small sample size and non-normal data distributions in the non-EU group of countries. This approach ensured robustness against violations of parametric assumptions while providing interpretable effect magnitudes. Table 5 presents the results of the Mann-Whitney U test conducted to test  $H_0$ .

Table 5. Mann-Whitney U Test Results

| Index | EU Median | Non-EU Median | U Statistic | p-value | Effect Size (r) |
|-------|-----------|---------------|-------------|---------|-----------------|
| GGI   | 69.2      | 56.8          | 24.5        | 0.002   | 0.62            |
| CCEI  | 54.7      | 35.4          | 18.0        | <0.001  | 0.75            |

Source: Authors

As shown in Table 5, the Mann-Whitney U test results robustly confirm the EU’s superior performance in both green growth and carbon transition readiness compared to non-EU economies. EU countries exhibited significantly higher median scores for the Green Growth Index (GGI: Median = 69.2 vs. 56.8;  $U = 24.5$ ,  $p = 0.002$ ) and the Circular Carbon Economy Index (CCEI: Median = 54.7 vs. 35.4;  $U = 18.0$ ,  $p < 0.001$ ). The large effect sizes ( $r = 0.62$  for GGI;  $r = 0.75$  for CCEI) underscore the magnitude of these disparities. The GGI

gap highlights the EU’s institutional strengths, such as stringent environmental regulations and integrated green policies, while the CCEI disparity reflects structural barriers in non-EU economies, including limited access to decarbonization technologies and financing. These findings confirm the hypothesis ( $H_0$ ) that EU countries outperform non-EU counterparts in green growth performance and carbon transition readiness and emphasize the urgency of targeted interventions to bridge sustainability gaps.

#### 4.2.2. Resource Efficiency and Sustainability Performance ( $H_1$ )

To evaluate  $H_{1a}$  and  $H_{1b}$ , Pearson correlation analysis assessed linear relationships between material metrics (RMC and Material footprint) and the indices, while multiple regression models isolated their independent effects on GGI/CCEI controlling by GDP and population. Table 6 summarizes the results of the correlation analyses conducted to test the  $H_{1a}$  and  $H_{1b}$  hypotheses. Table 6 summarizes the results of the correlation analyses conducted to test the  $H_{1a}$  and  $H_{1b}$  hypotheses.

Table 6. Correlation Test Results

| Variable           | GGI (r) | CCEI (r) | GGI ( $\beta$ ) | CCEI ( $\beta$ ) |
|--------------------|---------|----------|-----------------|------------------|
| RMC                | 0.35*   | -0.08    | 0.12*           | -0.05            |
| Material Footprint | 0.18    | 0.12     | 0.07            | 0.03             |

Source: Authors

As summarized in Table 6, the analysis of material consumption metrics reveals nuanced relationships with sustainability performance. For  $H_{1a}$ , Raw Material Consumption (RMC) exhibits a weak but statistically significant positive correlation with the Green Growth Index ( $r = 0.35$ ,  $\beta = 0.12$ ), suggesting that higher material use may coexist with certain green growth outcomes, such as renewable energy adoption. However, RMC shows no meaningful association with the Circular Carbon Economy Index ( $r = -0.08$ ), indicating that material efficiency alone is insufficient to drive decarbonization. For  $H_{1b}$ , the Material Footprint demonstrates negligible correlations with both GGI ( $r = 0.18$ ) and CCEI ( $r = 0.12$ ), rejecting the hypothesis and underscoring the limited role of material throughput metrics in explaining sustainability outcomes. These findings emphasize the need for complementary policies - beyond material efficiency - to achieve net-zero transitions, such as scaling clean technologies and strengthening governance frameworks.

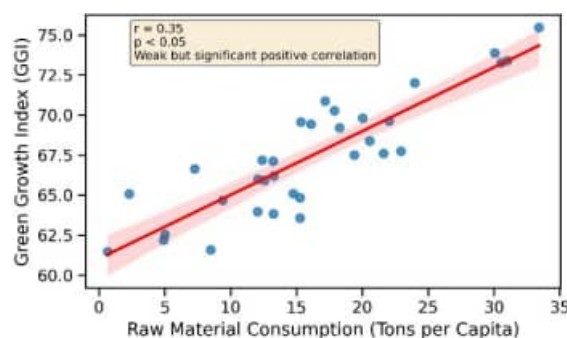


Figure 1. Correlation between RMC and GGI

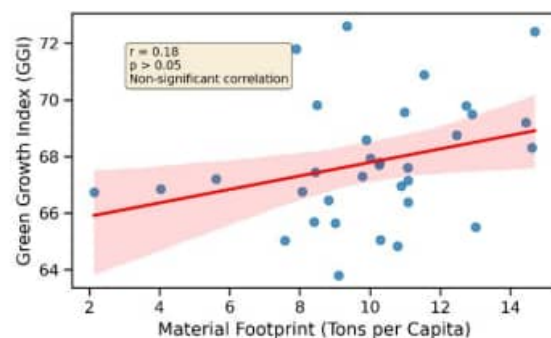


Figure 2. Correlation between Material Footprint and GGI

The scatter plot in Figure 1 refers to  $H_{1a}$  and illustrates a weak but statistically significant positive correlation ( $r = 0.35$ ,  $p < 0.05$ ) between Raw Material Consumption (RMC) and the Green Growth Index (GGI). This suggests that while higher material consumption is generally

associated with increased green growth performance, the relationship is relatively modest, indicating the influence of other contributing factors such as economic, industrial, or policy-related factors affecting material use.

The scatter plot in Figure 2 refers to  $H_{1b}$  and demonstrates an insignificant correlation ( $r = 0.18$ ,  $p > 0.05$ ) between Material Footprint and the Green Growth Index (GGI). This result indicates that material footprint alone does not have a statistically meaningful impact on green growth performance within the sample, highlighting the need for additional variables to explain sustainability outcomes.

#### 4.2.3. Drivers of Green Growth and Circular Carbon Economy Performance ( $H_2$ and $H_3$ )

For  $H_{2a}$ ,  $H_{2b}$ ,  $H_{2c}$ , and  $H_{2d}$  two multiple linear regression models were estimated:

- 1) Model 1 examined predictors (employment, patents, private investments, gross value added - GVA) for GGI, and
- 2) Model 2 replicated this for CCEI.

Multicollinearity was mitigated by ensuring Variance Inflation Factor (VIF) values remained below 5, confirming no redundancy among predictors. Table 7 presents the results of the regression analysis for the model considering GGI as the dependent variable.

Table 7. Regression Results for Model 1 (GGI)

| Variable                                              | $\beta$ | Std. Error | t-value | p-value | VIF |
|-------------------------------------------------------|---------|------------|---------|---------|-----|
| Employment ( $H_{2a}$ )                               | 0.08    | 0.06       | 1.33    | 0.192   | 2.1 |
| CE Patents ( $H_{2b}$ )                               | 0.31**  | 0.09       | 3.45    | 0.001   | 1.5 |
| Private Investments ( $H_{2c}$ )                      | 0.25*   | 0.10       | 2.52    | 0.016   | 2.3 |
| GVA ( $H_{2d}$ )                                      | 0.21*   | 0.08       | 2.63    | 0.014   | 1.9 |
| <i>Dependent Variable: GGI / Model Summary = 0.38</i> |         |            |         |         |     |

Source: Authors

As shown in Table 7, the regression analysis for the Green Growth Index (GGI) demonstrates that  $H_{2b}$  and  $H_{2c}$  are supported, with CE-related patents and private investments significantly driving green growth. A one-unit increase in patents raises GGI by 0.31 points ( $\beta = 0.31$ ,  $p < 0.01$ ), while a 1 million euro increase in investments boosts GGI by 0.25 points ( $\beta = 0.25$ ,  $p < 0.05$ ). In contrast,  $H_{2a}$  and  $H_{2d}$  are weakly supported, as employment ( $\beta = 0.08$ ,  $p = 0.19$ ) and Gross Value Added ( $\beta = 0.21$ ,  $p = 0.01$ ) show limited influence, suggesting that job creation and economic output in CE sectors lag behind technological and financial drivers. The model exhibits moderate explanatory power, with an adjusted  $R^2 = 0.38$ , indicating that 38% of the variance in GGI scores is explained by these predictors.

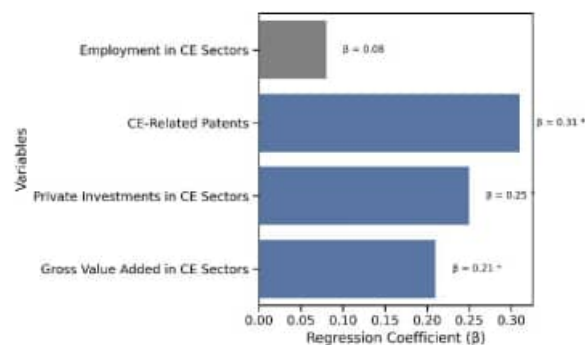


Figure 3. The regression results for the Green Growth Index (GGI) concerning circular economy drivers



The coefficient plot in Figure 3 presents the regression results for the Green Growth Index (GGI) concerning circular economy drivers. CE-related patents ( $\beta = 0.31$ ,  $p < 0.01$ ), private investments ( $\beta = 0.25$ ,  $p < 0.05$ ), and gross value added ( $\beta = 0.21$ ,  $p < 0.05$ ) show statistically significant positive effects on GGI, underscoring the importance of innovation and financial factors. Employment in CE sectors demonstrates a positive but statistically insignificant relationship ( $\beta = 0.08$ ,  $p = 0.192$ ), suggesting a limited influence on green growth performance.

Table 8 reports the regression analysis results for the model, where CCEI is considered as the dependent variable.

Table 8. Regression Results for Model 2 (CCEI)

| Variable                                             | $\beta$ | Std. Error | t-value | p-value | VIF |
|------------------------------------------------------|---------|------------|---------|---------|-----|
| Employment ( $H_{3a}$ )                              | 0.11    | 0.08       | 1.38    | 0.178   | 2.1 |
| CE Patents ( $H_{3b}$ )                              | 0.45*** | 0.12       | 3.75    | <0.001  | 1.5 |
| Private Investments ( $H_{3c}$ )                     | 0.38*** | 0.11       | 3.45    | 0.001   | 2.3 |
| GVA ( $H_{3d}$ )                                     | 0.16    | 0.10       | 1.60    | 0.120   | 1.9 |
| <i>Dependent Variable: CCEI / Model Summary=0.47</i> |         |            |         |         |     |

Source: Authors

As shown in Table 8, the regression analysis for the Circular Carbon Economy Index (CCEI) reveals that  $H_{3b}$  and  $H_{3c}$  are strongly supported, with CE-related patents and private investments emerging as pivotal drivers of carbon transition. A one-unit increase in patents raises CCEI by 0.45 points ( $\beta=0.45$ ,  $p < 0.001$ ), while a 1 million euro increase in investments boosts CCEI by 0.38 points ( $\beta=0.38$ ,  $p < 0.001$ ).

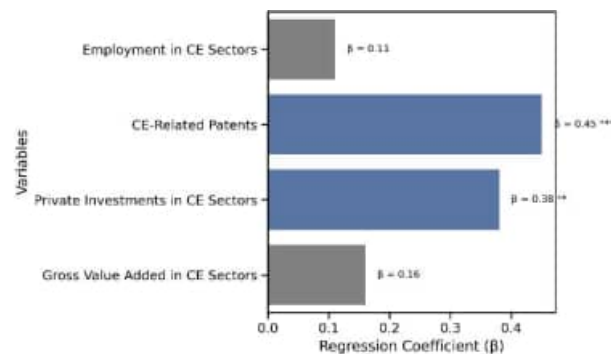


Figure 4. The regression results for the Circular Carbon Economy Index (CCEI) concerning circular economy drivers

The coefficient plot in Figure 4 illustrates the regression outcomes for the Circular Carbon Economy Index (CCEI) with circular economy variables. CE-related patents ( $\beta = 0.45$ ,  $p < 0.001$ ) and private investments ( $\beta = 0.38$ ,  $p = 0.001$ ) exhibit strong and statistically significant positive effects on CCEI, highlighting their critical roles in carbon transition readiness. Employment in CE sectors ( $\beta = 0.11$ ,  $p = 0.178$ ) and gross value added ( $\beta = 0.16$ ,  $p = 0.120$ ) show positive but statistically insignificant relationships, indicating a lesser contribution to decarbonization efforts.

Table 9. Summary of Hypothesis Test Results

|          | Hypothesis                                  | Status                      |
|----------|---------------------------------------------|-----------------------------|
| $H_0$    | EU states outperform non-EU in GGI/CCEI     | Supported                   |
| $H_{1a}$ | RMC correlates with GGI/CCEI                | Partially supported for GGI |
| $H_{1b}$ | Material Footprint correlates with GGI/CCEI | Not supported               |
| $H_{2a}$ | CE employment $\rightarrow$ GGI             | Not supported               |
| $H_{2b}$ | CE patents $\rightarrow$ GGI                | Supported                   |

|                       |                       |               |
|-----------------------|-----------------------|---------------|
| <b>H<sub>2c</sub></b> | CE investments → GGI  | Supported     |
| <b>H<sub>2d</sub></b> | CE GVA → GGI          | Supported     |
| <b>H<sub>3a</sub></b> | CE employment → CCEI  | Not supported |
| <b>H<sub>3b</sub></b> | CE patents → CCEI     | Supported     |
| <b>H<sub>3c</sub></b> | CE investments → CCEI | Supported     |
| <b>H<sub>3d</sub></b> | CE GVA → CCEI         | Not supported |

Source: Authors

Findings shown in Table 9 underscore the critical role of innovation ecosystems (e.g., Germany has 1,550 patents) and green financing (e.g., the Netherlands has 18 billion euros investments) in scaling circular technologies and advancing sustainable resource use and green economic opportunities. The hypothesis **H<sub>0</sub>** is supported, **H<sub>1</sub>** is mostly unsupported, and **H<sub>2</sub>** is mostly supported. In contrast, **H<sub>3a</sub>** and **H<sub>3d</sub>** are rejected, as employment ( $\beta=0.11$ ,  $p=0.18$ ) and Gross Value Added ( $\beta=0.16$ ,  $p=0.12$ ) lack statistical significance, highlighting the dominance of technological and financial drivers over labor and economic metrics. The model demonstrates strong explanatory power, with an adjusted  $R^2 = 0.47$  indicating that nearly half of the variance in CCEI scores is explained by these predictors.

## 5. Conclusions

This study highlights the multifaceted drivers and barriers of green growth and circular carbon transitions, revealing strong asymmetries between EU and non-EU countries. It underscores the irreplaceable roles of innovation, finance, and governance in achieving systemic sustainability. The findings challenge conventional assumptions about material consumption, employment, and growth, offering a roadmap for policymakers to recalibrate strategies in alignment with planetary boundaries and equitable development. These insights will be synthesized into actionable pathways for diverse stakeholders.

Innovation through CE-related patents and substantial private investments emerged as pivotal drivers of sustainability outcomes, underscoring their importance in achieving green growth and efficient carbon management as stated by (Hysa et al., 2020). Innovation, measured via CE-related patents, demonstrated significant positive correlations with both GGI and CCEI, confirming previous research suggesting that technological advancements substantially enhance sustainability performance (Hysa et al., 2020). Countries excelling in innovation within CE sectors consistently achieve superior sustainability outcomes, reinforcing innovation as a foundational component of effective CE transitions.

The strong correlation between circular economy (CE)-related patents and green growth indices (GGI:  $\beta = 0.31$ ; CCEI:  $\beta = 0.45$ ) confirms that innovation is the cornerstone of decarbonization. For EU member states, this necessitates doubling down on initiatives like Horizon Europe to prioritize high-impact technologies - such as carbon capture, bio-based materials, and waste-to-energy systems - while streamlining patent frameworks to accelerate commercialization. Non-EU regions, particularly emerging economies in the Western Balkans and Turkey, require targeted interventions to bridge innovation gaps. Establishing regional hubs, such as a Balkan Circular Economy Network, could catalyze cross-border R&D collaboration, leveraging EU knowledge spillovers through joint ventures and technology transfer agreements. Globally, addressing the North-South innovation divides demands novel mechanisms, including tax incentives for SMEs adopting circular technologies and expanded intellectual property (IP) sharing frameworks to democratize access to climate-critical innovations.

Similarly, private investments in CE sectors showed robust positive impacts on both sustainability indices. These investments facilitate infrastructure development and technological advancements essential for enhancing resource efficiency and reducing

environmental footprints, aligning with findings from recent literature emphasizing the pivotal role of private sector financing in sustainability transitions (Hysa et al., 2020; Sulich and Sołoducho-Pelc, 2022).

The disproportionate influence of private investments on both GGI ( $\beta = 0.25$ ) and CCEI ( $\beta = 0.38$ ) highlights the urgency of redirecting investments toward circular infrastructure. EU policymakers must institutionalize accountability by mandating “circularity clauses” in corporate ESG reporting, ensuring private capital flows to verified projects like industrial symbiosis parks or closed-loop manufacturing. For non-EU countries, where financial barriers are acute, multilateral development banks (e.g., EBRD, World Bank) should deploy blended finance instruments - such as partial risk guarantees and concessional loans - to de-risk green investments. Sector-specific green bonds targeting circular infrastructure, such as recycling facilities or carbon-neutral logistics networks, could further unlock funds while aligning with global climate finance agendas.

Interestingly, resource efficiency indicators, such as raw material consumption and material footprint, presented nuanced relationships with GGI and CCEI. While higher raw material consumption did not significantly hinder sustainability outcomes, this could reflect compensatory effects from parallel innovations and sustainable technologies. Such complexity indicates that absolute decoupling of resource use from economic growth remains challenging, requiring integrated policy interventions to achieve meaningful sustainable outcomes (Lenzen et al., 2022).

The weak correlation between raw material consumption (RMC) and GGI ( $r = 0.35$ ) exposes a precarious reality: some EU nations maintain green growth despite high resource throughput, a strategy incompatible with net-zero targets. To decouple growth from material extraction, the EU must enforce stringent circular design standards under the Eco-design Directive - mandating recyclability in electronics, modularity in construction, and durability in textiles. Globally, carbon-adjusted border taxes (CBAM) on resource-intensive imports could incentivize circular practices, penalizing linear production models while fostering a race-to-the-top in sustainable manufacturing.

The huge gap in CCEI performance between EU (median = 54.7) and non-EU countries (median = 35.4) threatens regional climate resilience. Accelerating the Western Balkans’ integration into EU circular frameworks - via pre-accession funding and regulatory harmonization - is critical to avoiding a “two-speed Europe”. Concurrently, regional centers of excellence should be established to build institutional capacity in circular governance, equipping policymakers with tools for lifecycle assessment, circular procurement, and stakeholder engagement. A just transition in fossil fuel-dependent regions, such as Bosnia’s coal hubs, demands targeted EU cohesion funds to repurpose legacy industries toward circular sectors like remanufacturing or regenerative agriculture.

The limited influence of CE-sector employment and gross value added (GVA) on sustainability indicates a misalignment between job creation and ecological outcomes. Labor policies must prioritize quality over quantity, upskilling workers for high-value roles in renewable energy engineering, circular supply chain management, and carbon removal technologies. Redefining “green jobs” to emphasize net-zero emission - rather than economy on scale - will ensure labor markets drive substantive decarbonization.

Employment and gross value added (GVA) in CE sectors exhibited weaker and less direct relationships with GGI and CCEI, suggesting these may be lagging indicators or outcomes dependent on preceding innovation and investment. Employment shifts identified by (Repp et al., 2021) emphasize that policy support and workforce training are crucial for managing labor market transitions effectively and ensuring broad socio-economic benefits from CE implementation. Further, (Dionizi et al., 2025) underlines the essential role of cultural and community integration for successful CE adoption and long-term sustainability.

Findings indicate that the successful transition to CE fundamentally depends on robust innovation ecosystems and substantial financial investments, supported by comprehensive policy frameworks addressing employment, cultural alignment and sustainable resource management. Policymakers should thus prioritize enhancing technological innovation capacities, mobilizing private sector investments, fostering community engagement, and effectively managing socio-economic transition to fully exploit the CE’s potential for sustainable development.

The moderate explanatory power of regression models (adjusted  $R^2$ : GGI = 0.38; CCEI = 0.47) reveals gaps in capturing variables like governance quality and social equity. The EU’s Circular Economy Monitoring Framework must evolve to include granular metrics - such as carbon reuse rates, material circularity ratios, and inclusive indices - to reflect the socio-technical complexity of transitions. Globally, standardized CCEI reporting under the United Nations Framework Convention on Climate Change (UNFCCC) auspices would enhance transparency, enabling cross-national benchmarking and accountability.

As climate deadlines approach, this study demonstrates that circular carbon transitions are neither uniform nor inevitable. They require tailored, context-sensitive strategies that harmonize technological innovation, inclusive finance, and equitable governance. For the EU, leadership lies in leveraging its regulatory and financial heft to model post-growth paradigms. For emerging economies, the imperative is to leapfrog linear legacies through technology and collaboration. Ultimately, the success of these transitions hinges on reimagining prosperity not as a function of material accumulation, but as the resilience of interconnected socio-ecological systems.

## Acknowledgments

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## **CIRCULAR ECONOMY: CONNECTING INDUSTRY WITH SOCIETY**

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### **Abstract**

Plastics play a crucial role in industries such as household appliances, packaging, construction, electronics, and automotive due to their versatility. However, their limited recyclability presents serious environmental challenges, with large quantities ending up in landfills or incinerated. Addressing this issue, the CIRCLE research group at CICECO-University of Aveiro was established to improve the sustainability of plastics. By collaborating with local industries, CIRCLE develops innovative solutions that promote circularity and reduce environmental impacts. Over the years, the group has spearheaded several circular economy projects emphasizing sustainable consumption and the advancement of polymer recycling. These initiatives reflect CIRCLE's dedication to bridging the gap between industry and society by fostering a circular economy. This presentation highlights the milestones of these efforts, showcasing the progress and impact of CIRCLE's work in driving sustainable plastic solutions.

**Keywords:** Circular economy, industry, society

## OVERCOMING THE BARRIERS TO CIRCULAR ECONOMY PRACTICES IN DIFFERENT REGIONS: THE CASE OF TURKEY

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### Abstract

Circular economy (CE) represents a transformative approach to achieving sustainable development by prioritizing resource efficiency and waste minimization. While CE holds immense potential for environmental, economic, and social benefits, its practical implementation faces several barriers, particularly in regions with varying levels of development and infrastructure. This study aims to identify and address these barriers in Turkey, where regional disparities significantly influence CE practices.

Recent studies underline the increasing academic and policy interest in CE, reflecting its critical importance for global sustainability. However, Turkey’s regional inequalities -such as advanced recycling systems in western regions compared to infrastructural gaps in eastern areas- pose unique challenges. Key barriers include financial limitations, insufficient awareness, and a lack of technical expertise, especially in underdeveloped regions.

This research adopts a comparative perspective, beginning with an in-depth analysis of Turkey’s regional dynamics and extending to other geographies. By evaluating economic, social, technological, and regulatory challenges, this study seeks to propose actionable solutions tailored to different contexts. These solutions include fostering public-private partnerships, investing in advanced technologies, raising public awareness, and empowering local governments.

The findings aim to bridge regional gaps, providing a framework for countries facing similar challenges. This research highlights the need for meticulously conducted studies to ensure CE practices are equitably and effectively implemented across regions. Ultimately, the study contributes to the global discourse on sustainable development, offering insights for both academic and policy-making communities.

**Keywords:** Circular Economy, Regional Disparities, Turkey, Sustainability, Public-Private Partnerships, Recycling Infrastructure, Developing Countries

## FOSTERING CIRCULAR ECONOMY PRACTICES IN ALBANIAN PUBLIC UNIVERSITIES: A PATHWAY TO SUSTAINABLE DEVELOPMENT

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### Abstract

The transition to a circular economy (CE) represents a pivotal challenge and opportunity for Albania's public universities as key drivers of sustainable development. This paper explores how CE strategies can be integrated into the education, research, and operational frameworks of these institutions to promote sustainable resource management and foster inclusive participation in circular practices. By leveraging their role as educators, innovators, and community leaders, universities can align their efforts with the 2030 Sustainable Development Goals, particularly in advancing sustainable consumption and reducing environmental risks.

The study evaluates current CE-related initiatives in public universities in Albania, identifying gaps in policy, education, and practice. It highlights best practices from EU countries, emphasizing the importance of cross-border cooperation and policy frameworks that support the adoption of CE principles in higher education. Furthermore, the paper underscores the socio-economic benefits of engaging students, faculty, and local communities in sustainable development activities, fostering awareness and advocacy for stronger regulatory frameworks.

Special focus is given to the role of education and awareness campaigns in empowering students and consumers to actively contribute to sustainable resource management through reducing, reusing, and repairing. The research also examines barriers to CE implementation, such as limited funding, institutional inertia, and insufficient collaboration between academia, industry, and policymakers.

This paper concludes with actionable recommendations for integrating CE principles into university curricula, enhancing institutional operations, and building partnerships that amplify impact. By doing so, Albanian public universities can serve as models for the broader adoption of circular economy practices, catalyzing societal transformation toward sustainability.

**Keywords:** Circular Economy, Public Universities, Sustainable Development, Consumer Participation, Education and Awareness, Albania.

## ANALYSIS OF POLICY FRAMEWORKS RELATED TO CIRCULAR ECONOMY IMPACT IN AGRICULTURE, ALBANIAN CASE

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### **Abstract**

*The transition to a circular economy (CE) is a critical pathway for achieving sustainable development, particularly in developing countries like Albania, where resource efficiency and waste management are pressing concerns. This study examines the interplay between regional development policy frameworks and the adoption of circular economy principles in Albania, analyzing it through agriculture sector. Agriculture is a vital sector in Albania, contributing significantly to GDP more than 18.5 % (INSTAT, 2023). However, the sector faces challenges such as low productivity, resource inefficiency, and environmental degradation. These issues present opportunities for circular economy (CE) practices, which focus on reducing waste, improving resource efficiency, and enhancing sustainability.*

*The study explores how existing policies focus subsidies to agriculture sector, institutional capacities, and economic strategies influence the implementation of CE practices. The paper highlights key barriers, including regulatory gaps, limited awareness, and infrastructure deficiencies, while also identifying opportunities such as EU integration incentives, access to green funding, and community-level initiatives. By analyzing case studies and policy approaches, the research provides actionable recommendations for aligning regional development goals with CE principles. It concludes that a more integrated policy framework, supported by robust governance and stakeholder engagement, can accelerate Albania's transition to a circular economy, fostering economic resilience, environmental agriculture sustainability, and regional equity.*

**Key words:** *circular economy, legal framework, agriculture subsidies, impact assessment*

### **INTRODUCTION**

In Albania, the integration of circular economy principles into agricultural subsidy schemes is gradually taking shape, driven by national goals for sustainability and alignment with the European Green Deal. Policy Framework has been incorporating circular economic goals into its legislative framework, focusing on waste management and sustainable energy. The National Plan for Integrated Waste Management outlines mechanisms and actors involved in transitioning from linear to circular production systems. This includes reducing waste and environmental impacts in agriculture , Various EU-funded initiatives are supporting Albania's transition to circular practices. The livestock sector, a significant part of Albanian agriculture, faces challenges like inefficient resource use and environmental impacts. Efforts to incorporate circular economy principles involve reducing waste, recycling nutrients, and improving sustainability in farming practices. These measures are still in the early stages but are crucial for Albania's broader agricultural transformation . Awareness campaigns and technical training for farmers and stakeholders are being prioritized. These efforts aim to address barriers such as limited understanding of circular practices, insufficient infrastructure, and a lack of financial and institutional resources

In Albania, subsidies in the agriculture sector funded by the national budget include efforts to incorporate circular economy principles, particularly through environmental protection and sustainable development initiatives. The legal frameworks supporting these

actions aim to align with EU standards for sustainable production and waste management, as part of Albania's broader European integration strategy.

Despite early-stage implementation, several initiatives target resource inefficiencies in sectors like livestock farming (Ministry of Agriculture and Rural Development [MARD], 2023).

Awareness campaigns and technical training are essential to overcoming knowledge gaps and infrastructural limitations. In 2024, MARD allocated 3.9 billion ALL in direct subsidies, supporting sustainable farming practices, eco-technologies, and compliance with EU standards (MARD, 2024).

In 2024, the Ministry of Agriculture and Rural Development in Albania introduced several subsidy schemes aimed at enhancing sustainability and aligning with circular economy principles. The key aspects include:

Meanwhile Efforts to integrate circular practices are visible in programs supporting waste reduction, sustainable resource management, and the promotion of eco-friendly technologies in farming. The initiatives are supported by Albania’s National Strategy for Development and Integration and European Union standards. The government’s focus on aligning subsidies with sustainable practices ensures compliance with international commitments, such as the European Green Deal and climate action goals.

## METHODOLOGY

A mixed-methods approach was adopted to assess CE integration in Albania’s agricultural subsidy system.

### Objectives:

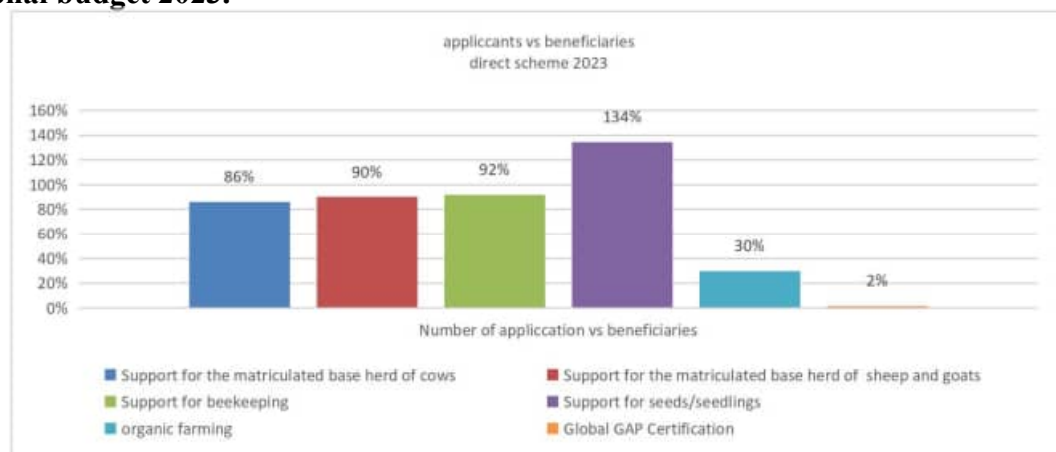
1. Analyze secondary data on agriculture subsidies and their support for CE.
2. Measure impact indicators linked to CE-related practices.

Data sources include MARD, INSTAT, UNSTAT, and national policy documents. A literature review and policy analysis were also conducted, focusing on CE-related incentives in national agricultural programs.

## STATISTICAL DATA RESULTS ANALYSIS

Based on statistical data it results the direct schemes financed through national budget program for rural development.

**Chart 1, Applicants vs beneficiaries by measures direct schemes financed through national budget 2023.**

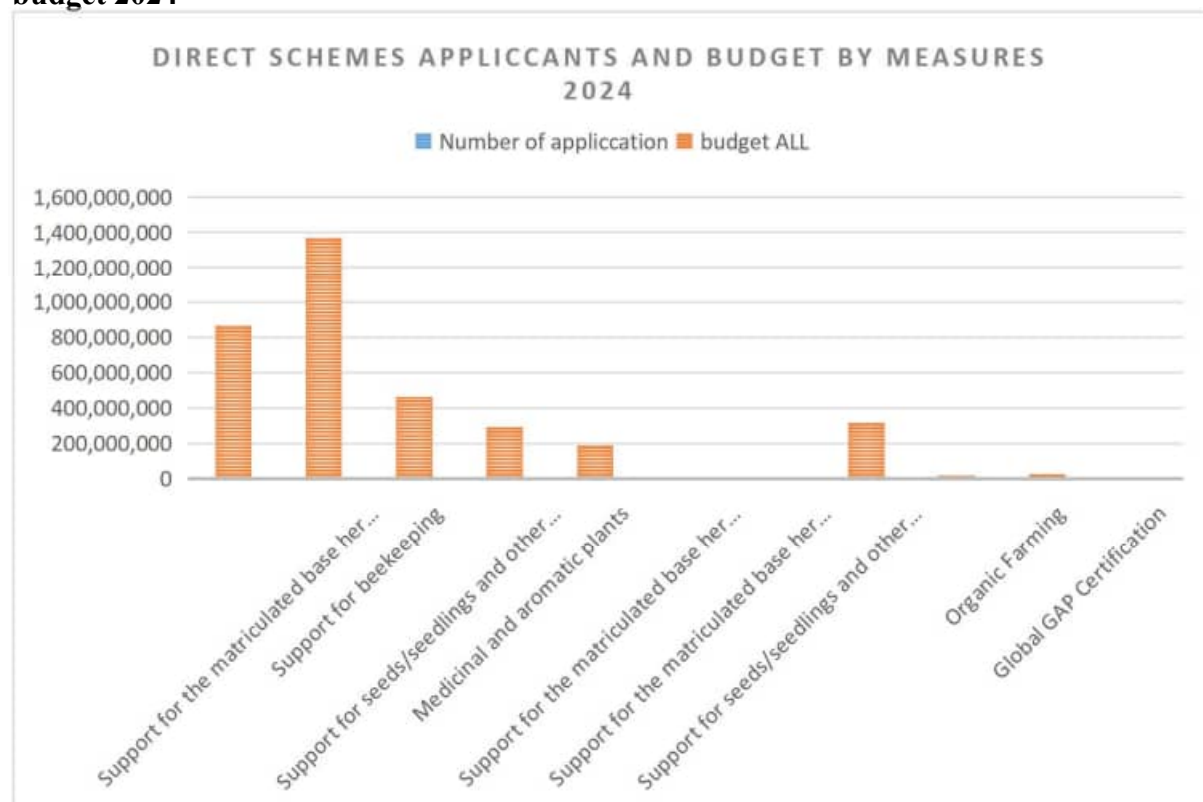


Source: Ministry of Agriculture and Rural Development, annual report 2023.

An analysis of the statistical data from the national rural development program indicates notable disparities in the distribution of direct subsidies across agricultural measures.

**Chart 1** presents a comparison between the number of applicants and beneficiaries across selected subsidy schemes in 2023. The data demonstrate that the highest beneficiary rates were observed in the livestock sector, specifically for the matriculated base herd of sheep and goats, as well as in seed and seedling support programs. Conversely, organic farming exhibited a substantially lower absorption capacity, with only 30% of applicants successfully securing subsidies. This pronounced gap underscores systemic challenges in promoting environmentally sustainable practices, suggesting that organic agriculture may face structural constraints such as limited institutional support, insufficient awareness, or more stringent eligibility criteria compared to conventional agricultural activities.

**Chart 2: Applicants and budgeted by measures. direct schemes financed through national budget 2024**



Source: Ministry of Agriculture and Rural Development, 2024

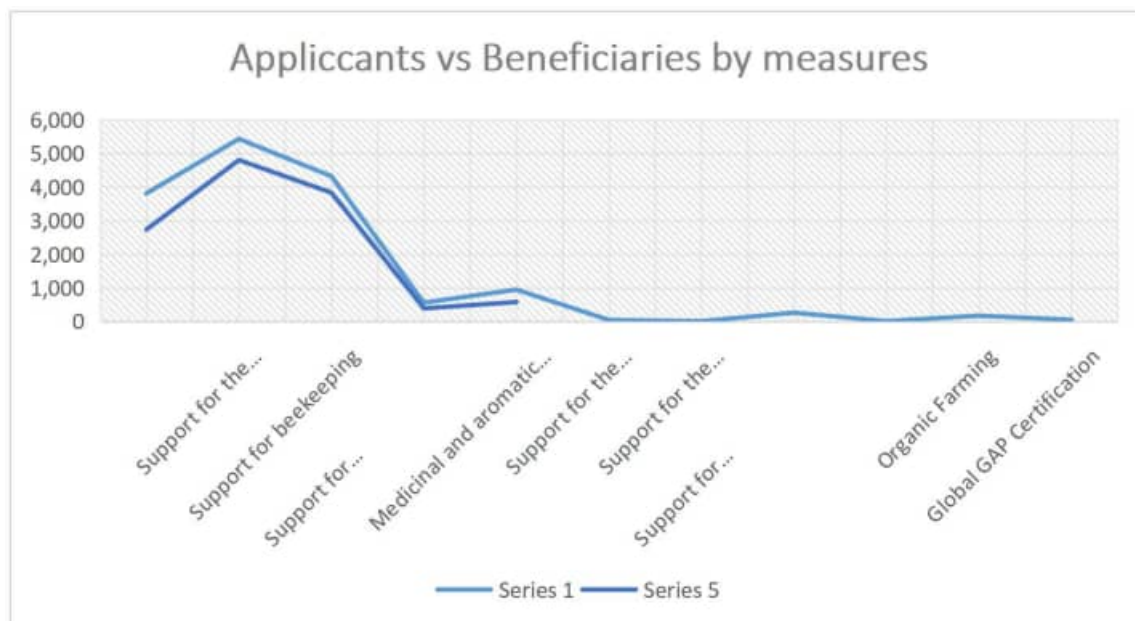
The analyzed data provide a comparative overview of both the number of applicants and the allocated budget across various measures under the direct schemes financed by the national budget for rural development as of 2024.

The data reveals a divergence between the volume of applicants and the distribution of financial resources across measures. While certain schemes, such as livestock herd support and seed/seedling programs, continue to attract the majority of applicants, the corresponding budget allocation is not always proportional to applicant demand. Some measures with fewer applicants, such as mechanization or eco-technology investments, receive relatively higher budget shares, reflecting policy priorities aimed at promoting modernization and circular economy principles.



This trend may indicate a deliberate policy shift to encourage capital-intensive investments aligned with sustainable agricultural practices, despite traditionally lower application rates. Additionally, the observed imbalance between applications and budgetary commitment highlights the need for further refinement in aligning subsidy distribution with sectoral demand, particularly in the context of advancing Albania’s transition towards more resource-efficient and circular agricultural systems.

**Chart 3: Applicants vs beneficiaries by measures. direct schemes financed through national budget 2024**



*Source: Ministry of Agriculture and Rural Development, 2024*

**Chart 3** presents a comparative analysis of applicants and beneficiaries across multiple subsidy measures under the national rural development program.

The data highlights a clear concentration of both applications and successful disbursements in a few key areas. The highest number of applicants and beneficiaries is observed in schemes supporting livestock herds and beekeeping, indicating these as the most sought-after and accessible funding categories. The notable gap between applicants and beneficiaries across these two measures, while present, is relatively moderate, suggesting efficient fund disbursement relative to demand.

Conversely, measures such as support for medicinal and aromatic plants, organic farming, and Global GAP certification exhibit significantly lower figures for both applicants and beneficiaries. This trend reveals two critical issues: first, a lack of widespread farmer engagement with specialized or sustainability-oriented schemes; second, a substantial implementation gap in promoting value-chain upgrades (e.g., certifications) and environmentally sustainable practices like organic farming.

The sharp drop-off in applicant and beneficiary numbers beyond the top two measures reflects a structural imbalance in the national program's appeal and possibly in its administrative complexity or eligibility criteria for niche sectors.

**Policy Implications:**

- The over-reliance on traditional subsidy categories (livestock and beekeeping) highlights the need for diversification and stronger incentives for underutilized programs like organic farming and certification schemes.
- The persistent gap between applicants and beneficiaries across all measure’s points to procedural bottlenecks, budgetary constraints, or challenges related to compliance with technical criteria, especially for measures aligned with circular economy objectives.

**CONCLUSIONS**

- During the design of policy making in agriculture sector Subsidies in Albania should improve Policy Integration Develop targeted policies that encourage Circular Economy in agriculture, supported by clear incentives and regulatory frameworks.
- Improve of Capacity Building: Train farmers and agribusinesses on CE practices and their economic and environmental benefits.
- Investment in Infrastructure: Establish composting facilities, biogas plants, and water recycling systems in agricultural regions.
- Market Development: Create demand for recycled and bio-based agricultural products through subsidies, awareness campaigns, and public procurement.
- Research and Innovation: Support R&D for CE technologies and practices tailored to Albania’s agricultural context.

**RECOMMENDATIONS****1. Diversify and Promote Underutilized Measures**

Strengthen awareness campaigns and technical assistance for less popular schemes, particularly those related to sustainable agriculture (e.g., organic farming and certification programs). Tailored outreach could enhance farmer engagement and improve uptake.

**2. Streamline Administrative Processes**

Review and simplify application and approval procedures to reduce the gap between applicants and beneficiaries. This may include clearer guidelines, faster review timelines, and reducing bureaucratic hurdles, especially for measures that currently show low conversion rates.

**3. Enhance Advisory and Extension Services**

Establish or strengthen advisory services focusing on niche and high-value sectors such as medicinal plants, organic farming, and eco-certifications. Improved access to technical knowledge will increase farmers’ confidence and capability to apply for and meet the requirements of these schemes.

**4. Rebalancing Budget Allocations**

Consider reallocating or increasing budgetary provisions for measures that are crucial to supporting the circular economy and climate-resilient agriculture. This rebalancing could encourage farmers to adopt more sustainable and innovative agricultural practices.

**5. Monitor and Evaluate Impact**

MARD in the function of policy design should implement continuous monitoring and evaluation mechanisms to assess the effectiveness of each measure and adjust program design

based on data-driven insights. Feedback loops between policymakers and farmers could further refine future rural development initiatives.

**Acknowledgments**

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## THE ROLE OF RENEWABLE ENERGY IN SHAPING INCOME (IN)EQUALITY DYNAMICS IN SOUTHEAST EUROPEAN COUNTRIES

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### Abstract

This study employs annual time series data from 2000 to 2022 to examine the correlation between renewable energy usage and inequality of income in Albania, Serbia, Croatia, Bulgaria, and Romania. These countries are economies situated in Southeastern Europe and have seen specific occurrences that constitute them particularly significant for the examination of economic expansion and stagnation periods. The ARDL limits test methodology is a suitable way for analyzing the energy-inequality relationship in countries facing both random shocks (outliers) and persistent shocks (structural breaks), which we utilize in our analyses.

An extensive corpus of research has been conducted to examine the correlation between income inequality and the consumption of renewable energy. Due to the persistent significance of renewable energy, numerous research has concentrated on the determinants influencing the adoption of renewable energy sources. The emphasis on income disparity is significant, as it has been associated with several outcomes that can affect renewable energy. Inequality has been associated with health and wellbeing, economic growth, and the environment, among other factors. The social advantages and favorable externalities of mitigating income disparity may facilitate the acceleration of renewable energy adoption; therefore, it is crucial to empirically validate the correlation between inequality and renewable energy to inform policy decisions.

The GINI coefficient serves as the dependent variable in our estimated model. The chosen independent variables are renewable energy consumption per capita, gross domestic product per capita, real gross fixed capital creation, exports, imports, and the political instability index, among others. The initial empirical results offer evidence supporting the energy-led growth hypotheses in the selected countries. Our analysis indicates that political instability impedes economic growth and development in certain countries. This discovery aligns with our previous assumptions.

**Key words:** Renewable energy, Income inequality, Southeastern European countries economic resilience, environmental agriculture sustainability, and regional equity.

## **AN EXAMINATION OF ZERO WASTE MANAGEMENT IN UNIVERSITIES IN THE CONTEXT OF CIRCULAR ECONOMY: A CASE STUDY OF DÜZCE UNIVERSITY**

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### **Abstract**

One of the most important problems of university campuses in Turkey in terms of zero waste is that the targeted success in recycling rate, i.e. recycling behavior change, has not been achieved. After achieving success in recycling waste, the next step is to reduce waste generation and reuse. In order to achieve the goal of a sustainable campus that contributes to the circular economy and responsible production and consumption processes, it is important that all academic, administrative staff and students have environmental awareness, transfer it to behavior, and participate in activities within the framework of daily campus life and curriculum. This study attempted to contribute to increasing awareness, interest and scope of activities on circular economy, starting from the zero waste management practices of Düzce University.

**Key words:** zero waste; circular economy; waste reduction; waste behavior; Düzce

## BIBLIOMETRIC ANALYSIS OF ACADEMIC STUDIES PUBLISHED ON CIRCULAR ECONOMY IN TURKEY

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### **Abstract**

The aim of this study is to evaluate academic studies on circular economy in Turkey and to determine research trends. For this purpose, publications from Turkey were examined through bibliometric analysis method from WOS and SCOPUS databases without any limitation on the starting year until 2025. A total of 561 publications were reached, and it is seen that studies on circular economy increased rapidly after 2021, and the first publications were made in 2017. It is thought that this research will contribute to many different areas. Firstly, it will provide the integration of Circular Economy research topics conducted in Turkey to date. It is aimed to provide ideas for future studies while emphasizing areas of interest for secondary research. As a result, it will provide a general overview of the concept of circular economy. In order to evaluate the publications in the study, changes in the volume and number of publications, keywords, trends in subject titles, and publishing institutions were considered. Institutions and authors were mapped with social network analysis in the research. Trends in subject titles, institutions that contributed the most to the field, most frequently used keywords and authors, and the most cited in the field were visualized using the VOSviewer program.

**Keywords:** circular economy; bibliometric analysis, waste behaviour, Turkey



## INTEGRATING CIRCULAR ECONOMY INTO SUSTAINABLE DEVELOPMENT GOALS: INSIGHTS FROM LIFE CYCLE IMPACT ASSESSMENT

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### Abstract

The integration of the circular economy (CE) into Sustainable Development Goals (SDGs) offers an approach to sustainable resource management and economic growth, with Life Cycle Impact Assessment (LCIA) as a tool for evaluating environmental and socio-economic outcomes. This study investigates how LCIA methodologies can drive circular economy strategies within the textile industry, addressing SDG targets such as responsible production and consumption and climate action. Textile production, which accounts for approximately 10% of global carbon emissions and 20% of industrial water pollution, presents significant opportunities for CE practices like recycling, reusing, and material innovation. Case studies from European textile manufacturers demonstrate the potential of LCIA in optimizing resource use, minimizing waste, and reducing greenhouse gas emissions by up to 50% when transitioning from virgin polyester production to closed-loop recycling systems.

LCIA software tools such as OpenLCA and GaBi were employed to assess the environmental impacts across key lifecycle stages, including raw material extraction, manufacturing, distribution, and end-of-life disposal. Results indicate that incorporating recycled fibres can lower energy consumption by 30–40%, while water usage can be reduced by as much as 70% compared to conventional production methods. Furthermore, the adoption of eco-design principles, supported by LCIA insights, showed a potential reduction in landfill waste by 25% through product lifecycle extension initiatives such as repair and reuse programs.

This research highlights the socio-economic implications of CE adoption, including job creation in recycling and upcycling sectors, which could increase by 15% in regions implementing waste management systems. Policy recommendations emphasize the importance of regulatory frameworks that incentivize sustainable practices, such as extended producer responsibility and subsidies for green technologies. The findings show the value of cross-sector collaboration, combining insights from LCIA with CE strategies to improve sustainable consumption patterns and support the transition towards a low-carbon textile industry.

**Keywords:** circular economy, Sustainable Development Goals

## **SMART CITIES AS DRIVERS OF TWIN TRANSITION - EVIDENCE FROM THE REPUBLIC OF SERBIA**

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### **Abstract**

The SDG 11 - sustainable cities and communities emphasizes the importance of cities, viewing them as actors that are largely influenced by economic and population growth, modern consumption and numerous environmental challenges. In urban areas, there are numerous challenges of modern life, which also imply major changes in the model of urban development. As extremely complex systems and hubs of various activities, cities that develop as “smart” get a key place in achieving the goals of economic and sustainable development, both in developed and developing countries. Undoubtedly, smart cities have a very important role in these processes and can facilitate the twin transition to a green and digital economy. The aim of this paper is to analyse role of the smart city development in twin transition. Consequently, the paper is divided into three thematic parts. The first part refers to basics and importance of twin transition. Second part analyses how smart cities, as concept of sustainable urban development, and twin transition are interconnected and contribute to each other, while the third part is about situation and perspective of smart city development and twin transition in Serbia. Through the beginning and to a certain extent implemented digitalization in the Republic of Serbia, a strong base for the formation of smart cities was created. In certain local governments and cities, successful projects that are important links in creating resilient and smart cities are an incentive and a good example for the future. Some of these examples will be presented in the paper. In conclusion, final remarks are given. From a methodological point of view, this work presents a desk research analysis and synthesis of data from relevant sources, with the aim of a detailed presentation and drawing conclusions about the subject. The research results contribute to the understanding and perception of this important topic.

**Keywords:** smart cities, urban areas, Serbia

## FROM POLICY TO PRACTICE: EXAMINING THE AGENCY-DRIVEN DYNAMICS OF TURKEY’S ZERO WASTE MOVEMENT AND ITS IMPACT ON RECYCLING

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### Abstract

Over the past two decades, the concepts of 'sustainability transitions,' 'circular economy,' and 'transformations' have gained increasing prominence in academic literature. These transitions are complex processes that result from the dynamic interactions among various actors, including businesses, consumers, scientific communities, policymakers, social movements, and advocacy groups. At the heart of these discussions lies the idea of the socio-technical system, which highlights the intricate connections between technical elements - such as technologies and infrastructure - and non-technical factors, including regulations, organizational interests, user practices, and cultural norms. Within this framework, the role of the “agent” becomes a focal point, representing entities or individuals who drive, influence, and implement change.

In this context, the primary objective of this study is to investigate the role and influence of these agents in the adoption and spread of the Zero Waste Movement in Turkey by using Multi-Level Perspective (MLP). A secondary aim is to assess the effectiveness of the movement in enhancing waste collection and recycling rates. Launched in 2017, the Zero Waste Movement in Turkey has already demonstrated considerable success, doubling the country's recycled waste volume within just five years. Since its inception, over 140,000 institutions and businesses have embraced the zero waste management system, highlighting a significant shift towards sustainable practices at the organizational level.

This case study underscores the evolving role of government, which is no longer solely a 'pilot' with the exclusive tools and knowledge to guide society towards sustainability. Instead, the government's role is increasingly that of an enabler, facilitating broader societal transformation and encouraging diverse stakeholders to participate in the transition to sustainable practices. Sustainability transitions inherently involve making normative choices—decisions that reflect different visions of the future and strategies for achieving them. This highlights the importance of fostering public participation to ensure that these transitions are informed by broad consultation and inclusive deliberation.

The Zero Waste Movement serves as a particularly relevant case for analyzing the concept of “agency.” As the most significant environmental initiative within Turkey's waste management sector over the past three decades, it provides a unique opportunity to examine how agency can drive substantial shifts in recycling behaviors, especially at the institutional level. The movement's comprehensive approach to waste management outlines a clear set of standards, technologies, and practices that organizations need to adopt. Its far-reaching impact illustrates how targeted environmental initiatives can reshape societal and institutional practices, fostering a large-scale transformation towards sustainability.

**Key Words:** Circular Economy, Transformation, Zero Waste Movement, Multi-Level Perspective (MLP)

## WASTE MANAGEMENT PRACTICES IN TURKEY PAST AND PRESENT

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### Abstract

The United Nations accepted its agenda in 2015, which includes 17 sustainable development goals and 169 sub-goals to improve and increase the welfare of people and to protect the ecosystem where all living things live, and published it in January 2016. In order to protect nature and our health, waste management must be carried out under the necessary conditions. Environmental awareness can be developed with education and can be transferred to future generations. Recycling and reusing waste, especially plastic waste, can prevent a significant environmental problem that threatens the ecosystem. It is very important in waste management that waste is collected separately without being mixed and recycled in various industrial areas.

In the European Union, waste is mostly produced in the construction sector, while in Turkey it is formed in homes. According to the 2020 Eurostat 2020 statistics, Turkey, which ranks 11th among EU countries in terms of waste production, also lags behind EU countries in terms of the recycling rate of waste. While Turkey's municipal waste is recycled by 12.3 percent, 49.6 percent of municipal waste in the EU is recycled. Turkey is third from the bottom among 36 European countries in this field.

Although there are many regulations on waste recycling in Turkey, it is seen that there are some deficiencies in implementation. According to the 'circular economy document' published in EU countries, it is foreseen that materials to be recycled should not be buried, energy conversion should be applied to non-recyclable materials, zero percent landfill, 40 percent recycling and 60 percent energy conversion should be realized in 2025.

As in the world, some regulations have been made on waste management in Turkey. However, it is seen that Turkey has not achieved effective results in terms of waste. For this reason, it is necessary to develop the regulations and legislation in Turkey, to make them compatible with EU standards and to restructure them within the framework of the practices in EU countries.

In this study, we aimed to investigate how waste management has evolved in Turkey, how effectively it is used in the field of application and what kind of regulations should be made for improvement in waste policy.

**Key words:** circular economy, waste, regulation, applications in Turkey

## CIRCULAR ECONOMY APPLICATIONS WITHIN THE FRAMEWORK OF SUSTAINABILITY IN TURKEY

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### **Abstract**

Circular economy is a major focus area at the EU level and in Turkey. The understanding of the circular economy concept is still developing, and more studies are being undertaken to apprise industry players in Turkey about the applications of circular economy in the industry for maintaining ecological balance. Turkey aims to create a new production model for the circular economy based on sustainability and innovation, in which all waste generated in a production system is re-evaluated, thus saving raw material costs, while providing maximum resource and energy efficiency and environmental benefits.

Circular economy and sustainable development goals are intertwined and sustainability management and assessment encompassing economic, social, and environmental dimensions are essential focus areas. Cities and municipalities are facing many challenges such as climate change, waste, emissions, and sustainability. Thus, industry practices and public applications to achieve circular economy goals can play a major role in addressing them.

This study addresses circular economy applications through a review of the industry and public practices applied in Turkey. This study evaluates circular economy practices in Turkey within the framework of sustainability and EU practices. In this context, it offers a series of policy and strategy recommendations for the future.

The most important future steps for the development of industry practices and public applications to achieve circular economy may include focusing on recycling, reuse, refurbishment, and remanufacturing of products, components, and materials, incorporation of sustainability and circular economy issues into local policy, strategy, and goals.

**Key words:** circular economy, sustainable development, Turkey

## **ENHANCING SUSTAINABILITY WITH CIRCULAR ECONOMY PRACTICES: MULTI-CRITERIA SOLUTIONS**

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### **Abstract**

The growing adoption of Circular Economy (CE) practices by companies marks a significant shift towards enhancing sustainability, optimizing resource utilization, and minimizing waste through environmentally sound practices. This transition not only supports environmental preservation but also fosters economic development, balancing growth with ecological responsibility.

This study explores the integration of CE principles with advanced Multi-Criteria Decision-Making (MCDM) methods to address the complexities of sustainable decision-making. The Analytical Hierarchy Process (AHP) and the Comprehensive Distance-Based Ranking (COBRA) method were employed, leveraging their proven effectiveness in evaluating and selecting alternatives in complex contexts. These methodologies offer practical tools for organizations to make informed decisions that align with sustainability objectives.

The findings emphasize the critical importance of embedding CE principles into corporate strategies and utilizing sophisticated decision-making frameworks. By doing so, companies can contribute to the advancement of a sustainable and circular economy. This research provides valuable insights for both academics and practitioners, guiding the development and implementation of sustainability strategies that promote economic growth and environmental stewardship.

**Key words:** Circular Economy; Sustainability Optimization; Multi-Criteria Decision-Making (MCDM)



## THE ROLE OF EDUCATION IN SUSTAINABLE CONSUMPTION AWARENESS AMONG ALBANIAN STUDENTS

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### **Abstract**

Sustainable consumption education is increasing in higher education institutions (HIEs) with the most common generic form which is education for sustainable development (ESD) which is becoming integrated in curriculms of different study programs in different study levels. Traditionnaly sustainable consumption education has been part of environmental education (EE). In business studies sustainable consumption education has been part of the courses of business ethics or corporate social responsibility (CRS). Courses require an interdisciplinary approach as sustainable consumption is interdisciplinar. In developing countries such as Albania, the term sustainable consumption is confusing because of a lack of awareness on sustainable consumption that is reflected at the individual, family and community level.

The present paper investigates the different levels of awareness on sustainable consumption of Albanian students integrating the different attitudes towards reusing, reducing, reusing and repairing at the individual level, family level and community level.

This study uses mixed methods. 3 focus groups were conducted with Bachelor students from the Aleksandër Moisiu University of Durrës in order to discuss about the different levels of awareness in October 2024. At a second stage a survey was distributed to 120 students of the Aleksandër Moisiu Unviersy of Durrës in order to identify their levels of awareness and analyzed through applying exploratory factor analysis (EFA).

The results show that the students are more aware at the individual and family level whereas there is a lack of awareness about the community level. This can be due to the fact that the lack of community awareness is a phenomena that is becoming very common in the Albanian society but this has long term impact in preparing students ready not only for the labor market but as well as responsible citizens, education on sustainable consumption can be cathalyst.

**Key words:** Sustainable consumption, reducing, reusing, repairing, community awareness

## FOSTERING CROSS-BORDER COOPERATION BETWEEN NORTH MACEDONIA AND GREECE FOR CIRCULAR ECONOMY SUCCESS: A MODEL FOR REGIONAL SUSTAINABILITY

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### Abstract

The circular economy offers a transformative pathway to sustainable development, particularly in regions with shared environmental and economic challenges. This paper explores the potential of cross-border cooperation between North Macedonia and Greece in advancing circular economy practices, focusing on resource efficiency, waste reduction, and sustainable consumption. Given their geographic proximity and intertwined trade and cultural ties, these nations are well-positioned to collaborate on circular economy initiatives that can drive regional development and contribute to the 2030 Sustainable Development Goals (SDGs).

The study examines existing barriers, such as regulatory misalignment, infrastructure disparities, and insufficient stakeholder engagement, which hinder effective circular economy implementation across borders. It also identifies opportunities for cooperation, including joint waste management projects, shared access to recycling technologies, and harmonized policies for product lifecycle extension.

Through policy and case analysis and stakeholder interviews, this research highlights successful collaborative efforts and offers actionable recommendations for enhancing cross-border synergies. These include the establishment of a bilateral circular economy task force, shared funding mechanisms, and the development of educational programs to raise public awareness about circular economy benefits.

The findings demonstrate how strengthened cooperation between North Macedonia and Greece can accelerate the adoption of circular economy principles, reduce environmental risks, and support economic growth. This model of regional collaboration serves as a blueprint for similar cross-border partnerships, fostering sustainable development and ecological resilience in Southeastern Europe and beyond.

**Key words:** Circular Economy, Cross-Border Cooperation, Sustainable Development Goals (SDGs), Regional Sustainability.

## IMPLEMENTATION OF THE GLOBAL GATEWAY STRATEGY THROUGH THE NEW EU CIRCULAR ECONOMY RESOURCE CENTRE

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### **Abstract**

Circular economy is a crucial component within European Green Deal strategy that is continuously emphasized in various policies. Parallel to this, the management technologies on economic circularity related to standardization and digitalization takes on significance. Important to note that a new initiative on the establishment of a EU Circular Economy Resource Center is in process. The initiative prioritizes knowledge, policy-making, and business features as part of the circular economy ecosystem that is necessary to study. In this context, the EU enlargement and integration policy (such as The Global Gateway) refers to these priorities; that means the circular economy can be considered as a research object within the implementation of the Global Gateway and the development of the Circular Economy Resource Center.

The paper investigates the circular economy management ecosystem in the framework of the knowledge-driven, sustainability-oriented, and technology-based policy-making. Green deal, circularity approaches and bio-economy that are important components of EU policies are discussed within EU Circular Economy Resource Centre. In the paper, the policy interoperability with non-EU countries, which are interconnected with EU through strong documentary base, are considered. Integration of partners from geographical large areas like Neighborhood countries, Asia, Africa and Latin America through EU circular economy know-how, is a completely new policy that targeted networking rather than dependence. In this paper the peculiarities of this approach also is considered as a soft policy that brings common benefit.

The achievement of this interdisciplinary research is related to conceptualization of field-related policy documents, regulations, and cross-border cooperation in the circular economy within sustainable development. In general, local initiatives contributing global tendencies on sustainability through circular technologies is the main conclusion of the research.

**Key words:** The Global Gateway, circular economy, green deal, bio-economy, technology

## Introduction

The Directorate-General for International Partnerships (DG INTPA), - which is responsible for formulating the EU’s international partnership and development policy, with the ultimate goal to reduce poverty, ensure sustainable development, and promote democracy, human rights, and the rule of law across the world, - established the EU Circular Economy Resource Center (hereafter: CER Center) in 2024. The establishment of the CER Center under the Global Gateway strategy will facilitate peer-to-peer exchanges and partnerships between EU and third-country stakeholders, fostering the uptake of sound circular economy policies and business models worldwide. Additionally, the CER Center’s activities align with the objectives of the Circular Economy Action Plan (CEAP) which aims to reduce consumption footprints and double Europe’s circular material use rate within the next decade, in line with the goals of the European Green Deal. The aim of this paper is to explore the matching activities between the Global Gateway and the CER Centre, considering the European Green Deal and the New Circular Economy Action Plan.

The bio-economy and digital monitoring are another important directions of circularity and green agenda that are discussed in the study as a part of the CER Center’s activity deriving from the Global Gateway implementation principles and priorities. Interdisciplinary specification of bio-economy related to energy, food, agriculture, forestry, and other sectors, as well as digitalization agenda for monitoring, are core components of the research promoting activities with the EU partner countries.

Waste electrical and electronic equipment (WEEE) is one of the fastest growing waste streams in the Union, currently growing by 2 % per year, resulting in severe risk for both human health and the environment, if not properly treated. Circular models such as reuse, repair or remanufacturing of small consumer electronics, as well as recycling the precious and critical raw materials contained in them, therefore contribute to waste prevention by reintroducing products, components, and secondary raw materials into the economy. Applying circularity principles to the entire lifecycle and extending longevity of small consumer electronics can therefore lead to significant benefits in terms of resource efficiency, decarbonization, and depollution, and in supporting a market for secondary raw materials. The Communication from the Commission of 2019 related to the European Green Deal highlights that the transition to a circular economy must focus on resource-intensive sectors such as the electronics sector.

Among the relevant actions proposed, was an assessment of the benefits of supporting take-back schemes to incentivize the return of unwanted devices, such as mobile phones, tablets and chargers (EU Recommendation 2023/2585). This is further detailed in the Commission Communication of 2020 on Circular Economy Action Plan, which calls for improving the collection and treatment of WEEE including by exploring options for take-back schemes to return used and waste mobile phones, tablets, and chargers.

The Directive 2012/19/EU on WEEE lays down measures to protect the environment and human health by preventing or reducing the adverse impacts of the generation and management of waste from electrical and electronic equipment (WEEE) and by reducing overall impacts of resource use and improving the efficiency of such use (EU Directive 2012/19/EU on WEEE).

It is also necessary to update Union law on the management of waste batteries and to take measures to protect the environment and human health by preventing or reducing the adverse impacts of the generation and management of waste, by reducing the impact of resource use and by improving resource efficiency. Such measures are crucial for the transition to a circular and climate-neutral economy and toxic-free environment, and for the Union’s long-term competitiveness and strategic autonomy. They can create important economic

opportunities, increasing synergies between the circular economy and energy, climate, transport, industry and research policies, and protecting the environment and reducing greenhouse gas emissions (EU Regulation 2023/1542).

In general, the study concentrates on the CER Centre's activity derived by the Global Gateway logic within green deal, circular economy action plan, and bio-economy. However, there is a future research topic in this framework that is related to WEEE.

### **Key Objectives of the Global Gateway that Align with the Green Deal**

The Global Gateway is an EU initiative designed to enhance global partnerships and drive sustainable investments, particularly in areas such as infrastructure, technology, and climate action. Key objectives of the Global Gateway that align with the Green Deal include:

- **Promoting green infrastructure and technology:** This includes supporting renewable energy projects, sustainable transportation, and digital technologies that reduce environmental impact. The Green Deal focuses on ensuring that all new infrastructure supports sustainability.
- **Climate resilience:** The Global Gateway aims to support developing countries in becoming more climate-resilient, particularly through green technologies, climate-smart agriculture, and infrastructure improvements aligned with the Green Deal's goal to reduce carbon emissions.
- **Sustainable development:** The initiative emphasizes investing in projects that meet the social, environmental, and economic needs of the Global South, ensuring projects are aligned with environmental sustainability goals.
- **Decarbonizing economies:** The Global Gateway focuses on initiatives that support a transition to cleaner energy, reduction of greenhouse gas emissions, and decarbonization of industries, which is central to the EU Green Deal's objectives for a climate-neutral economy by 2050.

All the above-mentioned components are related to the CER Center's Circular Economy Labs, in particular, the Promoting green infrastructure and technology can be considered within Business Lab, Climate resilience and sustainable development within Knowledge Lab, and Decarbonizing economies within Policy Lab.

The other focus of the study is to highlight the assessment of the environmental, social, and economic impacts of the Global Gateway that could be emphasized in the framework of CER Center. Exploring the documentary base such as regulations, directives, and policy papers, there is outlined the main directions of impact of the Global Gateway initiative:

- **Environmental Impact Assessment (EIA):** This process helps evaluate the potential environmental consequences of the projects funded under the Global Gateway, ensuring that they align with the EU's green policies, such as minimizing biodiversity loss, reducing emissions, and supporting circular economies.
- **Social Impact Assessment (SIA):** This includes understanding how projects affect local communities, including issues like access to clean energy, job creation, and human rights. The focus is on social inclusivity and the improvement of livelihoods.
- **Economic Impact Analysis:** This can be measured by assessing the economic benefits of investments, such as job creation, infrastructure development, and economic growth, alongside long-term impacts such as the fostering of green industries and sustainable trade partnerships.

- **Monitoring and evaluation:** Ongoing tracking of each project’s social, economic, and environmental outcomes is necessary for adaptive management and ensuring alignment with the Green Deal.

These directions are a profound base on bioeconomy that can be considered as a target for the CER Center’s activity. Being a combination model of economy including biodiversity, sustainable development and circularity, bioeconomy can be a driver of the CER Centre.

There are defined also the Global Gateway implementation strategies and challenges in this study. The strategies are discussed as follows.

- **Partnership with local governments and stakeholders:** Ensuring the active involvement of local governments, NGOs, businesses, and communities is essential for success. This also includes aligning with local regulatory frameworks and needs.
- **Sustainability-focused investments:** Encouraging investments that prioritize long-term sustainability, which includes environmental protection, social equity, and economic benefits. The EU aims to create a green investment pipeline that follows the EU’s green taxonomy and standards.
- **Technology transfer and capacity building:** Supporting countries with the necessary technology and expertise to implement the Green Deal objectives, focusing on renewable energy, energy efficiency, and digital infrastructure.
- **Funding mechanisms:** Mobilizing public and private sector funds, including innovative financing mechanisms such as green bonds, to support large-scale infrastructure and development projects.

Following to these, challenges are considered:

- **Political and economic instability:** In some regions, political and economic uncertainties can hinder the successful implementation of the Global Gateway projects.
- **Access to financing:** Despite the EU's commitment, obtaining sufficient financing, especially for low-income countries or projects with high initial costs, remains a challenge.
- **Geopolitical risks:** Global competition and tensions, such as those between the EU and China, can create risks in establishing effective partnerships and maintaining momentum on green investments.
- **Monitoring and transparency:** Ensuring that environmental and social standards are adhered to and that projects are regularly monitored is crucial. There can be challenges related to transparency in some regions, especially in countries with weak governance structures.

The CER Center should consolidate resources to mitigate the challenges. Important to note that the Belt and Road Initiative, as another worldwide project, focuses on solutions that ignore the mentioned challenges and promote project activities in an even unstable, risky, and not transparent environment.

### **Analysis of the New Circular Economy Action Plan in the Context of the Global Gateway Implementation**

According to the CER Center’s initiative, the objectives of the New Circular Economy Action Plan (NCEAP) is prioritized. This is a factor for NCEAP as a cornerstone of the European Green Deal, driving the transition to a resource-efficient and climate-neutral economy (European Commission, 2020). In the context of the Global Gateway, - the European Union’s strategy for global infrastructure and connectivity, - the NCEAP enhances sustainability by embedding circular economy principles into international partnerships and investments (European Commission, 2021). These efforts align with the Global Gateway’s objective to address global challenges such as climate change, environmental degradation, and resource



scarcity, which are integral to achieving the United Nations Sustainable Development Goals (SDGs).

The NCEAP promotes sustainability by emphasizing systemic changes in production and consumption patterns. It provides a framework for reducing waste, enhancing resource efficiency, and fostering innovation in sustainable practices. By prioritizing circular economy principles, the NCEAP supports the Global Gateway’s aim to develop sustainable infrastructure and foster inclusive growth in partner countries. For instance, the plan’s focus on creating a well-functioning market for secondary raw materials facilitates the decoupling of economic growth from resource use, addressing one of the critical pillars of sustainable development outlined in the Global Gateway (European Commission, 2020).

The NCEAP’s emphasis on digital tools further supports the Global Gateway. Digital solutions enable better resource management, enhanced monitoring of environmental impacts, and improved efficiency in infrastructure development. For example, the deployment of Digital Product Passports, - a concept highlighted in the NCEAP, - can aid in ensuring transparency and traceability of materials, a critical aspect of sustainable supply chains in the Global Gateway projects. Such innovations enhance accountability and help ensure that international investments meet stringent environmental standards (European Commission, 2020).

Although there are positive alignments between the CER Center’s activity and NCEAP in the framework of the Global Gateway, however detailed discussions on opportunities and challenges in integrating circular economy principles are studied. The opportunities are discussed through the following aspects.

*Resource Efficiency and Cost Savings:* Incorporating circular economy principles can reduce resource consumption and waste. Circular infrastructure has the potential to mitigate climate change and address resource scarcity by adopting the 6R principles: refuse, reduce, reuse, repair, refurbish, and recycle. This approach can lead to cost savings and long-term sustainability in infrastructure projects, enhancing their economic viability (Global Infrastructure Hub, 2023).

*Innovation and Job Creation:* Circular economy projects foster innovation in recycling technologies, material science, and design processes. These advancements can lead to new business models, such as product-as-a-service and extended producer responsibility, creating jobs in emerging sectors and stimulating local economies in partner countries (European Commission, 2020).

*Climate Action Alignment:* Circular economy practices, such as reducing embodied carbon in infrastructure materials and improving waste management systems, directly contribute to the Paris Agreement goals. By integrating these practices, the Global Gateway can enhance its credibility as a global leader in climate action (European Commission, 2019).

*Partnerships and Capacity Building:* The NCEAP promotes international cooperation, offering opportunities for knowledge transfer and capacity building in partner countries. Initiatives like Horizon Europe can support research and innovation partnerships, ensuring the adoption of best practices tailored to local needs (European Commission, 2018).

The study shows that there are challenges also in NCEAP and the Global Gateway interoperability that should be considered within the architecture of the CER Center.

*Policy and Regulatory Gaps:* Implementing circular economy principles requires robust regulatory frameworks, which may be lacking in some partner countries. Harmonizing standards and regulations across regions poses significant challenges, particularly in areas like waste management, secondary raw material markets, and eco-design (European Commission, 2020).

*Financial Barriers:* Transitioning to a circular economy demands significant upfront investments in infrastructure, technology, and capacity building. Securing these funds,

especially in developing regions, remains a challenge despite the Global Gateway’s commitment to mobilizing €300 billion by 2027 (European Commission, 2021).

*Cultural and Behavioral Shifts:* Achieving circularity requires changes in consumer behavior and business practices, which can be slow and resistant to change. Public awareness campaigns and stakeholder engagement will be critical to overcoming these barriers (European Commission, 2021).

*Data and Measurement Challenges:* Effective implementation of circular economy principles requires reliable data on material flows, waste generation, and environmental impacts. Developing standardized metrics and ensuring data availability are ongoing challenges (Global Infrastructure Hub, 2023).

The NCEAP provides a comprehensive strategy for embedding circular practices globally, which can be effectively leveraged through the Global Gateway’s infrastructure and development initiatives. The following components are discussed as supporting the transition to circular practices in partner countries.

*Technical Assistance and Capacity Building:* The NCEAP’s emphasis on research and innovation can guide capacity-building efforts in partner countries. Programs like Horizon Europe and Team Europe initiatives can provide technical assistance, training, and funding to local stakeholders, enabling them to adopt circular practices in areas such as waste management, eco-design, and sustainable production (European Commission, 2018).

*Policy Dialogue and Knowledge Sharing:* The Global Gateway can facilitate policy dialogues that promote circular economy principles, using the NCEAP as a model. These discussions can help partner countries develop tailored strategies and policies that align with their unique socio-economic contexts. Knowledge-sharing platforms can disseminate best practices, success stories, and technical expertise (European Commission, 2021).

*Financing Mechanisms:* To address financial barriers, the NCEAP can integrate innovative financing mechanisms into the Global Gateway’s investment strategy. Blending grants, loans, and guarantees can de-risk investments in circular economy projects. Public-private partnerships can further mobilize resources and drive innovation (European Commission, 2021).

*Focus on Priority Sectors:* The NCEAP’s sector-specific approach—targeting key value chains such as electronics, plastics, textiles, and construction—can be mirrored in Global Gateway initiatives. For example, promoting sustainable building materials and designs in infrastructure projects can reduce resource consumption and embodied carbon (European Commission, 2020).

*Digital Transformation:* Digital technologies play a crucial role in enabling circularity. The NCEAP’s focus on digital tools, such as the Digital Product Passport, can enhance transparency, track resource flows, and optimize supply chains. These tools can be integrated into Global Gateway projects to ensure accountability and efficiency (Global Infrastructure Hub, 2023).

*Monitoring and Evaluation:* Establishing robust monitoring and evaluation systems is essential for tracking progress and ensuring the effectiveness of circular economy initiatives. The NCEAP’s proposed metrics can be adapted for use in partner countries, enabling continuous improvement and alignment with global sustainability standards (European Commission, 2020).

Based on the examinations, the New Circular Economy Action Plan and the Global Gateway are complementary frameworks that can collectively advance global sustainability goals. By aligning their strategies and leveraging their respective strengths, the EU can foster transformative change in partner countries. The NCEAP’s emphasis on innovation, capacity building, and systemic change provides a robust foundation for integrating circular economy principles into the Global Gateway’s initiatives. However, addressing challenges such as

policy gaps, financial constraints, and behavioral inertia will require concerted efforts and sustained collaboration among all stakeholders. Together, these frameworks have the potential to create resilient, inclusive, and sustainable economies worldwide.

### **Analysis of the Sustainable bio-economy for Europe in the context of the Global Gateway implementation: How does the Sustainable Bio-Economy for Europe align with the goals of the Global Gateway?**

The Sustainable Bio-Economy for Europe aligns closely with the goals of the Global Gateway through its emphasis on sustainable development, global cooperation, and innovation. The European bioeconomy, with an annual turnover of €2 trillion and employing 18 million people, already contributes significantly to the EU's economic and environmental goals. The bioeconomy includes agriculture, forestry, fisheries, bio-based industries, and energy, which are important in order to achieve climate neutrality by 2050 under the European Green Deal. These objectives are positioned in the Global Gateway's focus on supporting inclusive growth, improving global connectivity, and promoting sustainability.

One of the most striking alignments is in job creation and socio-economic development. The bioeconomy has the potential to create 1 million new green jobs by 2030, specifically in rural and coastal areas, where economic opportunities are often limited. For example, the establishment of a single biorefinery can generate approximately 4,000 jobs over four years. This capacity to create employment directly supports the Global Gateway's aim to improve economic stability and reduce inequalities in partner regions.

The Global Gateway's objective to support infrastructure and innovation is also closely tied to the bioeconomy. The EU has allocated €10 billion under Horizon Europe (2021–2027) for research and innovation in food systems, natural resources, and the bioeconomy. This funding is important to scale up technologies like biorefineries, algae farming for renewable biomass, and bio-based materials such as biodegradable plastics. For instance, algae farming not only offers a renewable source of biomass but also contributes to carbon sequestration, reducing greenhouse gas emissions by up to 2.1 tons of CO<sub>2</sub> per ton of wood used in construction instead of concrete. Such improvements can be transferred to partner regions under the Global Gateway framework, in order to support not only innovation but sustainability as well.

Another important alignment is seen in the emphasis on resource efficiency and climate action. The EU bioeconomy supports the reduction of dependency on fossil fuels and encourages the use of bioenergy, which currently accounts for more than 50% of renewable energy production in the EU. Sustainable bioenergy, along with bio-based products, helps mitigate climate change while promoting resource efficiency. This directly supports the Global Gateway's ambition to combat climate change through sustainable energy transitions in partner countries.

The bioeconomy also supports the Global Gateway's goal of improving global cooperation by building sustainability-oriented trade relations. Approximately one-third of the biomass input to the EU bioeconomy is imported from non-EU countries. This highlights the interconnectedness of the bioeconomy with global markets. The Global Gateway can use this trade relationship to promote sustainable practices and strengthen global value chains in bio-based industries.

Moreover, the bioeconomy's contribution to circularity aligns with the Global Gateway's focus on sustainable economic models. Circular bioeconomy practices, such as transforming agri-food waste into biodegradable plastics or fertilizers, save costs and reduce environmental impacts. For instance, avoiding food waste in the EU could save up to €143 billion annually, a model that could be extended to partner regions through Global Gateway initiatives.

The environmental restoration aspect of the bioeconomy also reflects the Global Gateway's emphasis on resilience. The bioeconomy contributes to ecosystem restoration, such as reducing ocean plastic pollution by up to 90% by 2025 through bio-based alternatives. It also aligns with the EU's target of restoring 15% of degraded ecosystems, a priority that can be shared with Global Gateway partners to address global environmental challenges.

In this study, the opportunities, as well as risks and challenges for promoting bioeconomy principles in Global Gateway projects are subject of examination that is conceptualised through the following context. The key opportunities are seen as:

*Scaling bio-based industries for economic and environmental benefits:* The bioeconomy sector in the EU generates an annual turnover of approximately €2 trillion, employing over 18 million people and contributing €621 billion in added value annually, which accounts for 4.2% of the EU's GDP . These figures highlight the economic potential of bio-based industries, important for the process of transition from fossil-based materials to sustainable alternatives. Global Gateway projects can replicate this success by investing in renewable bio-based materials such as bio-plastics, chemicals, and biofuels. This will support additionally the global decarbonization efforts and create employment opportunities in both urban and rural settings.

*Transforming biomass into drivers for energy decarbonization and circularity:* The EU produces approximately 1.5 billion tonnes of biomass annually, of which 500 million tonnes are identified as sustainably available for additional uses by 2030 . This biomass can support various sectors, including bioenergy, bio-based materials, and food systems, with the aim to contribute to energy security and reduce dependence on non-renewable resources. For example, biomass currently supplies around 10% of global final energy, with projections suggesting it could meet approximately 15% of global energy demand by 2050 . With the integration of sustainable biomass use into Global Gateway projects, developing countries can improve their energy mix while preserving ecological integrity.

Some statistics on EU bio-based industries including energy, food, and other sectors are included in image 1.

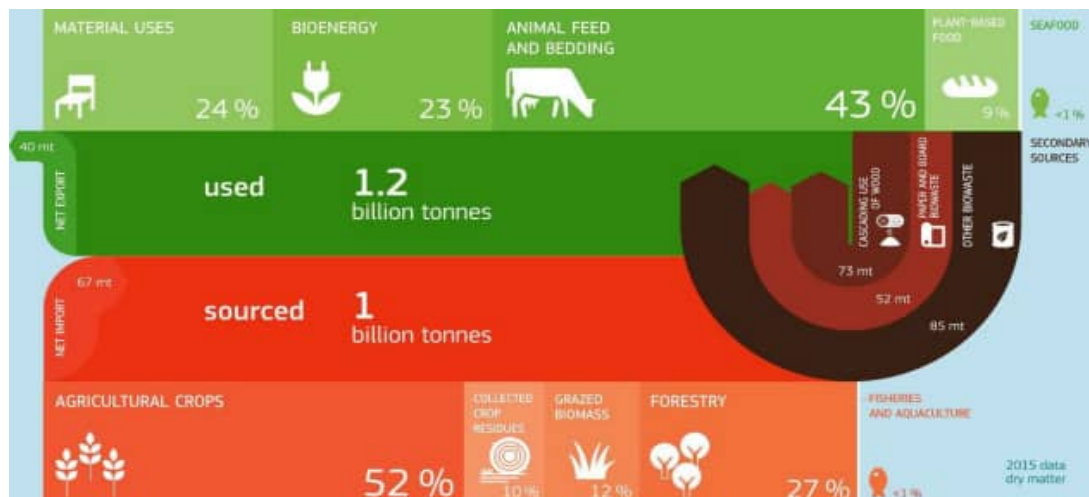


Image 1: Source: JRC

[https://ec.europa.eu/knowledge4policy/sites/know4pol/files/20190925\\_jrc\\_biomass\\_ri\\_days\\_final\\_pubsy\\_0.pdf](https://ec.europa.eu/knowledge4policy/sites/know4pol/files/20190925_jrc_biomass_ri_days_final_pubsy_0.pdf)

The image shows the distribution and utilization of biomass in the EU, highlighting its significant contributions to material uses (24%), bioenergy (23%), and animal feed and bedding (43%), among other applications. Biomass is sourced primarily from agricultural crops (52%) and forestry (27%), with smaller contributions from grazed biomass and crop

residues. This flow of resources provides an overview of the EU’s capacity to manage biomass sustainably, contributing to a circular economy. Supporting this, the 2018 EU Bioeconomy Strategy emphasizes that sustainably sourced biomass is key to fulfilling the demands of energy, materials, and food systems. The strategy outlines that annual biomass production in the EU amounts to 1.5 billion tonnes of dry matter, with approximately 500 million tonnes identified as sustainably available for additional uses by 2030. This sustainable management of biomass not only reduces dependence on fossil resources but also supports biodiversity and ecosystem restoration, aligning with the goals of the European Green Deal and Sustainable Development Goals.

*Creating green jobs and supporting rural economies:* Bioeconomy-driven initiatives are projected to create one million new green jobs in the EU by 2030, particularly in rural and coastal areas . Global Gateway projects can leverage this model by deploying small-scale biorefineries and promoting agroforestry, which provides diverse revenue streams for farmers, foresters, and fishermen. For example, better recycling of organic waste streams in Amsterdam generates €150 million in added value annually, creating 1,200 jobs and reducing CO<sub>2</sub> emissions by 600,000 tonnes .

*Supporting urban circular bioeconomy:* Cities can become major hubs for the circular bioeconomy. Initiatives like Amsterdam’s circular economy plan demonstrate the potential to recycle high-value organic waste streams into resources for bio-based industries. For Europe’s largest 50 cities, adopting such practices could multiply economic and environmental benefits by at least 50 times . Global Gateway projects can adapt these urban models to cities in developing countries, fostering local economies while addressing urban waste management challenges.

*Strengthening food security and sustainable agriculture:* Approximately 76% of EU bioeconomy employment stems from agriculture and food production . By deploying sustainable agricultural practices such as precision farming, crop diversification, and nutrient recycling, Global Gateway projects can improve food security while reducing environmental pressures. For example, innovations in turning organic waste into animal feed could save land currently used for feed production, with the potential to feed three billion additional people globally .

*Advancing biodiversity and ecosystem restoration:* The bioeconomy promotes the sustainable management of natural resources, including forests, oceans, and soils. EU initiatives aim to protect at least 30% of land and sea areas while restoring 15% of degraded ecosystems by 2030 . Global Gateway projects can incorporate these principles to preserve biodiversity hotspots in developing regions while supporting local communities through eco-tourism and sustainable forestry.

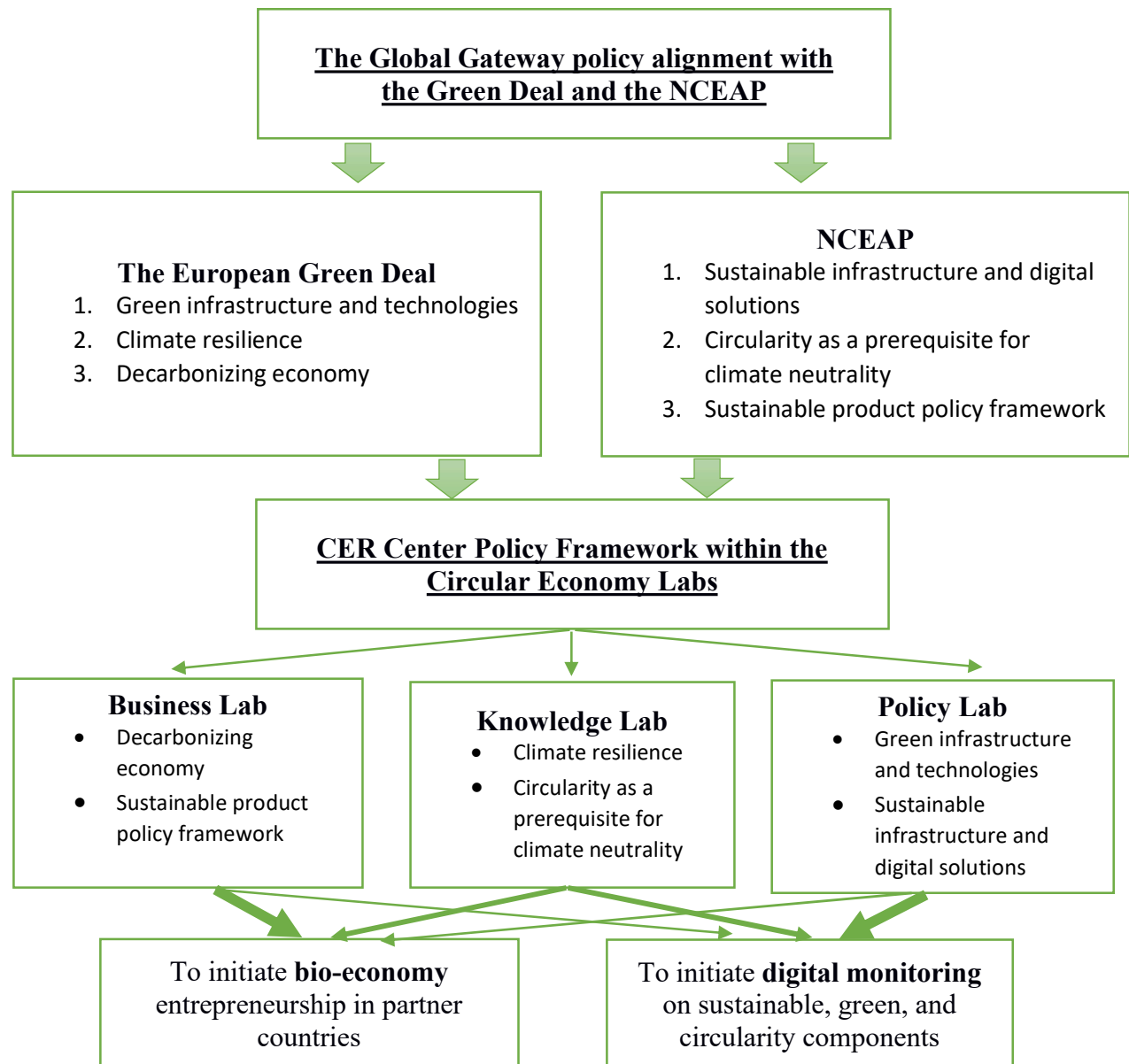
Challenges and risks in implementing bio-economy strategies in partner regions arise from factors spanning environmental, economic, and societal dimensions. One major challenge is the sustainable management of biological resources and land use. The EU Bioeconomy Strategy highlights that balancing the competing demands of food production, bio-based materials, and ecosystem conservation is complex. For instance, while there is enough sustainable biomass within the EU to meet projected needs by 2030, this requires integrating strategies that address carbon balance, biodiversity trade-offs, and socioeconomic constraints.

## **Modelling the CER Centre activities**

Based on the interoperability analyses of the Global Gateway functions with the European Green Deal, and the NCEAP, as well as considering specifications of the bio-economy in

relation to the Global Gateway and other field-related policies, the study suggests functional directions for the CER Centre that presents in Figure 1.

**Figure 1. CER Center Activity Modeling**



The model shows interoperability between certain policy directions of the Global Gateway, the Green Deal, and the NCEAP related to the circularity and sustainability functions. Delegating these functions between the Business, Knowledge, and Policy Labs, it will be possible to formulate new policy directions for CER Center related to bio-economy and digital monitoring.

1. To identify the policy compliance between the Global Gateway, the Green Deal, and the NCEAP – as the basic regulations for the CER Centre - in the framework of circularity and sustainability.
2. To delegate the identified policy directions to the CER Centre as a Global Gateway policy implementation unit.



3. To distinguish between delegated policy directions related to circularity and sustainability within the CER Center’s Circular Economy Labs.
4. To generate new policies for bio-economy and digital monitoring, based on the delegated circularity and sustainability functions. Thin, thick, and thicker arrows show the power of influence of each lab over the bio-economy and digital monitoring policies.

The initiatives within bio-economy and digital monitoring can be new policy direction for the Global Gateway implementation derived by the Green Deal and NCEAP, and providing through the CER Center.

Economic challenges are significant in regions with underdeveloped bio-based sectors. Despite the potential to create up to one million green jobs in rural and coastal areas by 2030, barriers such as insufficient investments, high upfront costs for establishing biorefineries, and limited market uptake for bio-based products hinder progress. The EU has proposed initiatives such as a €100 million Circular Bioeconomy Investment Platform to address these issues, but disparities in regional capacities remain a concern .

Environmental risks include the potential for overexploitation of natural resources, which could lead to soil degradation, water scarcity, and biodiversity loss. To mitigate these risks, strategies must incorporate ecological boundaries. Monitoring systems and frameworks like the EU Green Deal are in place to ensure that bio-economy activities align with sustainability goals. However, implementing these measures consistently across regions is a challenge, particularly in areas with limited governance structures .

Socially, the transition to a bio-economy may lead to disruptions in traditional sectors, creating resistance among stakeholders. Training and education programs are necessary to build local capacity and acceptance. Moreover, ensuring equity in resource distribution and benefits is critical to avoid exacerbating existing inequalities, especially in rural areas .

Technological challenges include the development and deployment of innovations needed for a circular and sustainable bioeconomy. For instance, advanced biotechnologies, bio-based product standards, and waste-to-resource technologies require significant research and development investments, as highlighted by the EU's allocation of €10 billion under Horizon Europe. Lastly, there are risks associated with policy coherence and coordination. Bioeconomy strategies must align with broader climate, energy, and circular economy policies, requiring cross-sectoral cooperation. The European Commission’s progress report emphasizes that gaps in policy coherence could undermine efforts to integrate bioeconomy principles effectively across regions.

## **Conclusion**

The study of the implementation of the Global Gateway strategy through the new EU Circular Economy Resource Centre was discussed in the paper considering (1) the Green Deal agenda, (2) the New Circular Economy Action Plan, and (3) the Bio-Economy. Important to note that the WEEE framework is mentioned in the study as a future research object in this context.

There are suggested in the study to prioritize key activities in the relevant labs focusing on circularity and sustainability components. In particular, promoting green infrastructure and technologies can be relevant with the Business Lab, climate resilience and sustainable development activities: Knowledge Lab, and decarbonizing economies: Policy Lab.

Although the environmental, social, and economic impacts of the Global Gateway are clearly emphasized, however, we assume to delegate the monitoring and coordination functions to the CER Centre. Moreover, the study shows challenges on political and economic instability; access to finance; geopolitical risks; monitoring and transparency; that are necessary to manage. In the context of these risks the Belt and Road Initiative, - as another

worldwide project, focuses on solutions that ignore the mentioned challenges and promotes project activities in even unstable, risky, and not transparent environment. We assume that the management of these challenges should be coordinated by the CER Center. This will enable to harmonize environmental, social, and economic benefits within risk analyses and promote effective solutions.

The study examined also the possible policy framework of the newly-established CER Center, modeling the activities toward the bio-economy and digital monitoring prioritization. In this context, the Global Gateway implementation is discussed as a policy toolkit to promote bio-economy and digital monitoring.

Based on the examinations, the New Circular Economy Action Plan, the Green Deal, and the Global Gateway are complementary frameworks that can collectively advance global sustainability goals as a macro solution, and promote circularity and bio-economy in micro levels. By aligning their strategies and leveraging their respective strengths, the EU can foster transformative change in partner countries emphasizing on innovation, capacity building, and systemic change, providing a robust foundation for integrating circular economy principles into the Global Gateway's initiatives. However, addressing challenges such as policy gaps, financial constraints, and behavioral inertia will require concerted efforts and sustained collaboration among all stakeholders, that could be implemented by the CER Center.

The bioeconomy also supports the Global Gateway's goal of improving global cooperation through Green Deal and the New Circular Economy Action Plan. However, this is a subject of cross-border cooperation, as approximately one-third of the biomass input to the EU bioeconomy is imported from non-EU countries. This highlights the interconnectedness of the bioeconomy with global markets through various regulations and directives, that could be a part of the CER Centre's coordinating functions.

### **Acknowledgments**

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## **PROCEEDINGS**

*2nd Open-Air Cities International Conference “Local & Regional Sustainable Development and Urban Reconstruction”, Harokopio University of Athens, February 14-16, 2025*

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Eu Directive 2012/19/EU of the European Parliament and of the Council of 4 July 2012 on waste electrical and electronic equipment (WEEE)

EU Regulation 2023/1542 of the European Parliament and of the Council of 12 July 2023 concerning batteries and waste batteries

EU Commission Regulation 2023/2585 of 6 October 2023 on improving the rate of return of used and waste mobile phones, tablets and laptops

## CIRCULAR ECONOMY STRATEGIES FOR SUSTAINABLE RESOURCE MANAGEMENT IN THE CONSTRUCTION INDUSTRY

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### Abstract

The construction industry is one of the largest consumers of natural resources, generating significant waste and contributing to environmental degradation. Circular economy (CE) strategies offer a transformative approach to sustainable resource management by closing material loops, reducing waste, and enhancing resource efficiency. This study examines the implementation of CE principles in the construction sector, focusing on design and construction aspects, material reuse, recycling, and innovative business models. By adopting strategies such as modular construction, cradle-to-cradle design, and the use of secondary raw materials, the industry can achieve significant reductions in environmental impact. The integration of digital tools, such as Building Information Modelling (BIM), enables more effective lifecycle management and resource tracking. Several challenges are discussed, such as consumer protection in the construction industry, product lifecycle extension through reducing, reusing, and repairing, as well as socio-economic impacts of circular economy practices on consumer rights and possibilities for overcoming barriers to circular economy implementation. The findings underscore the critical role of policy frameworks, technological advancements, and cross-sectoral partnerships in driving systemic change.

**Key words:** Circular Economy, Construction Industry, Consumer Protection, Barrier to CE implementation.

### Introduction

The conventional construction industry (CI) has a linear and unsustainable approach, based on the “take, make, dispose” model (zu Castell-Rüdenhausen et al., 2021). The result is the CI being the among the world’s largest consumer of natural resources as well as waste producer. Therefore, a paradigm shift in the construction is required which will transform the linear economy model to a circular model.

The Ellen MacArthur Foundation defines the CE principle as “an industrial system that is restorative or regenerative by intention and design” and then extended as “a new way to design, make, and use things within planetary boundaries” (*Circular Economy Introduction - Overview*, 2021). Circular economy (CE) strategies offer a transformative approach to sustainable resource management by closing material loops, reducing waste, and enhancing resource efficiency. To decrease resource consumption, the CE is based on a systematic approach which integrates the supply chain of materials and enables waste elimination by closing the materials flow. Also, CE can be aligned with industrial ecology (Deutz et al., 2017), considering it is based on sharing of resources between different sectors through industrial symbiosis and preserving the value of materials to be reused.

Even though there have been certain efforts in the CI to implement CE strategies, many unresolved issues persist, among which quantification of resources flow, assessing the ecological consequences, develop indicators and criteria for assessment, as well as

identification of strategies (Petit-Boix & Leipold, 2018). The CE challenges in the construction industry are multi-dimensional, and the areas of major challenges are pinpointed as: design & construction strategies, supply chain management, policy strategies for CE adoption, End-of-Life (EoL) principles, CDW management strategies, information exchanges & analytics for CE (Antwi-Afari et al., 2021). Also, in the business sector, at the company level, there are no common CE practices in terms of evaluation of circularity performances (Sassanelli et al., 2019)

This paper aims to make an overview of the implementation of CE principles in the construction sector, focusing on design and construction aspects, material reuse, recycling, and innovative business models. Also, the integration of digital tools in the construction industry is investigated, with a focus on Building Information Modelling (BIM), which enable implementation of CE principles as well as more effective lifecycle management and resource tracking.

Further, several challenges are discussed, such as consumer protection in the construction industry, product lifecycle extension through reducing, reusing, and repairing, as well as socio-economic impacts of circular economy practices on consumer rights and possibilities for overcoming barriers to circular economy implementation.

The findings underscore the critical role of policy frameworks, technological advancements, and cross-sectoral partnerships in driving systemic change.

In the following sections the methodology of this research is laid out followed by analysis of Circular Economy Design and Construction aspects, Digital tools development and implementation in CE

## **Methodology**

The research methodology used in this paper is consisted of eight steps, such as (Xiao & Watson, 2019): (1) formulating the research problem; (2) developing and validating the review protocol; (3) conducting a literature search; (4) screening for inclusion based on publication language and date range; (5) assessing the quality of selected studies; (6) extracting relevant data; (7) analyzing and synthesizing the data; and (8) reporting the findings.

Scoping review is used to analyze the existing literature and to provide broad overview of the research topic. A scoping literature review aims to provide a comprehensive overview of studies across various quality levels (Xiao & Watson, 2019). The target papers, the Web of Science and Scopus databases were used with theme-based specific and relevant keywords in this research area being made referenced to, e.g. ‘circular economy’, ‘construction industry’, ‘consumer protection’, ‘resource management’. The study findings are organized and presented in subsequent sections further in this paper.

## **Circular Economy Design and Construction aspects**

The construction sector is regarded as having significant potential to transition towards a Circular Economy (CE) model by embracing sustainable products and technologies (Smol et al., 2015). By enhancing the use of waste materials throughout various phases of the building life cycle, it can lead to a decrease in material expenses and overall construction costs, while also minimizing embodied energy and other environmental effects associated with the overconsumption of construction resources (Akanbi et al., 2019).

The recent focus on CE and its potential integration into the construction industry has prompted a reevaluation of supply chains to better facilitate waste reduction and reuse, as effectively recovering construction materials for recycling or direct reuse is crucial for a

successful transition to CE (Akinade & Oyedele, 2019; Pan et al., 2015). These initiatives have potential to reduce the demand for new raw materials and decrease the volume of waste sent to landfills.

Although producing construction materials typically requires substantial raw materials and energy, a large portion of these resources ends up being downcycled or wasted after use. Regrettably, the industry currently captures only a small fraction of the economic value and durability of these materials under existing practices. Adopting CE principles effectively can address these challenges by promoting material recirculation, such as through designing for disassembly with mechanical joints, thereby extending the lifespan of construction components for reuse in future projects or different applications (Schiller et al., 2019).

Initially, the CE concept was shaped around the 3R's principles, Reduce, Reuse, and, Recycle. The 3R's principles were later extended with intention to stimulate the transition towards CE, organized in three strategies (Rahla et al., 2021).

The first strategy consists of three actions:

1. *Refuse*: Depreciate a product with dire impacts and proposing a different one with identical or better functions and fewer impacts;
2. *Rethink*: Intensify the product use and adopt smarter strategies as sharing economy or products with multiple functions; and,
3. *Reduce*: Decrease virgin materials and energy consumption while enhancing efficiency.

The Second strategy considers product lifespan extension and consists of:

4. *Reuse*: Reuse a discarded product that keeps the same functions by another user;
5. *Repair*: Fix a damaged product to give back its initial performance;
6. *Refurbish*: Renovate an outdated product to make it as a new one;
7. *Recycle*: Include, into the manufacturing process of a product, materials that reached their end-of-life use to make materials with same, higher (upcycle), or lower (downcycle) qualities; and,
8. *Recover*: A process of retrieving heat, electricity, or fuel from non-recyclable materials by incineration.

The third strategy is comprised of the actions:

9. *Remanufacture*: Make a product using parts from a damaged product that had the same functions; and,
10. *Repurpose*: Make a product using parts from a damaged product that had different functions.

The Ellen MacArthur Foundation outlined three principles to embrace CE (*Circular Economy Introduction - Overview*, 2021):

1. “to preserve and enhance natural capital by controlling finite stocks and balancing renewable resource flows.”
2. “to optimize resource yields by circulating products, components, and materials at the highest utility at all times in both technical and biological cycles.”
3. “to foster system effectiveness by revealing and designing out negative externalities.”



Researchers aggregate the broader effects of implementing Circular Economy (CE) principles in the construction sector, such as (Hossain et al., 2020):

- (i) enhancing the use of sustainable materials by fostering collaboration among various stakeholders;
- (ii) increasing material efficiency through the recycling and reuse of construction resources; and
- (iii) preventing unnecessary waste generation and landfill disposal.

To facilitate the transition to circular construction, researchers propose several strategies, such as (Stephan & Athanassiadis, 2018):

- (i) utilizing sustainable and durable materials,
- (ii) adopting the design for disassembly approach,
- (iii) incorporating modular and prefabricated components, and
- (iv) creating recovery systems, akin to take-back programs in the manufacturing sector.

Other researchers present three tools to expedite CE adoption within the construction industry in Scandinavian countries (Høibye & Sand, 2018):

- (i) defining requirements and documentation standards for the quality of building materials, including sharing information on technical performance and recycling rates, and enhancing traceability;
- (ii) creating guidelines for reused building products and those made from recycled materials, which involves establishing minimum standards and green resource efficiency criteria, as well as facilitating the exchange of reused products; and (iii) setting requirements for waste and demolition plans, encompassing the screening, mapping, and sorting of valuable building items for reuse, establishing recycling targets and end-of-waste criteria, along with providing guidelines and training for demolition firms.

Authors (Minunno et al., 2018) propose seven strategies for circular prefabricated building construction, such as:

- (i) reduction of waste based on lean production chain.
- (ii) utilization of by-products in the production of new materials or components.
- (iii) reuse of replacement parts and components
- (iv) encourage design of adaptability (for another cycle with different applications).
- (v) design for disassembly using BIM (to improve the end-of-life deconstruction),
- (vi) design with attention for ensuring recyclability of reused materials is in the sixth strategy.

- (vii) use of tracking system for gathering information, tracking locations and life cycle to facilitate the materials or components being put to another cycle after disassemble or deconstruction.

Multitude of design and construction strategies are examined regarding their level of application and readiness to be utilized by the industry (Eberhardt et al., 2022), such as: assembly/disassembly, material selection/substitution, adaptability/flexibility, modularity, prefabrication, secondary materials, durability, standardisation, component and material optimisation, reusing, existing building/components/materials, optimised shapes/dimensions, accessibility, layer independence, material storage, short use, symbiosis/sharing. The most frequent strategy in the literature is assembly/disassembly, followed by material selection/substitution and adaptability and flexibility (Eberhardt et al., 2022).

Three priority barriers of CE in the design stage are identified, such as (Mahpour, 2018): agency and ownership issues of end-of-life of materials; lack of integration of sustainable waste management and potential reuse and associated uncertainty in C&D waste management. Also, other design challenges are durability of materials, lack of incentives of recycled materials or components, uncertainty of material flows, lack of material banks, material passports etc.

One of the most crucial parameters in DfD is the choice of the construction technology and how building elements will be assembled and disassembled. Researchers (Crowther, 2005) outlined a total of 27 principles for Design for Disassembly (DfD) that can be categorized as reducing the amount of input and reliance on safe and healthy secondary materials, standardizing the connection between materials and components while considering disassembly at the end-of-life, and retaining information regarding all materials and components involved in a building.

Authors (Eberhardt et al., 2022) suggest that in order to convey a comprehensive and uniform adoption of CE in the building industry a new design typology is required which will facilitate CE-oriented decision-making in a building context and which will prioritise design and construction strategies according to their potential for minimising building-related environmental impacts.

The ‘design for disassembly’ principles are noted to have a potential to reduce the buildings embodied greenhouse gas emissions by 36% in case the concrete elements are reused. In other case study where a building is ‘upcycled’, it is shown it can have 46% lower embodied greenhouse gas emission compared to the ‘design for disassembly’ building when building components and materials were reused and recycled (Rasmussen et al., 2019). Nevertheless the environmental implications of CE strategies need to be further investigated (Eberhardt et al., 2022).

## **Digital tools and Circular Economy**

The rapid advancement of digital tools and technologies enables an increased uptake of CE in the construction industry. Information and Communication Technologies (ICT) are recognized as a critical part of the path towards CE (Singh et al., 2021) and ICT-based solutions are prioritised for future CE implementation (Demestichas & Daskalakis, 2020).

The digital technologies can be utilized in various domains, such as: communication technologies (communication infrastructure, wireless transmission etc.); computing technologies (ex. cloud computing); cyber-physical systems (additive manufacturing (3D printing); Greens Sensing Virtual Enterprise, digital twins); data analysis and artificial intelligence algorithms (big data analytics, case-based reasoning, data and model integration,

data visualization, dynamic game theory, dynamic programming, evaluation models, fuzzy logic, heuristic algorithms, machine learning, recommender systems, semantic processing, and others); Data Collection and Internet of Things (IoT) (asset tagging, building information modeling (BIM), satellite imaging, GIS, SCADA, and others); data management and storage; software and simulation technologies (digital platforms, PLM systems, simulation technologies, smartphone applications, software tools); smart grids and products.

Regarding data collection and IoT it is noted that among the most widely used technologies are smart tags and radio-frequency identification (RFID) (Demestichas & Daskalakis, 2020). The smart tags are small devices which combine memory, data processing and communication services. Smart tags enable unique identification of items and tracking of the environmental conditions in which a product is maintained. This technology enables improved handling of resources and facilitates decision-making (Gligoric et al., 2019). The RFID tags, have a small microchip and enable identification of objects, using electromagnetic fields (Tuyls & Batina, 2006). Further, IoT is a global network of interconnected objects which have unique addresses and can communicate using standard protocols (Gubbi et al., 2013) and can have a range of implementation in resource management.

Building Information Modelling (BIM) enables creation of an accurate virtual model of a building and simulating all building life-cycle stages. The BIM model does not only represent the building in three dimensions (3D), but adds the dimension of time (4D), costs (5d) etc., providing opportunities for multitude dimensions. The BIM model integrates all building systems and technologies and enables identification of potential design, construction, or operational issues. In this regard, RFID and BIM technologies provide the building elements to be more traceable, adaptable, and reusable in new designs. BIM provide analysis of the disassembly and deconstruction of a building, ensuring efficient materials recovery as well as for checking if building designs are compliant with the concepts of CE (Akanbi et al., 2019).

However, it is noted that there is an insufficient uptake of ICT technologies for CE in construction industry. Authors investigate several challenges in adopting circular ICT solutions, such as (Demestichas & Daskalakis, 2020): consumer attitude, corporate responsibility, cooperation and trust, data uncertainty, economic, environmental impact, information use, lack of capacity, policies, product design and security.

Data uncertainty is identified as another obstacle for the CE. Van Schalkwyk et al. underline that some simulation models are imperfect and need to be enriched with further data (van Schalkwyk et al., 2018). Also, “Noise” in lifecycle big data is noted with a possible negative impact on the accuracy and reliability of decisions (Zhang et al., 2017).

Also, the lack of government laws and regulations is also noted as a barrier in the CE uptake (Rizos et al., 2016). Authors (Watkins et al., 2013) note that current legislation does not adequately support the development of potential symbiotic products that make use of multiple residue streams of industrial processes.

## **CE Business models in the construction industry**

A Business Model (BM) is a sustainable method of conducting a business (Nielsen & Lund, 2014). The successful implementation of the principles of CE, in large part depends on the business models which will be used. As the construction business environment is becoming more competitive, the Circular Economy Business Model (CEBM) are receiving considerable attention. As previously discussed, the implementation of CE in the construction industry imposes reforms in all value chains in the industry.

The distinctions in supply chains between traditional BMs and CEBM arise from the essential processes of closing, slowing, and streamlining material and energy flows (Bocken et al., 2016).

Value in a conventional BM is frequently focused on the financial benefit to investors and clients. In a CEBM, value is viewed more broadly, considering the environment, society, and a more comprehensive range of value chain partners (Huovila & Westerholm, 2022). Even more, the CEBM model needs to be integrated all phases of the building life-cycle, at every stage, from planning and design through construction.

Shafer et al. (Shafer et al., 2005) examined twelve criteria and found forty-two elements categorised as strategic decisions, value networks, and creating and capturing value. Others developed a framework that includes a customer interface, core strategy, strategic resources, and value network (Hamel, 2001).

Researchers propose categorization of existing CEBM in nine categories: product life extension, product as a service, waste as a resource, circular supplies, resource recovery, resell, remanufacture, sharing platforms, and repair (Guerra et al., 2021). Others (Mackebach et al., 2020) identified four CEBMs, refurbishment and reuse, repair and maintenance, product as a service, and upcycling, considering their adaptability, applicability, and usability in modular construction. However, there is a scarce research on CEBM in the construction industry and none of these studies have properly defined or elaborated on the practical applicability of the model (Jayakodi et al., 2024). Therefore, researchers define CEBM from the perspective of a construction organisation (Jayakodi et al., 2024). The organisational aspects are required to ensure the integration of CE in all supply chain processes in the construction.

Also, there is a need to reconsider ownership by introducing new ideas like product leasing or product-as-a-service (Cimen, 2021; Hartwell et al., 2021) as well as to support supply-chain models which encourage stakeholder collaboration and value co-creation (Hossain et al., 2020).

Six elements are identified for CEBM in CI (Jayakodi et al., 2024): value creation, value delivery, value proposition, value capture, the collaboration of stakeholders, and the lifecycle perspective, Figure 1.

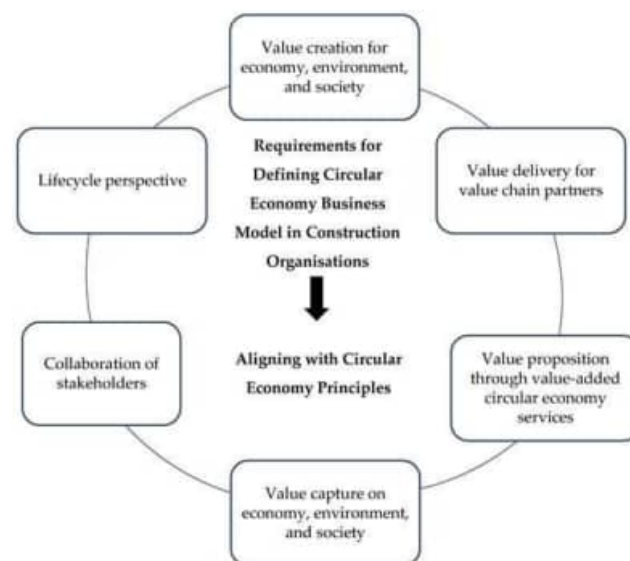


Figure 1. Requirements for defining circular economy business model in construction organisations (Jayakodi et al., 2024)

## Consumer protection in the construction industry

In this section, several challenges are discussed, such as consumer protection in the construction industry, product lifecycle extension through reducing, reusing, and repairing, as well as socio-economic impacts of circular economy practices on consumer rights and possibilities for overcoming barriers to CE implementation. In the paradigm shift of sustainability and CE, the consumption behaviour is also changing. The alternative and collaborative ways of consumption, such as sharing, gifting, renting, bartering, swapping, lending, and borrowing are intensifying the use of idle assets, decrease the need for new product purchases, and promote possession reuse (Böcker & Meelen, 2017). Studies show that policy and governance, permits and specifications, technological limitation, quality and performance, knowledge and information, and, finally, the costs associated with the implementation of CE model at the early stage are the main barriers (Purchase et al., 2022), and they note an urgent need to introduce a global framework and a practicable pathway to allow companies to implement such models, regardless of their scale and location.

A considerable number of studies have explored consumer acceptance of remanufactured, refurbished, recycled, reused, or shared products as contributing to past circular strategies relating to slowing or closing the loop (Shevchenko et al., 2023).

The consumer activity that contributes to slowing or closing the material loop can be defined as a CE-oriented consumer activity, and researchers illustrate the tri-dimensional role of consumer activity in the CE model, Fig. 1. (Shevchenko et al., 2023).



Figure 1. Tri-dimensional role of the consumer in the CE (Shevchenko et al., 2023)

Consumer protection as the practice of safeguarding buyers of goods and services, and the public, against unfair practices in the marketplace also needs to deal with the new ongoing tide of CE transformation. While the CE practices hold the potential to significantly reduce the environmental footprint in construction industry, they also raise concerns related to consumer protection (CP). The consumer protection aims to protect consumers against defective goods, unsatisfactory services, unfair trade practices etc.

The CP in the construction industry should be aimed to provide consumers, i.e. property buyers, tenants, and investors, product quality and safety. Recycled and reused materials must meet stringent safety standards to guarantee that buildings constructed with these materials are structurally sound and free from health hazards. For instance, reclaimed wood, recycled concrete, or repurposed steel must be thoroughly inspected for contaminants or defects that could compromise building integrity or occupant safety. Regulators and industry stakeholders must establish robust certification systems and transparent documentation practices to assure consumers of the quality of materials and construction methods employed.

Transparency is another cornerstone of consumer protection in the circular economy. Buyers and tenants need access to detailed information about the materials and methods used in construction projects. Material passports—digital documents that provide comprehensive data about the origin, composition, and lifecycle of building materials—can play a crucial role in achieving this transparency. These passports empower consumers to make informed decisions and hold construction companies accountable for their environmental claims.

Economic considerations also intersect with consumer protection. The adoption of circular practices may lead to cost variations, with some materials or methods initially being more expensive due to limited supply chains or technological constraints. It is vital that consumers are not unfairly burdened with these costs. Policymakers can address this issue by offering subsidies or incentives for sustainable construction practices, thereby balancing affordability with environmental responsibility.

Lastly, legal frameworks must evolve to support consumer protection in the circular economy. Clear guidelines on warranties and liabilities are essential to address potential disputes over the durability and performance of recycled materials. Moreover, regulatory bodies should enforce strict penalties for greenwashing—the practice of misleading consumers about the environmental benefits of a product or service—to uphold ethical standards in the industry.

## **Conclusions**

This research provides a comprehensive overview of the implementation of Circular Economy (CE) principles in the construction sector, with a particular focus on design and construction practices, material reuse, recycling, and innovative business models. Additionally, it investigates the integration of digital tools within the industry, emphasizing the role of Building Information Modelling (BIM) in enabling CE principles and enhancing lifecycle management and resource tracking. The study highlights several key challenges, including consumer protection in the construction sector, strategies for extending product lifecycles through reducing, reusing, and repairing, and the socio-economic implications of CE practices on consumer rights. It also explores pathways to overcome barriers to CE implementation.

The findings of the research underscore the pivotal role of policy frameworks, technological advancements, and cross-sectoral collaborations in fostering systemic change. By adopting strategies such as Design for Disassembly (DfD), adaptability, and materials upscaling, the construction industry can achieve significant reductions in environmental impact. Furthermore, the study emphasizes the need to address specific challenges, such as ensuring consumer protection, extending the lifecycle of construction products, and mitigating socio-economic impacts through equitable and sustainable CE practices.

To successfully adopt CE business models, it is crucial to identify key stakeholders, resources, activities, and services where CE can be effectively implemented. These models should be supported by a circular cost structure and benefit from the integration of digital technologies to facilitate new circular design and construction approaches. The literature reviewed in this study demonstrates that strategies such as adaptability, prefabrication, the use of sustainable and durable materials, and DfD principles are effective in achieving circular buildings. Future research should focus on evaluating the implications of various CE design and construction strategies in terms of consumer satisfaction, acceptance, and protection.

In conclusion, integrating CE principles into the construction industry also requires prioritizing consumer protection as a prerequisite for the widespread adoption of CE practices. Critical aspects such as safety, transparency, affordability, and robust legal frameworks must



be emphasized. These measures will not only strengthen consumer confidence but also propel the construction industry towards a more sustainable and resilient future.

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## MANAGING AGRICULTURAL LAND AND LANDSCAPE IN THE ISLANDS: CHALLENGES AND STRATEGIES

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### 1. Introduction to Agricultural Land

Agricultural land refers to any land used for agricultural activities, including cultivation, grazing and other farming uses. It is a non-renewable natural resource that requires protection to ensure the sustainability of farming practices and food production. Agricultural land is crucial for Greece's socio-economic sustainability, covering 30% of the country's total area, with arable crops, permanent crops, and horticultural land as the main uses (Paschalidis et al., 2021).

According to the Greek Ministry of Rural Development and Food, High-Productivity Agricultural Land (HPAL) refers to areas distinguished by exceptionally high productive capacity, attributed to factors such as soil quality, microclimate, and other natural resources. These areas are legally protected from land-use changes, including urban development and other non-agricultural activities, to preserve their agricultural function and sustainability (Ministry of Rural Development and Food, n.d.).

Thus, the Greek Ministry considers only High-Productivity Agricultural Land (HPAL) worthy of protection. However, we argue that the sustainable management of all agricultural land, rather than solely HPAL, is fundamental for territorial cohesion, the preservation of cultural heritage within local communities, and the promotion of sustainable development. A broader approach to agricultural land management is essential for ensuring environmental quality, cultural heritage conservation, and social well-being (Fazekaov, 2012; Kuzmich, 2022). This article further aims to explore the role of landscape as a multidimensional conceptual tool for protecting high-value agricultural land, integrating landscape-based methodologies into spatial planning, and enhancing sustainability within the framework of the European Landscape Convention (ELC).

### 2. Legislative Framework on High-Productivity Agricultural Land in Greece

The existing legislative framework concerning HPAL in Greece primarily addresses construction regulations and photovoltaic (PV) installations, without providing a comprehensive approach to broader land-use and environmental considerations. Over time, legislative amendments have introduced exceptions and allowances, often prioritizing economic interests over the long-term sustainability of agricultural landscapes.

### 2.1. Construction Regulations

The legal provisions governing construction on HPAL have evolved, gradually allowing for specific exemptions to the initial strict protection measures:

- Law 2945/2001 establishes that "any activity other than agricultural exploitation is prohibited" on designated HPAL.
- Law 3399/2005 introduces an exemption, excluding land within 600 meters of provincial road axes from HPAL classification.
- Law 4178/2013 further relaxes restrictions by permitting construction and building permits for properties within HPAL, provided they have frontage on national, provincial, or municipal roads or are located within 200 meters from the axis of national and provincial roads and 150 meters from the axis of municipal roads.
- Law 5087/2024 reinforces HPAL protection by mandating continued agricultural activity and requiring a study to define the plant species and cultivation conditions for the land in question.

### 2.2. Regulations on Photovoltaic Installations

Despite the formal protection of HPAL, legislation has progressively allowed for the installation of photovoltaic stations, subject to certain limitations:

- Law 3851/2010 permits PV installations on HPAL, restricting their total coverage to no more than 1% of the total cultivated land in each regional unit.
- Joint Ministerial Decision (JMD) YΠEN/ΔΑΠΠΕΕΚ/74123/2971/2020 (Government Gazette 3149/B/2020) allows PV stations up to 1 MW on HPAL, maintaining the 1% cap, except in Attica and the islands, where the limit is 0.5%.
- JMD YΠEN/ΔΑΠΠΕΕΚ/104605/4389 (Government Gazette 5342/B/2022) reduced the threshold in October 2022, setting a 0.8% limit for mainland Greece, while keeping the 0.5% restriction for Attica and the islands.

The scope of legislation remains narrowly focused on construction and photovoltaic installations, largely disregarding broader agricultural, environmental, and landscape concerns. While HPAL is granted legal protection, the emphasis is placed on intensively cultivated land, overlooking high-nature-value agricultural systems such as low-intensity cropping, pastures, and agroforestry areas. As a result, the regulatory framework reflects a prioritization of economic activities over a holistic approach to agricultural land management, failing to recognize the ecological and cultural significance of diverse agricultural landscapes.

### 2.3. The Only Comprehensive Legislation on HPAL

Apart from construction and PV-related regulations, the only legislative framework explicitly classifying and assessing HPAL is Joint Ministerial Decision 168040/2010 (Government Gazette 1528/B/2010). This decision classifies agricultural land into productivity categories based on two types of criteria:

- Productivity criteria:



- Presence of irrigation or existing (or planned) land consolidation projects.
- Environmental criteria:
  - Formation of natural units with local characteristics and multiple uses.
  - Traditionality and uniqueness of crops, special soil composition.
  - Insularity, recognizing the specific role of agricultural land on islands.
  - Proximity to protected areas (e.g., NATURA 2000).

This framework attempts to prioritize land protection based on both productive potential and broader spatial, social, ecological, and cultural values. However, even the wording of the Joint Ministerial Decision reflects a bias toward productivity criteria, emphasizing economic considerations over environmental and cultural significance. Notably, one year later, proximity to protected areas was removed from the list of criteria, weakening the framework's environmental safeguards. Furthermore, while areas meeting productivity criteria are clearly defined, no official delineation exists for environmental criteria, making them impractical to implement and easy to overlook.

The evolution of legislation regarding HPAL indicates that legal protection remains limited and conditional, with a strong bias toward economic productivity. While regulatory measures exist, they primarily focus on intensively cultivated land, construction allowances, and renewable energy development, largely neglecting high-nature-value agricultural systems, such as low-intensity cropping, pastures, and agroforestry areas. As a result, land-use policies fail to integrate a holistic perspective, prioritizing short-term economic gains over long-term environmental sustainability, cultural heritage preservation, and landscape resilience.

### 3. Effectiveness of Protection of Agricultural Land

Agricultural land in Greece is undergoing significant transformation, with vast areas being converted into urban land. This process not only affects agricultural production but also disrupts biodiversity and the cultural heritage associated with rural landscapes. The loss of meadows and shrublands, areas that are often used as pastures, exacerbates the degradation of the rural environment, particularly on the Greek islands, where agriculture has long been a cornerstone of local economies and cultural practices.

The Greek rural landscape is under attack from a variety of multi-dimensional threats, which collectively contribute to the decline of agricultural spaces. The major forces reshaping the rural environment include:

1. *Urbanization*: The expansion of real estate development, including the rise of second homes and various constructions, leads to the rapid conversion of agricultural land into urban areas (Stathakis, and Baltas, 2024; Zambon, et al, 2018). This not only reduces land available for agriculture but also fragments ecosystems (Salvati, 2016).
2. *Industrialization and Land Grabbing*: The increasing demand for industrial development and land grabbing often results in the exploitation of rural areas for non-agricultural purposes. Pollution from industrial activities and the uncontrolled installation of industrial wind parks and photovoltaic systems on agricultural land lead to unfavourable consequences for local communities and the environment (Kati et al, 2023; Siamanta, 2019).
3. *Touristification*: The rapid growth of mass tourism in many Greek islands has intensified the pressures on rural spaces. While tourism brings economic benefits, it also leads to the over-exploitation of land for tourist facilities, transforming agricultural land into tourist infrastructure, thus reducing the capacity for food

production and local sustainability (Sarantakou & Terkenli, 2019; Lagarias et al, 2023).

4. *Erosion, Land Degradation & Desertification*: Soil erosion, land degradation, and desertification are significant challenges facing Greek agricultural land, particularly in areas exposed to overgrazing and poor agricultural practices. These processes contribute to the decline of land quality, affecting agricultural productivity and ecological resilience (Cherif et al, 2023; Paschalidis et al., 2021)
5. *Climate Change and Poor Protection Measures*: Climate change exacerbates existing vulnerabilities, contributing to more extreme weather events, such as droughts and floods, which negatively impact agricultural productivity. The ineffective implementation of protection measures, combined with a lack of comprehensive land-use planning, further undermines the sustainability of agricultural land (Gklavopoulos, et al, 2024; Kalogiannidis, et al, 2023).

Given the multitude of threats facing Greek rural spaces, a critical question arises: “Is the Greek rural space merely a sum of plots that can be built upon indiscriminately?” This question underscores the growing tension between the economic pressures to develop rural areas and the need to preserve agricultural landscapes that are vital for food security, ecological balance, and cultural heritage. The unchecked conversion of agricultural land into urban and industrial spaces is not just a land-use issue, but a societal challenge that requires urgent attention to protect the environmental, cultural, and economic values embedded in rural spaces.

Focusing solely on productivity as a selection criterion for agricultural land protection overlooks significant areas that provide essential ecosystem services and possess diverse cultural, ecological, and socio-economic values. This narrow approach risks neglecting multifunctional landscapes that contribute to biodiversity, water regulation, and cultural heritage. A more comprehensive framework is needed, incorporating additional criteria that reflect the multifunctionality of agricultural landscapes. Existing quasi-operational criteria, such as those related to biodiversity and water resources (Dimopoulos et al., 2020), offer a foundation for expanding the assessment framework. Prioritizing land based on multiple values rather than productivity alone is crucial for sustainable landscape management and informed policy decisions.

#### **4. Agricultural Land: A Rural Landscape Matter**

The protection of agricultural land is inherently linked to the broader challenge of safeguarding, managing, and planning the rural landscape. A comprehensive approach to agricultural land protection must go beyond productivist criteria and incorporate ecosystem services, cultural heritage, and landscape values. However, two common concerns arise when expanding these criteria:

- a) the absence of formal delineation and
- b) the lack of an established assessment or classification process.

While robust methodologies already exist for evaluating biodiversity and water management, landscape remains a critical yet often overlooked factor. The rural landscape plays a fundamental role in shaping cultural identity, particularly in island regions where the smaller scale of landscapes makes agricultural areas with traditional crops and practices even more significant. These landscapes not only support biodiversity and ecological functions but also preserve cultural heritage and maintain a sense of place for local communities (Meinig, 1979).

In the following discussion, we will focus on the role of landscape in agricultural land protection

Landscape serves as a medium through which the relationship between humans and space is depicted, demarcated, manifested, and expressed (Pavlis and Terkenli, 2023). It functions as both a cultural reflection and a palimpsest, where historical, cultural, and environmental transformations accumulate over time, revealing the evolution of land use and its associated meanings. Beyond its physical form, landscape embodies a complex interplay of relations, images, ideas, and values—ranging from aesthetic and historical to ecological and national significance (Wylie, 2007).

In rural contexts, landscapes contribute to tourism by shaping visitors' experiences and reinforcing local identity. The protection of agricultural land is thus critical, not only for preserving rural landscapes but also for fostering sustainable tourism development through its link to local production (Carneiro, et al, 2015). However, rural landscapes are subject to continuous transformation due to shifts in agricultural and forestry practices, industrial and extractive activities, spatial and urban planning, infrastructure expansion, and tourism development. These forces accelerate landscape change, underscoring the need for effective management and policy interventions (Primdahl, 2014).

## **5. The Landscape Concept**

Historically, the term landscape has been associated with physical land and territorial organization, with definitions referring to a collection of lands, an organized system of rural spaces, a piece of plowed land, or the extent of immovable property of a village (Pavlis, 2012). These older definitions primarily emphasized land ownership, use, and management within agrarian societies.

In more recent conceptualizations, the meaning of landscape has evolved significantly. The transition from the natural to the visual perspective positioned landscape as an image or scenic view, reflecting a way of perceiving and representing the world (Cosgrove, 1984). However, contemporary theories have moved beyond this visual representation toward an experiential understanding of landscape. This shift redefines landscape as dwelling, emphasizing its role as a lifeworld shaped by human interactions. This perspective introduces the concept of landscaping—a dynamic process shaped by embodied acts such as walking, cycling, driving, climbing, and gardening, reinforcing the idea that landscapes are continuously created and lived rather than merely observed (Wylie, 2007).

## **6. Landscape and Ecosystem: Interconnected Realities**

Landscape embodies the intersection of nature and culture, forming an integral part of everyday life that is experienced through all senses. It encompasses both material and intangible dimensions, reflecting historical, ecological, and socio-cultural values. Strongly influenced by scale, landscape is recognized as a public good and a valuable resource, inherently linked to quality of life. Its significance extends beyond aesthetics, involving both rights and responsibilities for individuals and communities.

Similarly, an ecosystem consists of living and non-living elements that interact within a dynamic regulatory framework. While ecosystems possess mechanisms for maintaining stability, they remain vulnerable to human interventions that can either sustain or disrupt their balance. In particular, small-sized island ecosystems exhibit heightened sensitivity to external pressures such as environmental degradation, climate change, and unsustainable development.

Recognizing the interdependence between landscape and ecosystem is essential for ensuring sustainable management and resilience in both natural and cultural contexts.

## **7. Landscape and Policy**

During the 2023-2027 period, the Common Agricultural Policy (CAP) is organized around ten main objectives that address social, environmental, and economic goals. These objectives form the foundation of the Strategic Plans developed by EU countries for the CAP.

Among the key goals are:

- Support for maintaining agricultural activity across regions, especially for the smaller Aegean islands.
- Incentives for the cultivation of threatened species facing genetic erosion.
- Subsidies aimed at landscape protection, particularly for unique agricultural landscapes such as the vineyard of Santorini and the maintenance of terraced cultivation systems.
- Funding for the construction and restoration of agricultural terraces.
- Preservation of high natural value agricultural systems and landscapes.

Additionally, the concept of Globally Important Agricultural Heritage Systems (GIAHS), as defined by the United Nations Food and Agriculture Organization (FAO), recognizes landscapes of outstanding aesthetic and cultural value that serve as multifunctional ecosystems. These landscapes provide essential goods and services, supporting millions of smallholder farmers worldwide. GIAHS areas face threats from climate change, economic unsustainability, loss of biodiversity, and abandonment of traditional farming practices, yet they also serve as sources of agricultural innovation and cultural preservation.

In this context, the European Landscape Convention (ELC) emphasizes the need for landscape protection, management, and planning. The landscape is not only a natural and cultural asset but also a common good that belongs to everyone, ensuring quality of life through public participation and the acknowledgment of shared rights and responsibilities. The character of a landscape, as defined by the Council of Europe (Florence 2000) and Greek Law 3827/2010, results from the interaction between natural and human factors, emphasizing the need for integrated management approaches.

## **8. Landscape Policy & Methodology**

An effective practice for protecting High-Value Agricultural Land (HVAL), which provides essential ecosystem services, can be achieved through the implementation of the ELC. "Landscape policy" refers to the principles, strategies, and guidelines developed by competent public authorities to guide the protection, management, and planning of landscapes (CoE, 2000)

A critical step in the ELC's implementation was the inclusion of the Landscape Parameter in 12 Regional Frameworks for Spatial Planning and Sustainable Development through the addition of Special Sections for Landscape (2014-2015). These sections categorized landscapes into different zones, based on qualities such as aesthetic and natural beauty, recognizability, and rarity, alongside already recognized protected elements. They also involved the documentation of landscape characteristics, landscape values, the identification of threats, and proposals for protection and management measures (Kyvelou & Gourgiotis, 2019).

The ELC advocates for the creation of new institutional tools dedicated to landscape protection, management, and planning across Europe. Landscape Character Assessment (LCA) is a systematic process used to identify, describe, and map distinct landscape characteristics,

offering a framework for landscape management and conservation while preserving unique character.

LCA involves observing and recording aesthetic and experiential qualities, identifying landscape types and areas, and engaging stakeholders through consultations. The process aims to recognize the intrinsic value of landscapes without making subjective judgments about their quality. Key components analyzed in LCA include landforms, land cover, settlement patterns, hydrology, cultural context, aesthetic factors, and socio-cultural influences. LCA also considers distinctiveness and scalability, making it an important tool in understanding public perceptions of landscapes, influencing decisions related to land use, conservation, and development (Senetra et al. 2015; Smyth 2011).

## **9. Example of Methodology Application**

Gkoltsiou, Athanasiadou, and Paraskevopoulou (2021) present a methodological framework based on theories and applications involving Landscape Character Assessment (LCA), Globally Important Agricultural Heritage Systems (GIAHS), and UNESCO World Heritage Cultural Landscapes. This framework integrates knowledge from geography, landscape architecture, and landscape ecology.

The proposed criteria cover both natural and cultural landscape factors, including morphological and functional aspects, and values related to biodiversity, ecosystem services, and land and water management. It also encompasses aesthetic beauty, sustainable food practices, cultural values, traditional agricultural systems, cooperative structures, rules and regulations, and customs such as religious ceremonies and traditions.

To evaluate the applicability of these criteria, a comparative analysis was conducted using three Greek case studies: the mastic cultivation landscapes of Chios, the raisin vineyards of Aigialeia, and the olive groves of Thassos. This analysis aimed to identify strategic steps for applying the framework in real-world settings.

## **10. Conclusions**

Agricultural land is a critical resource, providing a range of ecosystem services, yet its loss continues, with protection primarily granted to highly productive land. However, the current institutional protection mechanisms fall short in addressing the complexities of land use planning. A multidimensional conceptual tool, such as landscape, is needed to offer a more comprehensive approach to land protection.

The concept of landscape has evolved from a static "image" to a dynamic "experience," with actions like walking, cycling, driving, and gardening playing a role in shaping the landscape as a "lifeworld". There are methodologies available for applying landscape criteria and developing policies, particularly within the framework of the European Landscape Convention (ELC), which could be adapted to the Greek context, especially on its islands.

Agricultural ecosystems not only offer vital ecosystem services but also constitute significant rural landscapes, which are particularly vulnerable on islands where the smaller scale of landscapes makes them more sensitive. While providing incentives for agricultural conservation is helpful, it does not address broader external pressures such as urbanization and tourism. Therefore, there is a need to combine regulatory measures with existing incentives, such as those provided by the Common Agricultural Policy (CAP), while focusing on stricter, more integrated strategies. Prioritizing additional criteria and regulations could help ensure more effective landscape management, and there is a pressing need for Greeks to



reconnect with their landscapes and rediscover them as "places of life" before they are irreversibly lost (Terkenli, 2005).

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## **CARBON FARMING IN FORESTRY AND CARBON STORAGE IN WOOD PRODUCTS. THE NEW CERTIFICATION FRAMEWORK AND THE POTENTIALS FOR THE RELATED MARKETS**

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### **Abstract**

The EU is committed to achieving climate neutrality by 2050 to ensure a sustainable future. The most urgent priority remains the reduction of greenhouse gas emissions. At the same time, the EU must compensate for remaining emissions that cannot be eliminated by scaling up carbon sinks by absorbing carbon dioxide from the atmosphere.

Carbon credits are a type of market-based instrument that allows stakeholders to address greenhouse gas emissions by financing projects that reduce or remove carbon dioxide or other harmful greenhouse gas (GHG) emissions from the atmosphere. The goal of carbon credits is to create a financial incentive for businesses and governments to reduce their carbon footprint and invest in cleaner, more sustainable practices. The carbon market is a system of buying and selling carbon credits. There are several types of carbon markets, including:

- Compliance-based Carbon Markets (CCMs).
- Voluntary Carbon Markets (VCMs).

A harmonized Union certification framework was recently issued to address the above issues. The framework is expected to enhance the environmental integrity and transparency of permanent carbon removals, carbon farming and carbon storage in products, while reducing the associated administrative costs.

This paper is a theoretical approach that explores the potential that the above framework offers in trying to integrate Greek forest land, as well as long-term carbon storage in wood products, into mandatory and voluntary carbon credit markets, through optimized forest management and carbon dioxide (CO<sub>2</sub>) storage and the required collaborative ecosystem of forest owners, public and private, in the forestry sector.

**Key words:** Carbon removals, carbon markets, forestry, wood products, certification framework

## Introduction

Climate change is one of the greatest challenges of our time, with carbon dioxide (CO<sub>2</sub>) emissions contributing significantly to global warming. Forests play a key role as natural carbon sinks, absorbing CO<sub>2</sub> from the atmosphere and thus contributing to climate change mitigation. However, the accurate recording, monitoring and certification of carbon removals from forests remains a very complex and costly process, resulting in limited utilisation of carbon markets, especially in Greece. The EU is committed to achieving climate neutrality by 2050 to ensure a sustainable future for our continent and our planet. The first and most urgent priority remains the reduction of greenhouse gas emissions (GHG's). At the same time, the EU must compensate for remaining emissions that cannot be eliminated by scaling up carbon removals or, in other words, by absorbing carbon dioxide (CO<sub>2</sub>) from the atmosphere (EC, 2019).

Carbon Dioxide Removals (CDRs) refer to the process of removing CO<sub>2</sub> from the atmosphere through anthropogenic activities. Since this is the opposite of emissions, practices or technologies that remove CO<sub>2</sub> are often described as achieving 'negative emissions'. The process is sometimes more broadly referred to as greenhouse gas removal if it involves the removal of gases other than CO<sub>2</sub>. There are two main types of CDR: either enhancing existing natural processes that remove carbon from the atmosphere (e.g. by increasing its uptake by trees, soil or other 'carbon sinks') or using chemical processes to capture, for example, CO<sub>2</sub> directly from the atmospheric air and store it elsewhere (e.g. underground). All CDR methods are at different stages of development (E.C., 2024).

Carbon credits are a type of market-based mean that allows companies, governments and other organizations to address greenhouse gas emissions by financing projects that reduce or remove carbon dioxide or other harmful greenhouse gas (GHG) emissions from the atmosphere (Trouwloon, et al. 2023; Freedman and Keith, 1996). The goal of carbon credits is to create a financial incentive for businesses and governments to reduce their carbon footprint and invest in cleaner, more sustainable practices. The carbon market is a system of buying and selling carbon credits. There are several types of carbon markets, including (EU ETS, 2025; Calel, 2013; Stephan and Paterson, 2012; Convery, 2009):

- Compliance-based Carbon Markets (CCMs).

CCMs have arisen from the need to comply with national, regional and/or international policy or legal requirements as a result of commitments made by countries to reduce their emissions under international agreements or treaties. CCMs are regulated by law and therefore operate on a mandatory basis, as participating organizations, i.e. companies and governments, have a legal obligation to offset their emissions. Emission permits are allocated according to a schedule and can be auctioned or purchased by other equivalent organizations.

- Voluntary carbon markets (Voluntary Carbon Markets or VCMs).

VCMs are supported by non-state actors and enable companies to take the initiative to voluntarily reduce their own carbon footprint beyond what is required by law. Rather than being driven by international regulations or agreements, the voluntary purchasing 'movement' was created so that companies can join the effort to address climate change by offsetting the greenhouse gas emissions they cause, alongside the direct emissions reductions they implement in their production chain. With increased investment demand for actions with a positive environmental footprint supported by scientific evidence, VCMs have emerged as fast-growing markets. By investing in carbon reduction projects, companies can issue Voluntary Carbon Offset Credits, which can then be offered through VCMs to companies that need to reduce their own carbon footprint, or to investors seeking rewarding and sustainable investments.

Voluntary Carbon Offset Credits (VCCs) can be generated by various types of projects that reduce greenhouse gas emissions, including:

- Projects related to nature-based solutions: enhancing the capacity of natural ecosystems to sequester CO<sub>2</sub> or reversing ecosystem degradation to prevent the release of carbon into the atmosphere. Typical examples include reforestation and sustainable forest management efforts.
- Blue carbon projects: They focus on coastal ecosystems such as mangroves, seaweed and reefs. These ecosystems store large volumes of carbon within marine flora and sediment.
- Agricultural projects: improve land management practices to reduce emissions and enhance carbon removal in the soil.
- Green-green infrastructure projects: 'integrate' nature into urban and rural lands.
- Technology projects: rely on technology to reduce emissions, such as renewable energy initiatives, direct atmospheric carbon capture technologies, energy efficiency improvement projects, fuel switch projects and efficient waste management.

Carbon pricing is a central element of the EU's successful and ambitious climate policies, implemented through the EU Emissions Trading Scheme (EU ETS). Greenhouse gas pricing is a fair and cost-effective way to reduce greenhouse gas emissions by penalising polluters and providing incentives to invest in clean technologies. Carbon pricing also generates revenue for public sector investment in climate action. Since the introduction of the EU ETS in 2005, emissions in the sectors covered have fallen by more than 37 %. In addition, revenues from the EU ETS have amounted to €175 billion. Since 1990, total EU emissions have fallen by 32.5 %, while our economy has grown by around 65 %, showing that we have succeeded in decoupling economic growth from emissions. Emissions trading will soon be applied to new sectors in Europe under recently agreed reforms, with an extension to maritime and aviation transport, and later to fuels for buildings and road transport.

For the relevant market to work, there will need to be the development of an adapted certification method for the resulting carbon capture activities. This approach was adopted by the European Parliament in November 2023 with the Carbon Removals Certification Framework - Final adoption 6/11/2024 (EC, 2024). The voluntary framework aims to facilitate and accelerate the development of high-quality carbon removal and land-based emission reduction activities in the EU.

However, in Greece, the regulatory framework for the integration of private forests into the carbon market remains unclear and limited. Small and medium forest owners face high costs and complex certification and verification procedures, which limits their ability to participate in the carbon market. At the same time, the lack of transparency and credibility in voluntary carbon markets, such as double counting of removals, undermines buyer confidence, leading to price volatility and limited demand.

### **Certification of carbon removals for carbon credits**

The agreement extends the scope of the regulation to land-based emission reductions and maintains an open definition of carbon removal, in line with that used by the UN Intergovernmental Panel on Climate Change (IPCC). It also distinguishes between the following carbon removal and emission reduction activities and four corresponding types of units (EC, 2024):

- permanent carbon removal (storage of atmospheric or biogenic carbon for several centuries)

- temporary storage of carbon in long-life products (such as wood-based construction) for at least 35 years and which can be monitored on site throughout the monitoring period
- temporary carbon storage from carbon farming (e.g. forest and soil restoration, wetland management, seagrass meadows)
- reduction of soil emissions (from carbon farming), which includes carbon and nitrous oxide reduction from soil management and, where these activities lead to an overall improvement of the soil carbon balance, wetland management, no tillage and cover cropping practices combined with reduced fertiliser use, etc.

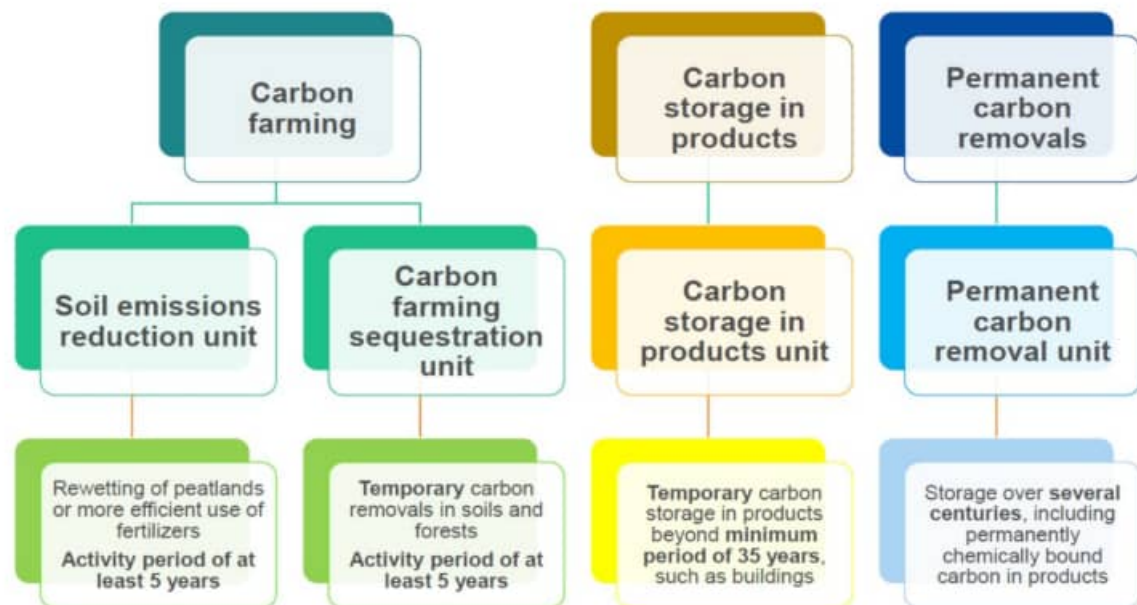


**Figure 1:** Carbon removal activities (Source: European Commission, DG CLIMA, Unit C3 -5th Meeting of the Carbon Removals Expert Group)

More generally, in line with the relevant EU Regulation to ensure the quality and comparability of carbon removals, we have a first EU-wide voluntary certification framework for carbon removals. The proposal sets out requirements for third-party verification and certification of carbon removals, the management of certification schemes and the operation of registries. Four Q.U.A.L.I.T.Y criteria are established (EC, 2024):

- **QUantification:** carbon removal activities must be accurately measured and yield indisputable carbon removal benefits. The additional carbon removals produced by an activity (compared to a baseline) should exceed any greenhouse gas emissions produced as a consequence of the implementation of the activity throughout its life cycle. The 'net carbon removal benefit' should be quantified in a reliable and accurate manner. In the context of carbon removal agriculture, the quantification of the benefit in terms of net carbon removal can be done in a cost-effective way by using empirical data, remote sensing technologies (e.g. Copernicus) and highly accurate models based on machine learning and artificial intelligence. The acquisition of climate-relevant data compatible with electronic maps will also contribute significantly to improving the quality of national GHG inventories for the LULUCF (land use, land use change and forestry) sector and will improve the quality of forest monitoring activities under the forthcoming proposal for a regulation on forest monitoring.

- **Additionality:** carbon removal activities should go beyond existing practices and legal requirements. The preferred way of demonstrating additionality is to establish a 'standard' baseline that accurately reflects the normal practices, regulatory and market conditions under



which the activity takes place. A standardized baseline facilitates cost-effective and objective demonstration of additionality and has the advantage of recognizing the early efforts of land managers and industries that have already been involved in carbon removal activities in the past. To ensure ambition over time, the standardized baseline should be updated periodically.

- Long-term storage: carbon removal activities should ensure that the carbon sequestered is stored for as long as possible and that the risk of carbon release is minimized. The certificates will clearly indicate the duration of the carbon storage and distinguish between permanent and temporary storage. The release risk varies between carbon removal activities. Therefore, the risk should be monitored and mitigated, and operators should be held responsible through specific liability mechanisms in the event of a carbon release. In addition, certificates should transparently indicate an expiry date which depends on the release risk of each type of carbon removal. In this way, the proposal distinguishes between technologies that ensure permanent carbon storage (for which there should be no expiry date) and temporary carbon removals (e.g. from carbon farming and carbon storage in products). Thanks to these rules, providers of temporary carbon removal services will be subject to more realistic commitments that do not prevent adoption, while having an incentive to continue carbon removal activity in order to be recertified.

- Sustainability: carbon removal activities should have a neutral impact or produce co-benefits for other environmental objectives such as biodiversity, climate change adaptation, greenhouse gas emission reduction, water quality, zero pollution or the circular economy. For example, industrial solutions such as BECCS should not lead to unsustainable biomass demand. The Commission will prioritize the development of adapted certification methodologies for carbon removal activities that provide significant co-benefits for biodiversity. At the same time, practices such as monoculture forestry, which have harmful impacts on biodiversity, should not be eligible for certification.

To apply for certification of compliance under the Regulation, an operator or a group of operators applies to a certification scheme. Upon acceptance of that application, the operator or group of operators shall submit to a certification body a plan of activities including evidence of compliance and the expected net benefit in terms of carbon removal or the expected net benefit in terms of soil emission reduction resulting from the activity, and a monitoring plan. The certification scheme shall designate a certification body to carry out a certification audit to verify that the information submitted is accurate and reliable, and to confirm the compliance of the activity. At least every five years, or more frequently if specified in the applicable certification methodology based on the characteristics of the activity concerned, the certification body shall carry out recertification audits to reconfirm the compliance of the activity and to verify the net carbon removal benefit or the net soil emission reduction benefit resulting from the activity (EC, 2024).

Certification bodies designated by certification schemes shall be accredited by a national accreditation body or recognized by a national competent authority as competent to cover the scope of this Regulation or the specific scope of the certification scheme. Certification bodies (EC, 2024):

- are responsible for carrying out the certification audit and the re-certification audit;
- be legally and financially independent of an operator or a group of operators; and
- carry out in the public interest the activities required under the Regulation.

The EU Commission shall establish by 2028, and thereafter duly maintain, a Union registry for permanent carbon removal, carbon removal agriculture and carbon storage in products, with a view to making information related to the certification process publicly available in an accessible manner. Certified units shall be issued once and shall not be used by more than one natural or legal person at any time. Permanent carbon removal units, product



carbon storage units and soil emission reduction units shall remain distinct from each other (EC, 2024).

### **The role of forests and wood products**

Forests can make a substantial contribution to this market as they are the most important carbon pool with a constant potential for improvement. In combination with agriculture, products, and construction (especially wood) a significant potential for carbon sinks can be developed with multiple benefits for companies - investors - cooperatives with additional revenues. There is a very high demand for carbon sinks especially from carbon removal projects and investments in the primary sector.

Carbon is stored in the aboveground biomass of plants (stems, bark, leaves, branches, understorey), underground (roots, stumps), in forest soil but also as leaf litter and dead wood. A much larger amount is stored in soil than in biomass. The stored carbon is associated with the wood stock (i.e. the woody capital). To do this, the wood stock is converted to aboveground biomass in tons of dry mass using BCEF (Biomass Conversion and Expansion Factors) factors according to IPCC 2006 (Guidelines for National Greenhouse Gas Inventories) and IPCC 2019. These factors take into account branches, leaf litter and shrub understorey as well as wood density in different forest types. The biomass is converted into stored carbon with the so-called carbon fraction, which according to the above-mentioned source is 0,47. Thus, according to the Forest Europe 2020 report on European forests, the total carbon storage capacity for forest biomass (above and below ground) in the forests of Southeast Europe is estimated at about 41.6tn/ha. Also, according to the same report, the wood stock of Greek forests is about 47m<sup>3</sup>/ha. From the above it can be generally concluded that a total of about 100-160mt of carbon is stored in the Greek forests, as the area of forests and woodlands is about 3.9 million ha. According to relevant research in Greece (Pappas et al, 2015), and considering the CO<sub>2</sub> uptake per area occupied by forest types, the storage (CO<sub>2</sub>/ha), in aboveground and belowground biomass, was significantly higher in deciduous broadleaf species than in coniferous and evergreen broadleaf species by 26.7 and 36.1%, respectively. In terms of annual uptake, it was significantly lower in coniferous species by 55.7 and 47.2% respectively compared to deciduous and broadleaf species. These differences could be attributed to the different physiology, growth mode (fast-growing, slow growing), allometry, density and chemical composition of the biomass, which characterize the functional groups of forest species. The influence of the forest species on both the storage and annual uptake of atmospheric carbon dioxide is important.

Examples of effective carbon farming practices according to the European Commission include afforestation and forest management that respect biodiversity-friendly ecological principles and enhanced sustainable forest management, including biodiversity-friendly practices and forest adaptation to climate change.

Focusing on forests, carbon foresight refers to the management of carbon pools, such as forests, and greenhouse gas flows at the forest farm level, to mitigate climate change. This includes the management of both land and livestock, all carbon pools in soils, materials and vegetation, as well as carbon dioxide (CO<sub>2</sub>) and methane (CH<sub>4</sub>) and nitrous oxide (N<sub>2</sub>O) fluxes. Carbon forestry is a land management concept that first gained global interest after the Kyoto Protocol (KP) entered into force in 2004. In recent years, following the Paris Agreement and the recognition of nature-based solutions as key to achieving climate neutrality by 2050 at the latest, interest from the private sector has increased. However, no national or international compliance system has recognized mitigation outcomes from action under land use, land use change and forestry (LULUCF) in the form of credits.

In the EU, Regulation 2018/841 on LULUCF to meet the objectives of the Paris Agreement, the European Green Deal from 2019 and the new European Forest Strategy changed the framework. The Farm to Fork Strategy, the Circular Economy Package and the Fit for 55% program make it clear that the land sector needs more and better incentives to manage carbon emissions in order to drive the necessary transformation towards 2050. Improved understanding and implementation by land managers and in carbon forestry will be a critical factor, along with a strong and transparent governance system that sets out common and clear rules for monitoring, reporting and verification and the use of results from carbon 'farming' activities.

A holistic approach is required that considers carbon storage in forest biomass, soil and wood products, substitution effects, and potential leakage effects. In addition, sustainable, climate-smart forest management must secure current and future supplies of raw materials, protect, and enhance biodiversity and maintain soil and water quality, for a balanced contribution to all ecological, economic and social functions. In managed forests, carbon removal should be enhanced by stimulating forest productivity (e.g. selection of species and tree origin, thinning and harvesting regimes) and by enhancing the resilience of forests to climate change (e.g. increasing species diversity). This should be achieved through sustainable forest management practices that are local oriented and take into account future climate conditions (EC, 2021).

The Regulation (EU 2018) on land use, land use change and forestry (LULUCF) activities ensure that Member States report and account for changes in carbon stocks not only in forests but also in carbon pools of harvested products, which will be strengthened under the revised regulation proposed as part of the 'Fit for 55 %' package. Logging products in the EU represent an active net carbon sink of around -40 million tonnes of carbon dioxide equivalent (MtCO<sub>2</sub>e)/year, and generate climate benefits through material substitution, with values ranging from -18 to -43 MtCO<sub>2</sub>e/year (E.C. 2020). The longer the life of the product, the more climate change mitigation is favored, which is then reflected in increased net removals in Member States' LULUCF reporting and accounting, and, as it reflects substitution effects, reported and accounted for indirectly as reduced emissions in other sectors.

Forest harvesting and carbon storage should be analyzed in conjunction with the other functions performed by forests. Reducing harvesting increases carbon storage in forest ecosystems in the short term and can bring benefits for biodiversity, soil, and water quality. However, it can jeopardize the economic benefits of forests and the increase in carbon storage is valid until the carbon pool in the forest is saturated. In addition, forest management should also consider that natural disturbances such as storms, fires and pests are expected to increase under climate change conditions, with a direct economic impact in terms of wood applications, and ultimately lead to carbon release into the atmosphere.

We also underline that the market for forest carbon credits using cutting-edge technologies is growing globally. In Greece it is at an early stage, while in Europe and globally initiatives such as Puro.earth in Finland and the Land Life Company in the Netherlands are using advanced technologies such as drones and GIS for carbon capture and credit marketing. Carbon Direct in the UK offers analytics for credit management, while in the US Pachama and VERRA are applying artificial intelligence and geospatial technologies for certification. The global REDD+ program uses remote sensing and lidar to monitor forests.

On the other hand, the sustainable use of wood for materials and products should follow the principles of cascading use (EC, 2018). Cascading use of biomass refers to the resource-efficient and cyclical use of biomass (E.C. 2016). Cascading use of forest woody biomass refers to the practice of utilizing wood and its products in successive stages, maximizing the value of the material and minimizing waste. This approach is fundamental to the development of a cyclical and climate-neutral wood-based bioeconomy, which seeks to keep resources in

use for as long as possible. In this approach, wood is used, reused and recycled, thus extending the life of the material within the system. In addition, wood should be used for products that store carbon for as long as possible and for products that provide large substitution benefits by avoiding emissions. Forest-based bioenergy has a role to play in the transition of the energy sector towards emission-free energy production. When using woody biomass for energy purposes, preference should be given to post-consumer wood and forest residues which are not suitable to produce other materials, and which do not lead to additional harvesting.

According to the European Forestry Strategy (EU 2021), given the increasing and sometimes competing demands on forests, it is necessary to ensure that the amount of wood used remains within the limits of sustainability and is used optimally, in line with the principle of chain of custody and the circular economy approach. This will ensure as far as possible the substitution of circular or non-cyclical materials and products that are fossil-based, long-lived and of greatest value for carbon storage, the circular economy and the bio-economy. It is vital, in building a sustainable and climate-neutral economy, to optimize the use of wood in accordance with the principle of chain of custody, in particular by creating market incentives. This means that wood should be used as much as possible for materials and long-life products to replace carbon-intensive and fossil-based materials and products, for example in buildings and furniture; it is obvious, however, that not every type of wood is suitable for such use. Process innovations in this area can also provide bio-based materials and products with a lower environmental footprint than fossil-based materials and products in the context of the bio-economy.

Short-life wood-based products can also play a role, as a substitute for their fossil-based counterparts. Wood used to produce short-life products as well as for energy production should be based on the type of wood that is unsuitable for long-life materials and products, as well as on secondary woody biomass, such as sawmill by-products, logging residues and recycled materials. Technological advances are already facilitating the processing of woody biomass residues and waste for cyclically innovative materials and products, resulting in the diversification of bio-based products, and providing climate-friendly solutions for new or emerging application areas (E.E. 2021). Respecting the principles of the circular economy is also crucial. Priority should be given to better use, reuse, and recycling of all wood-based products, as enhancing the circularity of products offers the possibility to keep all wood-based products in the economy for a longer period of time for multiple uses (E.U. 2021).

### **Challenges and potentials for related markets**

There is a growing understanding that a rethink of the global economic system is necessary to address the root causes of unsustainable use of natural resources and achieve sustainable development. However, forests and the forest sector are important elements of a sustainable and climate-neutral circular bioeconomy. This is precisely why the role of forests and their products, in particular wood products, are included in all strategy documents for achieving a sustainable and climate-neutral economy, such as the European Green Deal, the Bioeconomy Strategy, the Action Plan for the Circular Economy, the European Forestry Strategy (E.E. 2018; 2019; 2020; 2021) and many others. While forest products can offer benefits compared to the use of non-renewable GHG-intensive materials, there are also potential risks associated with increased production and consumption of forest products. The production and extraction of the raw materials needed to manufacture products has economic, social and environmental impacts. Increased use of forest products raises concerns about increasing pressure on forests and the people who depend on them, which, in the case of unsustainable practices, could potentially lead to forest degradation and ultimately to a loss of biodiversity and a reduction

in carbon stocks and storage. Existing analyses of the life cycle of forest products show that the processing, manufacturing, use and disposal of wood products has climate-related and other environmental impacts.

As mentioned, given the increasing and sometimes competing demands on forests, we need to ensure that the amount of wood we use remains within the limits of sustainability and is used in an optimal way, in line with the principle of chain of custody and the circular economy approach (EU 2021). Respecting the principles of the circular economy is vital. Priority should be given to the best use, reuse and recycling of all wood-based products, as enhancing the circularity of products offers the possibility of keeping all products for a longer period of time in the economy for multiple uses (EU 2021). High ecological value timber should not be used and the wood-based bioeconomy should remain within the limits of sustainability and be compatible with the EU's climate and biodiversity targets for 2030 and 2050. As reported in recent studies (Grassi et al. 2021), in the short to medium term, i.e. up to 2050, the potential additional benefits from harvesting products and material substitution are unlikely to offset the reduction in net forest sink associated with increased logging.

The CRCF would not directly impact on voluntary markets – legally these markets could continue to certify activities according to their own rules, irrespective of the new requirements set by the CRCF. However, the CRCF could have a significant effect on voluntary carbon markets. For the first time, the EU – home of the world's largest carbon market – would set legally binding rules for the certification of carbon removals. Project developers as well as buyers of carbon credits are likely to prefer certification under the CRCF because of its greater legal and political weight and credibility.

The regulation does not regulate the end-use of certified credits, to avoid duplication with horizontal EU legislation on reporting and climate-related claims. Rather, the EU certification framework is intended to help public and private organizations to support their voluntary claims on carbon removal. With certification under today's proposal, carbon farming can provide a new source of income for farmers, foresters and land managers. Carbon removal activities have great potential to offer mutually beneficial solutions for sustainability.

There are various examples of the use of carbon removals for the distribution of subsidies. One example is the EU's Common Agricultural Policy (CAP), which provides subsidies to farmers for various agricultural practices, including those that have positive environmental impacts such as carbon removal through soil carbon sequestration. Another example is the EU's Innovation Fund. Carbon removal technologies, such as direct air capture and carbon mineralization, are eligible for funding under this fund. The UK government's Woodland Carbon Guarantee scheme or the US Department of Agriculture's Conservation Reserve Program are examples from outside the EU. The CRCF could facilitate the distribution of results-based subsidies for certified activities (in contrast to investment subsidies) which provide incentives for the effective implementation of removal activities. Carbon removal certificates can be used for outcome-based rewards from private or public sources. Several examples follow:

- Food companies can reward farmers for higher carbon removals resulting from greater carbon storage in soils or other climate-friendly practices such as agroforestry. While farmers will benefit from additional income, food companies can reliably document their carbon footprint. It will be easier for consumers and investors to compare food companies' climate claims thanks to harmonized certification rules.
- Public authorities or private investors who want to finance innovative carbon removal projects or procure carbon removal - e.g. through reverse public auctions or upfront market commitments - can use the certification rules to better compare bids and reward projects based on the amount of certified removal.



- Regional authorities can finance the creation or expansion of natural parks through the sale of carbon removal certificates, monetizing both climate and biodiversity benefits.
- Construction companies or property owners who invest in the long-term use of more sustainable building materials that remove and store carbon - such as wood-based ones - can earn additional income through the sale of carbon capture certificates. Labelling schemes for sustainable building materials could equally benefit from harmonized certification rules.
- Carbon reduction certificates can be used for results-based funding under EU programs such as the Common Agricultural Policy or the Innovation Fund, or state aid schemes by Member States.
- Certificates can also increase transparency in private markets, such as under the CORSIA (Carbon Offsetting and Reduction Scheme for International Aviation) mechanism for offsetting emissions from international aviation.
- Carbon offset certificates can also help public and private organizations to support credible carbon offset claims and meet high stakeholder expectations that carbon offsets should not be used for "greenwashing", in line with the Corporate Social Responsibility Directive and related sustainability reporting standards.

The challenge that is also posed by the proposed EU framework concerning certification schemes is that they should operate based on reliable and transparent rules and procedures and should ensure the accuracy, reliability, integrity and non-questionability of the information and data submitted by operators, as well as protection against fraud. They should also ensure the correct accounting of certified carbon removal units, by avoiding double counting. To this end, techniques - methodologies for certification, including appropriate standards of reliability, transparency, accounting, and independent verification to be applied by the certification schemes should be developed, while ensuring a cost-effective certification process by reducing unnecessary administrative burden for operators or groups of operators, for small and medium-sized enterprises, including small foresters.

Carbon and nature pricing efforts to address the global climate and biodiversity crisis may not be perfect solutions, but these mechanisms should be strengthened and improved, rather than discarded altogether. Nature and carbon markets could potentially bring new sources of finance, especially from the private sector, to address severely underfunded natural and climate crises. Complex regulatory frameworks, which are necessary to define markets, protect public safety, and achieve societal goals such as environmental justice, may generate costs that reduce or potentially even prevent investment in infrastructure supporting CO<sub>2</sub> utilization markets and can slow down the diffusion of CO<sub>2</sub> utilization technologies needed to support a net-zero future.

All governments should craft regulations that are efficient and clearly communicated to achieve public policy goals while providing a usable framework for participation in CO<sub>2</sub> utilization markets without unnecessarily penalizing the deployment of CO<sub>2</sub> utilization projects across the value chain. The CCRF manages to coordinate the permitting and authorization process for CO<sub>2</sub> utilization projects, guiding developers through the process of dealing with the multiple states and localities to obtain the required permits.

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