Journal of Integrated Information Management

Vol 9, No 1 (2024)

Special issue (Jan-Jun 2024)

ISSN: 2623 - 4629

Journal of Integrated Information & Management

e-Journal

Volume 9 - Number 1: Special Issue / Jan - Jun 2024
https://ejournals.epublishing.ekt.gr/index.php/jiim

Journal of Integrated Information Management

Special Issue

Information technologies, data management, and digital storytelling on heritage tours and trails

Vol. 9 – No 1
Jan – Jun 2024

ISSN 2623-4629 (on-line)

Table of contents

Special issue editorial message

Dear Colleagues,

JIIM, the Journal of Information and Integrated Information Management, is an international, multidisciplinary, peer-reviewed open-access journal that publishes research on all facets of Information Science and Integrated Information Management. Previously hosted by the University of West Attica (UNIWA) at this portal, JIIM has now transitioned to the Greek National Documentation Centre (EKT) ePublishing platform, accessible here.

In recent years, the proliferation of digital cultural products for heritage and historical tours has surged, marking a significant intersection of multiple disciplines and organizations. Exploring the emerging possibilities within information science is crucial as digital and virtual guides, exhibitions, applications, and other tools establish a novel framework for the interplay between historical and contemporary experiences through advanced information technologies. Utilizing databases, network analysis maps, and the broader semantic web, these tools enable the creation of intricate links between sources, events, places, dates, and individuals. This multidisciplinary approach involves a diverse array of collaborators, including memory institutions, universities, research institutions, informal groups, and both for-profit and non-profit organizations, forming a complex network of cooperative endeavors.

The current special issue publishes research papers that explore the convergence of information technologies, data management, and digital storytelling in the context of cultural heritage tours and trails. The rapid advancement of digital technologies has transformed the way we preserve, interpret, and engage with cultural heritage. This issue highlights innovative approaches and case studies that exemplify how these technologies can enhance our understanding and appreciation of cultural heritage.

Together, the six research papers included offer a comprehensive examination of the multifaceted impacts of digital technologies on cultural heritage management and engagement. They provide an in-depth analysis of current methodologies and innovations, addressing both theoretical and practical dimensions. These studies highlight the potential of integrating digital storytelling, data management, and interactive applications to create immersive and accessible heritage experiences. By presenting diverse case studies and approaches, this special issue aims to deepen our understanding of how digital tools can be leveraged to preserve, interpret, and promote cultural heritage across various contexts.

The paper "Enhancing Cultural Heritage through the Integration of Digital Technologies, Arts, and Story-telling" by Polyxeni Mantzou et al. provides an overarching view of how digital technologies and storytelling can synergistically enhance the preservation and dissemination of cultural heritage. The authors discuss various digital tools and artistic practices that can be integrated to create engaging and educational heritage experiences, offering a theoretical foundation and practical insights.

"Digital Cultural Heritage Management for Local Heritage: Overcoming the Barriers to Accessibility through Regional Digital Infrastructures" by Mariana Ziku et al. delves into the challenges and solutions related to making local heritage accessible through regional digital infrastructures. This paper examines technical and organizational barriers and proposes strategies to overcome them, ensuring wider accessibility and engagement with local heritage sites.

In "OpenLab Evaluation of CAnTi: Advancing Conservation of Ancient Tiryns through Virtual and Mixed Reality Interactive Applications," Markos Konstantakis et al. present a case study on the use of virtual and mixed reality applications to enhance the conservation and public engagement of Ancient Tiryns. The authors evaluate the effectiveness of these applications in communicating conservation efforts and enhancing visitor experiences, offering valuable insights into the intersection of technology and heritage conservation.

The fourth paper by Angeliki Antoniou et al. explores the Digistoryteller project, which uses digital storytelling to document and share the experiences of refugees of 1922-1924 in Attica. Combining walking tours with multimedia narratives, the project creates an immersive and empathetic experience for participants, highlighting the potential of digital storytelling in social and cultural contexts.

"Unveiling Urban Narratives: eLEONAS ppWebGIS - A Multifaceted Digital Storytelling Journey through Eleonas" by Giorgos Velegrakis, Theodoros Vakas, and Antonis Faras introduces the eLEONAS ppWebGIS project, which uses digital storytelling and webGIS technologies to explore the urban landscape of

Eleonas. The project highlights the social, architectural, and environmental narratives of the area, engaging the public in a participatory exploration of its transformation, and demonstrating the power of digital tools in urban heritage storytelling.

Finally, the last research paper by Georgios Dermitzoglou examines the role of cultural routes and activities in showcasing sepulchral heritage, focusing on the Anastasis Cemetery in Piraeus. This study gathers and analyzes audience opinions to understand how these routes can enhance public engagement and appreciation of sepulchral sites, offering insights into public perceptions of heritage and its presentation.

We would like to extend our heartfelt thanks to the editorial board for their support and guidance in bringing this special issue to fruition. Their dedication and expertise have been invaluable in curating this collection of insightful and impactful research papers. We hope this special issue will inspire further research and innovation in the field of digital cultural heritage. The integration of information technologies, data management, and digital storytelling offers immense potential for preserving our past and enriching our understanding of it in the present and future.

Special Issue Editors

Assistant Prof. Angeliki Antoniou, Christos Chrysanthopoulos, Foteini Efthymiou

Department of Archival, Library and Information Studies, University of West Attica

Agiou Spyridonos Str., 12243 Aegaleo, Athens, Greece

The Editorial Board welcome special Issue proposals that should be emailed to Associate Professor Dimitrios Kouis (dkouis@uniwa.gr) or Assistant Professor Artemis Chaleplioglou (artemischal@uniwa.gr). Finally, we expect your contribution and active support, as well as remarks and points of improvement.

Journal of Integrated Information Management electronic journal

Enhancing Cultural Heritage through the Integration of Digital Technologies, Arts and Story-telling

Polyxeni Mantzou[1], Xenofon Bitsikas[2], Anastasios Floros[3], Ioulia Papastavrou[2], Aristeidis Panagiotidis-Diktampanis[4]

[1]University of Ioannina, Department of Architecture, Greece
[2]University of Ioannina, Department of Fine Arts & Art Science, Greece
[3]Democritus University of Thrace, Department of Architectural Engineering, Greece
[4]University of Ioannina, Department of Computer Science & Engineering, Greece
pmantzou@uoi.gr [**ORCID:** 0000-0002-9244-4252], xbitsika@uoi.gr [**ORCID:** 0000-0002-4553-3682], anasfloros@gmail.com [**ORCID:** 0000-0002-5970-4120], jupapastavrou@gmail.com, aris.panagiotidis.d@gmail.com

Article Info

Article history:
Received 15 January 2024
Received in revised form 20 February 2024
Accepted 18 March 2024

https://doi.org/10.26265/jiim.v9i1.38583

Abstract:

Purpose *- The paper presents the research done by the School of Fine Arts, University of Ioannina, Greece as well as the methodologies utilized, challenges faced, and key findings during the implementation of the Research Project "Centre for Research, Quality Analysis of Cultural Heritage Materials and Communication of Science" funded by the Operational Program NSRF 2014-2020. The School of Fine Arts aim was to explore, in a holistic way, how digital technologies and artistic practices can enhance the experience of Cultural Heritage in the Region of Epirus, Greece, with the use of story-telling techniques, while, at the same time, safeguarding and valorizing it, making it more accessible and engaging for larger audiences.*

Design/methodology/approach *- Through a comprehensive and innovative methodological approach, the research team divided the work into discrete but interconnected phases, to achieve the project's objectives. In the first phase, archival and field research was conducted for various cultural sites in Epirus. In the second phase, state-of-the-art digitization techniques and advanced imaging technologies were employed to capture and document the places of interest. Finally, through artistic co-creating processes and game engine technology, story-telling scenarios were developed in AR and VR environments. This methodology enabled openness and flexibility throughout the process, and challenges faced during the project's implementation were easily assessed.*

Findings *- The implementation of the chosen methodological approach and the findings underscore the impact that the integration of arts and digital technologies can have on Cultural Heritage preservation, representation, and promotion. The project's findings highlight how digital media can become tools for interpreting and valorizing CH, offer novel experiences in a more inclusive and engaging way, and bridge the gap between art and technology, to preserve collective memory, enhance cultural identity, and deepen a sense of belonging.*

Originality/value *- The integration of digital technologies and artistic practices in Cultural Heritage can offer new possibilities for the representation and interpretation of the content, modifying the way in which CH is perceived and experienced. The potentials of the new media are often focused on recreating high-quality copies of cultural assets as physical entities, which may be important for their safeguarding but fails to employ them as agents for surveying and exploring complex relations, notions, and concepts linked to their context. This merely technical approach does not take into account that digital media can be intentionally utilized to affect the significance of the content and impact the information and its representation, thus constituting expressive, interpretative tools. Through the integration of artistic practices and digital technologies, new, engaging modes can emerge, where cultural assets, tangible and intangible, are not just passive exhibition or storage objects, but become active agents for the design and development of meaningful experiences.*

Index Terms — cultural heritage, digital technologies, arts, story-telling, integration.

I. Introduction

The utilization of digital technologies and artistic practices has emerged as a transformative force in the fields of Cultural Heritage (CH) preservation, valorization, and promotion. The paper presents a comprehensive overview of the research performed by the School of Fine Arts, University of Ioannina during the implementation of the Project "Centre for Research, Quality Analysis of Cultural Heritage Materials and Communication of Science" (KEYPK) funded by the Operational Program NSRF 2014-2020. The main objective of this endeavor was to explore the novel potentials offered by integrating digital technologies and artistic practices to enrich the Cultural Heritage experience of the Region of Epirus, thereby fostering broader accessibility and heightened engagement among diverse audiences. Through this presentation, we hope to promote

an interdisciplinary dialogue with various agents regarding the evolving realms of digital technologies and artistic reinterpretation within Material and Immaterial CH.

A. Background

The proliferation and advances in digital technologies are altering how CH is documented, preserved, represented, and experienced. As a result, the reimaging of CH has become an imperative undertaking. Traditional approaches of preserving cultural assets as static entities, while essential for safeguarding, often fall short in conveying the richness of their historical, cultural, and contextual significance. Recognizing this evolving landscape, the School of Fine Arts at the University of Ioannina tried to reinvigorate the appreciation and exploration of Cultural Heritage in Epirus by integrating the fields of arts and digital technology. The Region of Epirus embodies a rich field of cultural assets that resonate with historical depth and significance, representing a shared heritage, a repository of collective memory, and a source of cultural identity.

The research project KEYPK sought to transcend the defined boundaries of preservation, holistically utilizing digital media as an expressive and interpretative tool. In doing so, it aimed to explore new dimensions of engagement, where CH assets, both tangible and intangible, would evolve from passive exhibits to dynamic agents in creating meaningful experiences. This approach is propelled by the desire to preserve the past and infuse it with relevance, making it more accessible, relatable, and captivating to contemporary and future generations, enabling a dynamic reimagining of Cultural Heritage.

By employing artistic practices, digital media, and narrative techniques, the project endeavors to create immersive, interactive, and engaging experiences that bridge the gap between the past and the present, ensuring CH remains a vibrant and dynamic part of our cultural landscape. The project's outcomes contribute to the discourse surrounding the harmonious coalescence of digital innovation and artistic interpretation in the context of CH, with the potential to reshape the way we perceive and engage with our shared past.

B. Purpose and Significance

The purpose of this research project was to explore the potential of the dynamic synergy between digital technologies and artistic practices within the field of CH. This interdisciplinary endeavor sought to offer alternative perspectives on how Cultural Heritage is experienced and represented, specifically in the Region of Epirus. Employing artistic practices, storytelling techniques, and cutting-edge technologies the project aimed not only to enhance the accessibility and engagement of a broader audience but also to ensure the preservation and valorization of the cultural legacy.

The significance of this undertaking lies in its potential to reshape the way we engage with CH. The application of digital media in the context of preserving and representing CH has primarily revolved around the digital replication of cultural assets, ensuring their safeguarding, albeit in a static and passive form. However, this technical approach often neglects the transformative potential of digital media as a dynamic, interpretative tool. It overlooks the capacity of digital technologies to infuse CH with new significance, transcending the realm of mere representation to become active agents for the exploration of intricate relationships, notions, and contextual concepts. By merging artistic practices with digital technologies, this project introduces innovative, immersive modalities in which CH, whether tangible or intangible, assumes an active role in the creation of profound and meaningful experiences, redefining the way we perceive and engage with our cultural landscape.

The project's significance extends beyond the preservation of cultural assets; it encompasses the preservation of collective memory, the enrichment of cultural identity, and the cultivation of a profound sense of belonging. This research fosters a new paradigm for CH preservation and interpretation, promising to stimulate broader discourse and inspire further exploration of the transformative potential inherent in the integration of digital technologies and artistic expression.

C. Aims of the Project

The overarching aim of the KEYPK project is to rethink CH for the digital age through the prism of creative practices. The specific aims of the project are the following:

a) Exploration of CH Holistic Enhancement: The project seeks to explore how a holistic approach, merging digital technologies and arts, can profoundly enhance the perception and engagement with CH in Epirus.

b) Innovative Storytelling Techniques: With an emphasis on narrative methodologies, the project aspires to foster storytelling approaches designed to invigorate CH narratives. The overarching objective is to enhance the accessibility, engagement, and relevance of these narratives across diverse audiences.

c) Preservation and Valorization: By its creative objectives, the project aims to ensure the preservation and valorization of CH, emphasizing its intrinsic value and significance.

d) Dynamic Interpretation: By integrating artistic practices with digital technologies, the project endeavors to move beyond the conventional, technical approach to CH and enable dynamic interpretation, imbuing the content with new meaning and relevance.

e) Cultural Assets as Active Agents: A central aim is to transform cultural assets, whether tangible or intangible, from passive exhibition objects into active agents that play a pivotal role in designing and developing profound and engaging cultural experiences.

f) Inspire Future Research: The project seeks to inspire future interdisciplinary research. Through its innovative approach to enriching CH, the KEYPK project holds implications for other CH sites and regions, encouraging them to embrace technology, art, and participatory methodologies in revitalizing their CH and cultural experiences.

These aims constitute the project's roadmap towards

redefining the CH landscape in Epirus and establishing a novel approach to preservation, interpretation, and engagement within the broader CH context.

II. Theoretical Background

Digital technologies are altering established practices and paradigms, which succumb to the dynamic transformation of our rapidly evolving world **[1]**. This new condition presents significant questions and challenges for Cultural Heritage, constituting the need to reevaluate its role paramount, as conventional approaches of preservation, interpretation, and representation become outdated **[2], [3]**. This necessitates a novel perspective, one that leverages digital innovations and artistic practices to foster dynamic, inclusive, and engaging experiences for broader audiences **[4], [5], [6]**.

The preservation and documentation of CH have undergone an important evolution in recent years, due to the advances of digitization methods and techniques **[7], [8]**. However, the potentials of these methodologies are often focused on the high-quality replication of cultural assets as physical entities, which may be important for their safeguarding but fails to employ them as active agents for the examination and exploration of intricate relationships, ideas, and concepts associated with their contextual framework **[9], [10]**. The significance of these intangible aspects of CH including memory, identity, and sense of belonging, shifts the perspective towards a more holistic understanding of Cultural Heritage, one that recognizes its capacity to evoke emotions, shape identities, and foster connections between past and present **[11], [12], [13]**.

Additionally, this merely technical orientation does not take into account that digital media can affect the significance of the content and impact the information and its representation, thus constituting an expressive, interpretative tool, capable of creating aesthetic value **[14], [15]**. Consequently, the integration of artistic practices and digital media in the context of Cultural Heritage can enhance contextual understanding as artistic representation can convey the historical, cultural, and contextual significance of CH in ways that raw data cannot, and prevent default or generic representations [16]. Artistic interpretations can add layers of context that help audiences appreciate the historical and cultural context of cultural assets. Furthermore, artistic and aesthetic value infuse CH digitization with elements that resonate emotionally with the audience, making it more accessible, engaging, and inclusive **[17], [18]**.

Through the integration of artistic practices and digital technologies, new, engaging modes can emerge, where cultural assets, tangible and intangible, are not just the passive exhibition objects of the past directly confronted by the dominant subject **[19], [20]** but become active agents for the design and development of meaningful experiences, engaging, immersive, and more inclusive **[21], [22], [23]**. This convergence of art and technology represents a critical juncture in the evolution of Cultural Heritage engagement.

In this context, the KEYPK project proposes a new approach to the safeguarding, valorization, and promotion of Cultural Heritage utilizing digital technologies, artistic practices, and storytelling techniques. The multidisciplinary conceptual framework of the project has been informed and influenced by a concise review of key studies and research on art, cultural heritage, and digital technologies, providing a solid foundation for its approach.

A. Cultural Heritage and Digital Studies

The advancement of Digital Studies has changed the way that Cultural Heritage is approached, preserved, and disseminated **[24], [25], [26]**. Research demonstrates the potential for bringing more people into contact with Cultural Heritage events by using digital technology to promote inclusivity and interaction **[27], [28], [29], [30], [31], [32]**. Building upon the fundamental ideas of Digital Studies, the KEYPK uses digital media to investigate and interpret Cultural Heritage in novel ways, allowing a deeper understanding of the history, and cultural identity of the Region through interactive interfaces, semantic mapping and analysis, and data visualization. The integration of the arts into the interdisciplinary field of Digital Studies, which now encompasses various disciplines beyond its original focus, represents an organic progression, enhancing out-of-the-box thinking for researchers and technologists, thereby stimulating innovation and creativity. This interdisciplinary methodology not only introduces novel experiential avenues for users but also establishes innovative mechanisms for linking historical contexts with contemporary experiences, thereby enhancing users' cognitive and emotional connections to Cultural Heritage. Widespread encouragement is extended to diverse audiences to actively engage in and contribute to the preservation, valorization, and promotion of both tangible and intangible cultural assets through the seamless integration of digital technologies with Cultural Heritage.

B. Art and Technology Integration

Integration of art and technology has been investigated as a novel strategy for enhancing experiences with Cultural Heritage **[33], [34]**. Empirical studies have indicated that the amalgamation of art and digital media can augment historical narratives and elevate cultural awareness **[35], [36], [37]**. Additionally, audiences can establish more immersive, meaningful, and captivating connections with Cultural Heritage through this integration. By combining digital tools, the KEYPK project effectively blurs the lines between the real and virtual worlds by fusing art and technology. Because of this mutually beneficial relationship, Cultural Heritage can be more accessible and relatable to wider audiences.

III. Methodological Approach

The Methodology section of the study outlines the systematic framework employed to achieve the project's overarching aims. This section provides a detailed account of

the specific methodologies performed, the challenges and limitations faced, and the procedures applied throughout the project.

A. Project's Methodology Overview

Through a comprehensive and innovative methodological approach, the research work was divided into discrete but interconnected phases to achieve the project's objectives. In the first phase, the research team gathered a selection of cultural sites related to the water routes of Epirus, focusing on three traditional stone bridges, the Bridge of Spanos, the Bridge of Kyra, and the Bridge of Politsa. Stone bridges constitute an integral part of the region's architectural, cultural, and historical landscape and their comprehensive study is pivotal for the preservation of Epirus' CH, the promotion of regional identity, and the acquisition of valuable historical and cultural knowledge. When the sites were selected archival and field research was conducted. In the second phase, state-of-the-art digitization techniques and advanced imaging technologies were employed in order to capture and document the places of interest. In the third and last phase, through artistic co-creating processes and game engine technology, story-telling scenarios were developed in Augmented Reality (AR) environments.

B. Challenges

Throughout the implementation of the selected methodological approach, several limitations and challenges were encountered, and appropriate mitigation actions were taken that enabled the successful and timely delivery of the project's outcomes:

a) Site Selection Complexity: The selection of the three traditional stone bridges entailed careful deliberation due to the rich and diverse architectural, cultural, and historical context of the region. This process posed notable challenges concerning the representativeness of the chosen sites. To address the complexities associated with site selection, a comprehensive approach was adopted, involving a multidisciplinary team of experts. The team engaged in consultations and assessments with relevant stakeholders and CH institutions to ensure that the chosen bridges sufficiently represented the architectural and cultural diversity of Epirus.

b) Archival and Field Research Challenges: The subsequent phase, involving archival and field research, was marked by difficulties related to data accessibility and data acquisition. This included issues such as access to historical records, documentation, and the physical exploration of often remote cultural sites. These challenges introduced temporal and spatial constraints to the research process. To mitigate the challenges proactive measures were implemented. Collaboration with local historical and archival institutions was intensified to facilitate data accessibility. The spatial and temporal constraints were addressed through careful planning and the utilization of advanced research methodologies, including remote sensing and digital archival techniques.

c) Technological Complexities: The utilization of state-of-the-art digitization techniques, was indispensable for capturing and documenting the selected sites, however technical issues related to equipment calibration, data processing, and the acquisition of high-quality imaging presented challenges that required a proactive approach to resolution. As a result, regular calibration checks and quality control procedures were integrated into the research process to ensure the acquisition of high-quality data.

d) Artistic Integration Challenges: The final phase, involving the artistic development of story-telling scenarios in AR environments, introduced challenges in artistic collaboration and technological alignment. Ensuring a seamless fusion of artistic creativity with technological precision demanded interdisciplinary coordination. For this reason, regular interdisciplinary workshops and feedback sessions were conducted to foster effective communication and synergy between creativity with technological precision.

Throughout the project's implementation, the iterative nature of the methodology facilitated adaptability but also necessitated ongoing assessment of emerging challenges and opportunities, thereby contributing to the project's overarching flexibility. This iterative approach enabled the team to refine the project's methodologies and outcomes in response to evolving circumstances.

C. Literature and Field Research

The conducting of literature and field research of the project was designed to establish a comprehensive understanding of the traditional stone bridges' context as well as their architectural morphology.

The first stage was a systematic review of relevant literature and archival research. Academic databases, historical archives, and CH repositories were extensively explored to gather a solid knowledge base. The search encompassed a range of academic disciplines, including architecture, history, and cultural studies, to ensure a holistic approach to the subject matter. Additionally, collaborations with local heritage institutions, such as the Service of Modern Monuments and Technical Works of Epirus, North Ionian, and West Macedonia, and the Ephorate of Antiquities of Ioannina, were cultivated to facilitate access to primary source materials. Archival research played an important role in unveiling historical narratives associated with the traditional stone bridges under investigation.

Field research was instrumental in augmenting the understanding of the selected stone bridges. The research team embarked on physical explorations of the cultural sites, employing advanced surveying and mapping technologies (**Fig.1**). This included 3D laser scanning and photogrammetry techniques, enabling precise documentation and imaging of the bridges.

Fig. 1. *Field research in the bridge of Kyra (photo of the authors).*

The research benefited significantly from the interdisciplinary collaboration involving architects, historians, and archaeologists. This collective expertise fostered a multifaceted approach to the analysis of the bridges, encompassing architectural design, historical context, and cultural significance. Finally, a data management system was established to catalog and store research findings. Digital repositories were employed to house the collected data, ensuring its accessibility and preservation for future reference and analysis.

D. Digitization and 3D Reconstruction

The digitization and 3D reconstruction phase of the research was undertaken employing advanced technological tools and a systematic approach to ensure a comprehensive and accurate representation of the selected traditional stone bridges.

The primary stage involved data acquisition, where state-of-the-art digitization techniques, such as high-resolution 3D laser scanning and photogrammetry, were utilized to capture detailed information about the stone bridges (**Fig.2**).

Fig. 2. *Digitization of the bridge of Politsa using laser scanning (photo of the authors).*

This methodology was employed to obtain precise and comprehensive spatial data, facilitating the creation of detailed point clouds, and enabling the accurate documentation of the bridges' geometry and architectural features. Multiple scans were performed in each bridge, to create as complete a point cloud as possible in the subsequent processing. At the same time, in places where the 3D scanner couldn't be positioned due to the steep and rocky geomorphology of the terrain, the material was collected utilizing drone footage and the method of photogrammetry. Georeferencing was conducted to position the acquired data within a geographic context. This process allowed for the spatial alignment of scanned datasets, ensuring that the point clouds accurately represented the physical locations of the stone bridges. Quality control measures were applied to guarantee the fidelity and accuracy of the registered datasets.

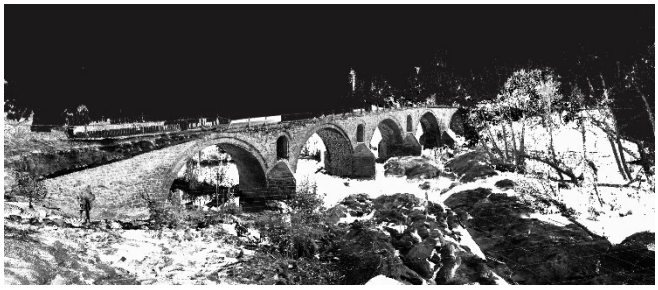


Fig. 3*. Registered point cloud of the bridge of Spanos (image of the authors).*

Subsequently, the results of the individual scans and photogrammetric data were registered into a single, processable, point cloud for each stone bridge (Fig.3). However, as the total amount of points reached at times even 360 million, containing a large amount of excess information, the usability and further processing of the files was constituted rather difficult. As a result, in the next stage, the point clouds were thoroughly cleaned of the extra data, to keep only the necessary material, creating a complete digitized dataset. The cleaned dataset was then imported into building information modeling (BIM) software to be used as a reference for performing measurements and test sections to the maximum level of detail. The extracted results from the processing in BIM were vectorized in a CAD application and the final architectural drawings were produced (**Fig.4**).

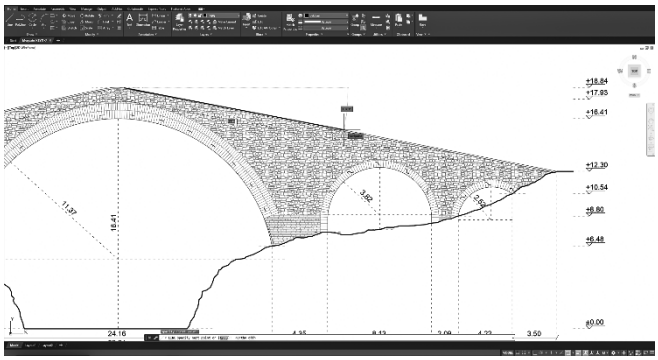


Fig. 4. *Creation of architectural plans in CAD ((image of the authors).*

The last stage involves 3D modeling and reconstruction of the selected stone bridges. Utilizing specialized software, the acquired point clouds and the vectorized architectural drawings were processed to generate 3D models of the stone bridges (**Fig.5**). These models preserved the structural integrity and architectural details, providing a faithful representation of the physical structures. To enhance the visual fidelity of the 3D models, texture mapping was applied. High-resolution images captured during the field

research phase were seamlessly integrated into the 3D models. This step imbued the models with realistic surface details, such as color, texture, and material characteristics.

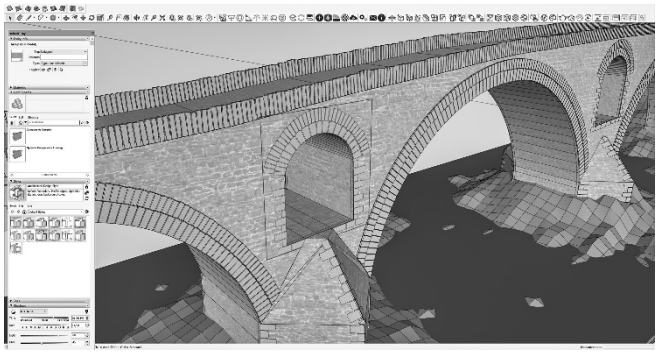


Fig. 5. *3D modeling of the bridge of Spanos (image of the authors).*

Quality assurance processes were executed at each stage of the digitization and 3D reconstruction process. This entailed constant checks for data accuracy, alignment, and model completeness to ensure that the final 3D representations faithfully represented the stone bridges' physical attributes.

At the last stage of this methodological step, an interdisciplinary analysis, encompassing collaboration between engineers, architects, and CH experts was conducted. This collective expertise allowed for a holistic evaluation of the 3D models, ensuring that architectural and historical details were accurately captured and preserved.

E. Drafting of Story-telling Scenarios

Concurrently with the digitization and 3D reconstruction phase, the research team started the process of drafting story-telling scenarios for Augmented Reality (AR) environments. Utilizing the data acquired during the literature review and the archival research regarding the historical and cultural context, the team conducted a creative, interdisciplinary approach to provide engaging and immersive experiences, bridging technology and art.

The initiation of this phase involved the conceptualization and design of narrative structures for the story-telling scenarios. The drafting of the narratives was a collaborative effort between artists, and technology experts and played a major role in ensuring the successful outcome of the project. Artists, architects, graphic designers, 3D modelers, and software developers worked to create a seamless narrative experience that would constitute the experience meaningful and relevant to contemporary audiences. This involved iterative feedback and collaborative workshops to refine and optimize the storytelling scenarios.

In the next stage, the research team created the digital assets, including 3D models, textures, audio, and visual elements. These assets were created to be integrated into the AR environments, providing users with an immersive experience. High-resolution imagery, audio recordings, and historical elements were utilized to enhance the narrative.

The development of the AR platforms, which are described in the next section, involved an iterative development process to ensure that the scenarios were optimized for various devices and platforms, promoting accessibility and engagement for a broad audience. To achieve high-quality outcomes, pilot testing of the story-telling scenarios was conducted to gather user experience and feedback. The insights garnered from these tests played a crucial role in refining the scenarios, addressing user concerns, and enhancing the overall narrative experience.

F. Development of Augmented Reality Applications

The last phase of the methodological approach concerned the development of Augmented Reality (AR) applications (**Fig.6**). Technological innovation and artistic creativity were seamlessly integrated into three extended reality experiences to not only offer an additional means of representation of the project's results but also provide accessible, engaging, and immersive interactions with the selected cultural heritage sites.

The inception of the XR applications began with the conceptualization of the user experience. Aiming at an action-driven presentation of information and the narrative unfolding of events, while encompassed by the interactivity of augmented reality, meaning that the realization of said experiences had to be a multidisciplinary effort. Developers, user experience (UX), and narrative designers worked together to realize the requirements, constraints, and challenges and provide a cohesive enactment of the storytelling scenarios. Storyboards were created and when the narration layouts were complete, we were ready for the development of the experiences.

Fig. 6. *Development of the AR experiences in game engine environment (image of the authors).*

The 3D models, textures, and audio elements that were created in the previous phases were cataloged and organized in a library of assets constituting a pool of available resources for the creation of scenes. Prototypes of these scenes were drafted using game engine technologies (namely Unity). This way, the initial spatial planning of the experiences could be evaluated and reiterated to meet the criteria set by the creative team. These spaces and the various elements that constitute them were then geolocated and mapped using various software development kits (e.g., Vuforia SDK, MRTK for UWP). Specifically, Model Targets were created from the cataloged 3D models, and Area Targets were generated from the geo-referenced point clouds representing the bridges' locations. After this phase, the experiences started to assume form and the testing

phase could begin.

User testing and feedback sessions were conducted to evaluate the application's functionality and efficiency. The insights and suggestions gathered during these sessions were instrumental in refining the applications, addressing usability concerns, and enhancing overall engagement. Moreover, since inclusivity was a fundamental component of the project's objectives, the testing process which included a diverse set of subjects, helped pinpoint which parts of the experiences needed to change for them to warrant the desirable accessibility.

IV. RESULTS

The results of the KEYPK project provide a comprehensive overview of the experimental findings and outcomes derived from the innovative methodologies employed to reapproach and enhance the cultural experience of Epirus. The combination of the digitized cultural assets, the AR applications, and the artistic interpretation and storytelling narratives offer users personalized encounters with the Region's past, encouraging active engagement and participation. The interpretation of the project's findings underscores the significance of the KEYPK project in facilitating cultural engagement, preserving CH, fostering a dynamic relationship between past and present, and inspiring future research and interdisciplinary collaborations. The results of the project can be summarized as follows.

A. Research and Documentation

The research team carefully selected three traditional stone bridges, the Bridge of Spanos, the Bridge of Kyra, and the Bridge of Politsa, as focal points for the project. These bridges are integral to Epirus' architectural and cultural landscape. Comprehensive archival and field research was conducted, uncovering historical narratives associated with these bridges, enabling access to primary source materials, and contributing to the preservation of Epirus' CH. This part is very important for the safeguarding of the Region's CH as these structures, due to their age, use, and neglect, are in danger of ruination or collapse. Additionally, this research facilitated the exploration of the original forms of the bridges, for example, the Bridge of Kyra was destroyed in the 1850s, illuminating historical and architectural aspects that are lost or unknown. Specifically:

1) The bridge of Spanos

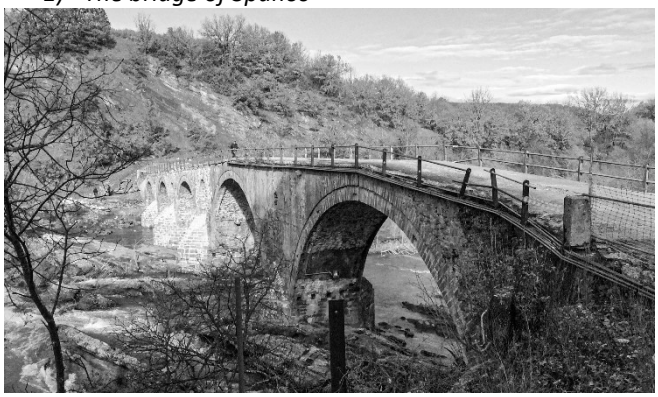


Fig. 7. *The bridge of Spanos, current condition (photo of the authors).*

The bridge of Spanos connects Epirus with Macedonia and is built on the Venetikos River, shortly after its confluence with the tributary of the Stavropotamos River (**Fig.7**). It is the largest surviving stone bridge in Macedonia. The choice of the specific point for its construction was because, in contrast to the relatively soft, clay soil of the surrounding hills, the bottom of the river is rocky and uneven so it is considered suitable for laying the foundations. In addition, the great width of the river, at this particular point, makes its flow less rapid **[38]**. The total length of the bridge is approximately 85m and its width is 3.50m. It has five arches of similar size and shape. It is built with hewn stone and reinforced with iron on the sides of the arches. It has four relief holes, while all the middle piers have wedge-shaped projections at the base, to channel the water under the arches. It should be noted that the original form of the bridge has been altered after its repair with reinforced concrete so that it can also be used by vehicles. The construction of the bridge is dated in 1846, according to an engraved inscription on the north-eastern face of the pier of the great arch. The sponsor of the bridge was Mustafa Aga from Argyrokastro, the so-called "Spanos", which means someone with little or no facial hair. Right next to the bridge, Mustafa built an inn, where the caravans going to Thessaloniki or Ioannina and the herdsmen of the plain spent the night on their way to the pastures of Pindos [39]. The income from the inn was used for the maintenance of the bridge. According to the physician and historian Ioannis Lambridis (1839-1891), the cost of building the bridge amounted to 50,000 grossi, while the hostel received 400 grossi annually **[40]**. Mustafa Pasha himself was buried in the same area, and his tomb was preserved until 1980 when it was destroyed by gravediggers **[38]**. Of interest is the testimony of the French doctor, traveler, and consul in Ioannina, François Pouqueville (1770-1838), who crossed the area in the spring of 1806 and who, at a distance of about 2-3 km from the point of the bridge of Spanos mentions the existence of five stone arches, remains of a large bridge, which had been erected in the 14th century by the Ottoman conqueror Bayezid Yildirim (1354-1403) [41]. Contrary to Pouqueville, the English Captain William Leake (1777-1860), who was in the area in 1805, mentions the existence of a bridge **[42]**. In 1995 the bridge was classified as a historic and preserved monument (Government Gazette 632B/1995).

2) The Bridge of Kyra

Fig. 8. *The bridge of Kyra, current condition (photo of the authors).*

The Bridge of Kyra was located east of Ioannina, where Arachthos River joins its tributaries Zagorisios and

Metsovitikos (**Fig.8**). During the 19th century, the bridge was a particularly important passage, as it connected Epirus with Macedonia and Thessaly. François Pouqueville (1770 –1838), mentions this road axis as the busiest road in Lower Albania, a fact which is proven by the large number of inns that were in the area **[41]**. Pouqeville, in his "Voyage de la Gréce", mentions the bridge of the "Kyra" (meaning "Lady"), describing a stone bridge with four arches, situated right in the gap formed between the mountains of Mitsikeli and Chuka Rosa (Red Mountain) and forming the western side of Pindos **[41]**. According to him, the bridge was built by Suleiman Pasha's wife. The latter ruled the Vilayet of Ioannina from 1780 to 1786 **[40], [43], [44]**, when he was beheaded by a sultanic order. During this time, according to Pouqeville, the bridge was erected and took on the nickname "Kyra", in honor of the pasha's wife. We derive the same information from Panagiotis Aravantinos, who in his work "Chronographia of Epirus", mentions the wife of Suleiman and sister of Kalos Pasha, Ayse, as the sponsor of the bridge and the adjacent inn [45]. From the above, it can be concluded that the bridge of "Kyra" was built in the period from 1780 to 1786, the time of Ayse's first term as pasha's wife. The financing for the construction of the bridge was obtained through heavy taxation and the imposition of compulsory labor on the citizens. References to the bridge of "Kyra" continue in the works of three English travelers, who found themselves in Epirus at the beginning of the 19th century. Captain William Leake (1777-1860), who visited the area in August 1805, describes it as a bridge of three arches, disregarding the auxiliary arches **[46]**. The doctor Sir Henry Holland (1788-1873) refers to the bridge describing it as "well built" **[47]**, and the diplomat William Turner (1792-1867) as "very beautiful" **[48][49]**.

In the first half of the 19th century, the bridge began to show clear signs of deterioration, resulting in its collapse. The English bishop Christopher Wordsworth (1807-1885), who traveled through Greece in 1832-1833, mentions that he visited the bridge of "Kyra", which, however, he attributes to Ali Pasha **[50]**. Continuing, he points out that the bridges on the road to Thessaly are either demolished or have decks covered with grass, while the inns are deserted. As for the date of the destruction of the bridge, the Greek-Turkish newspaper "Yanya-Ioannina" mentions the year 1858 **[51]**. The destruction of the bridge was also mentioned by the military engineer Ifikratis Kokkidis (1833-1922), in 1880 **[52]**. Given the importance of the passage, it was deemed imperative to immediately restore the broken communication. In the following years, a series of attempts were made to restore the connection, which, however, did not succeed. A remnant of these unsuccessful attempts is a part of the pier with the beginning of an arch, which is located on the left bank of the river. The first recorded attempt to rebuild the bridge dates to 1864, when the English consul in Ioannina reported the start of construction work, in a location adjacent to the original one. The consul mentions the existence of the remains of three older bridges, which had been washed away by the waters of the river **[53].** The next recorded attempt dates to 1871, when a tender was held for the construction of a new bridge. The project, undertaken by the master craftsman Ziogas Frontzos, was not completed for unknown reasons **[39]**.

Fig. 9. *The bridge of Kyra painted by Louis Dupré (Public Domain, source: National Historical Museum, www.nhmuseum.gr)*

Given the collapse of most of the bridge, its original form can be deducted from drawings by foreign travelers. The French painter Louis Dupré (1789-1837), drew the bridge of the "Kyra" during his trip to the area on March 28, 1819. He then used it in the background of his work entitled "Un Grec de Janina", which was included in his book "Voyage á Athènes et á Constantinople, ou Collection de Portraits, de Vues et de Costumes grecs et ottomans, peints sur les lieux, d' après nature lithographiés et colors... accompanied d' un texte" and published six years later (**Fig. 9**) **[54]**. The English writer and landscape painter Edward Lear (1812-1888) crossed the area on May 14, 1849, during his journey from Ioannina to Thessaly. In his diary, he describes the moments of midday rest at the inn of "Kyra", where he had the opportunity to draw it **[55]**. The sketch shows the inn, the bridge, and other buildings, probably mills and watermills, which were usually erected near the inns (Fig.10).

***Fig. 10** The bridge of Kyra depicted by Edward Lear (Public Domain, source: Archive of Stone Bridges, arhiogefirionipirotikon.blogspot.com)*

3) The Bridge of Politsa

The Bridge of Politsa was built to serve the villages of Ambelochori, Raftanaioi, Agnanta, Pramanta, and Ktistades and to connect them with Ioannina (**Fig.11**). It consists of four unequal arches. The central arch, through which the Arachthos river passes, has a span of 23.50 m and a height of 13.70 m. During the 19th century, the bridge was part of a busy route, and had an inn, catering to travelers and ranchers. The construction of the bridge was made with local stone, by masons originally from Ambelochori **[56]**. The date of its construction has not been determined.

***Fig. 11.** The bridge of Politsa, current condition (photo of the authors).*

It is, however, known that in 1874 repair work took place on the bridge, which cost 17.000 grossi, and was sponsored by Ioannis Loulis **[40], [57]**. In its original form, the bridge had a single arch, which was founded on rocky ground. In 1932, due to a series of accidents that had occurred, it was decided to repair it again. Nikos Mantzos (1891-1967) from the village of Raftanaioi was chosen as the master craftsman, who added three additional arches to the bridge. The arches, whose aim was to absorb the Arachthos River flood, relieve the construction, and constitute it a safe passage, gave the bridge its current form. In 1984 the bridge was classified as a work of art (Government Gazette 814B/1984), given that, due to its form, materials, and construction method, it is a remarkable example of 19th-century Epirus architecture. In the 1980s, next to the stone bridge, a new reinforced concrete bridge was built, to serve vehicles.

B. Digital Documentation and 3D Representations

The digitization and 3D reconstruction of traditional stone bridges have resulted in highly detailed, accurate, and visually engaging 3D models (**Fig.13,14,15**). These models faithfully replicate the architectural and historical features of the bridges, providing invaluable resources for heritage preservation and research.

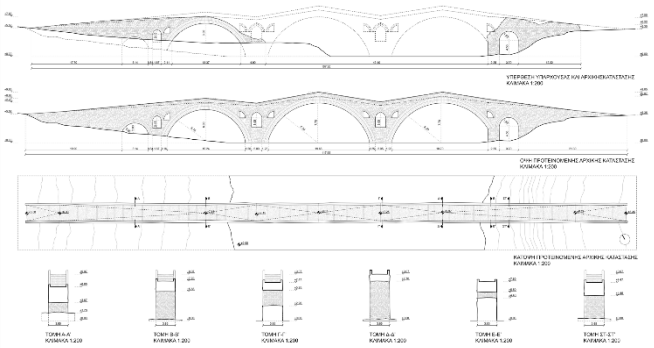


***Fig. 12.** Architectural plans of the current and the proposed original condition of the bridge of Kyra, produced by the digital documentation (image of the authors).*

Of special importance is the digital reconstruction of the destroyed bridge of “Kyra” as it allows us to witness its original form for the first time. Utilizing the previous data from the archival and field research, the research team came up with a proposed original form of the Bridge, which satisfies the numerous research parameters, such as the travelers' reports, the pictorial references, the remaining parts of the building and the change in the flow of the Arachthos River, with the subsequent fillings. It was therefore a bridge with a total length of about 118 m with three large arches, the central and the right one almost identical with an arch span of 19.50 and 18.50 m respectively, while the left one was a little smaller at 15.50 m (which is still preserved). The river ran under the central arch. The deck followed the movement of the arched exteriors, and had an average width of 3.80m, with parapets on either side. There were also 6 relieving quatrefoils (one survives on the left bank), and 3 pointed arches, of Islamic style, in the middle ones. On the left bank, there was an auxiliary lower arch, which survives, to achieve a smooth end, while on the right bank, there is a rectangular one with semi-circular coping (**Fig.12**). All the arches were constructed with a double row of domes, arranged alternately light and dark.

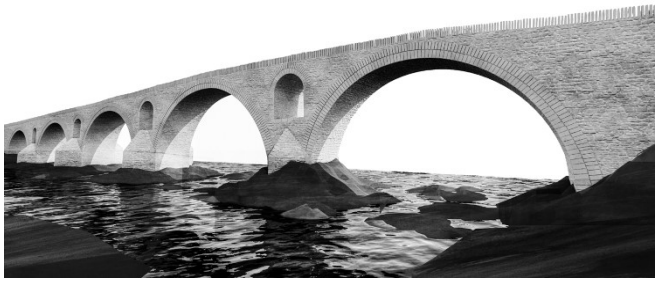


***Fig. 13.** 3D representation of the bridge of Spanos (image of the authors).*

Fig. 14. *3D representation of the bridge of Kyra (image of the authors).*

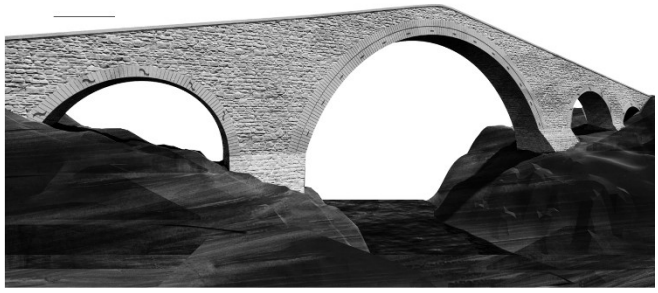


Fig. 15. *3D representation of the bridge of Politsa (image of the authors).*

C. Augmented Reality Experiences

An important part of the project's motive has been the artistically curated yet engaging and informative presentation of its results. Augmented reality experiences can satisfy these demands by enabling the blending of aesthetic mediation in representation – as produced by the project's digitization and 3D reconstruction phase – with interactivity and play. Three AR experiences were created – one for each bridge studied – allowing users to learn about the research outcomes in a dynamic and captivating way.

For every bridge, a narration was crafted. A printed corpus of targets (i.e., images or sketches that can be used as triggers for the augmented content) was created and printed as a booklet. One target was created for each bridge and each narrative corresponds to a different target. The person, assuming the role of a 19th-century explorer of Epirus, scans the different triggers found in the corpus via a smartphone application.

1) The Bridge of Spanos

The app detects the target and provides a brief introduction to the Bridge of Spanos, displaying a 3D model of the bridge over the Venetikos River as it is today. With a simple gesture, you can choose to "travel back in time" and watch the bridge transform from its current state to its 19th-century form. As you explore the 19th-century version of the bridge, an AR character of Mustafa Aga appears, sharing his story about why he sponsored the bridge's construction. He explains the bridge's significance and how it benefited travelers and herdsmen in the region. Mustafa Aga also provides insights into the inn's history and its connection to the bridge's maintenance. When you zoom in or tap on the different construction features of the bridge, a modal window appears containing its name and information on its usage.

2) The Bridge of Kyra

Fig. 16. *Demonstration of the AR experience (photo of the authors).*

Puzzles, challenges, and riddles have been incorporated into the bridge of Kyra experience forming a gamified exploration of its past (Fig.16). After its initial collapse in 1858, the bridge has undergone various efforts of reconstruction. This setting forms the narrative that aims to involve users in these endeavors while at the same time introducing them to the bridge's history. During this narration, various figures related to the Bridge of Kyra – benefactors like Suleiman Pasha and Ayse and historians like François Pouqueville and Captain William Leake – appear revealing construction characteristics and morphological features. You are then prompted to aid the craftsman Ziogas Frontzos in the reconstruction (by dragging and dropping elements or answering questions).

3) The Bridge of Politsa

Given the architectural and historic significance of the Bridge of Politsa, the AR experience focuses on promoting and showcasing its qualities. After scanning the appropriate trigger from the booklet, you are presented with a detailed model of the bridge in its original form (the one with four arches). Through a gesture, you can "fast forward" in time to its current state (after the addition of three extra arches). Both models are meticulously crafted to encapsulate the bridges' morphological intricacies while also providing structural and architectural information. Users can traverse their length or choose specific features and learn more

about their significance via modal windows (pop-ups). A soundscape consisting of sounds from the roaring Arachthos River along with the bustle of the then-busy roads is prevalent.

In conclusion, the results of the project underscore the transformative potential of integrating digital technologies and artistic creativity in the preservation and promotion of CH. These outcomes not only provide resources for scholarly research but also engage and educate the broader public, contributing to a deeper appreciation of the CH in Epirus.

V. Discussions

The application of the selected methodological approach and the resultant findings emphasize the profound influence of integrating arts and digital technologies on the preservation, representation, and promotion of CH. The project delves into the capacity of digital media to serve as tools for interpreting and enhancing CH, providing innovative experiences more inclusively and engagingly. Through a synergistic and dynamic blend of historical research, advanced digitization techniques, innovative AR applications, and artistic interpretation, the project aimed to rekindle the historical narrative of Epirus' cultural assets and shed light on their cultural significance. It successfully bridges the gap between art and technology to safeguard collective memory, enrich cultural identity, and foster a heightened sense of belonging. The discussion below highlights key insights and implications stemming from the project's execution:

a) Digital Technologies and CH Preservation: The project's success in applying advanced digitization techniques to traditional stone bridges has demonstrated the value of technology in CH preservation. The 3D models and architectural drawings generated provide a comprehensive and accurate record of these cultural assets. This not only ensures their structural integrity but also facilitates their long-term preservation. Moreover, the georeferencing of data allows for spatial accuracy, which is essential in safeguarding these sites.

b) Interpretation and Engagement: The project has not only preserved CH but also reinvigorated its interpretation and engagement. The creation of AR story-telling scenarios has provided a dynamic means of interacting with these historical sites. These scenarios bridge the gap between art and technology, enhancing the understanding of their cultural significance. Users can explore the bridges in an immersive and inclusive way, promoting a deeper connection with CH and its historical narrative.

c) Collective Memory and Cultural Identity: By merging artistic creativity with technology, the project contributes to the safeguarding of collective memory and the enrichment of cultural identity. The innovative experiences created through AR scenarios not only educate but also instill a profound sense of belonging among users. CH is no longer a static representation but an active agent in the preservation of cultural identity.

d) Future Implications: The success of this project has broader implications for the field of CH preservation and interpretation. It encourages the exploration of innovative approaches that combine the richness of historical research with the power of digital technology and artistic expression. Furthermore, the project's flexible and iterative methodology serves as a model for future endeavors.

e) Limitations and Future Research: It's important to acknowledge the challenges faced during this project, particularly concerning site selection, archival and field research, and technological complexities. Future research can delve into refining methodologies to address these challenges more effectively. Additionally, the project's outcomes provide a strong foundation for further studies examining the impact of digital technologies on CH engagement.

In conclusion, the KEYPK project has laid a solid foundation for future research in the field of arts, digital technologies, and CH. These future research directions have the potential to offer new possibilities for the preservation and education of CH, fostering a deeper appreciation for its significance in contemporary society.

VI. Conclusion

The KEYPK project is reconsidering the potential of integrating arts and digital technologies in the preservation, representation, and promotion of CH in the Region of Epirus. In combining innovative approaches in historical research, advanced digitization techniques, AR applications, and artistic interpretation, the project has not only revitalized the appreciation of CH but also enriched the understanding of its cultural significance, modifying the way CH is perceived and experienced. By bridging the gap between art and technology, the project has succeeded in creating new, engaging modes for holistically interpreting and valorizing CH. It highlights the potential of digital media as expressive and interpretative tools, dynamic agents for exploring complex relationships, notions, and contextual concepts, capable of preserving collective memory, enhancing cultural identity, and deepening a sense of belonging. By merging artistic practices with digital technologies, new and engaging modalities emerge, where CH, both tangible and intangible, becomes an active and meaningful part of our cultural landscape.

VII. References

[1] **Mantzou, P. (2017).** *Aporia in architecture: What now?* Epikentro.

[2] **Cameron, F. (2021).** *The Future of Digital Data, Heritage and Curation in a More-than-Human World*. Routledge.

[3] **Mantzou P, Bitsikas X, Floros A. (2023).** *Enriching Cultural Heritage through the Integration of Art and Digital Technologies.* Social Sciences. 12(11):594. https://doi.org/10.3390/socsci12110594

[4] **Bitsikas, X., Mantzou, P., Floros, A., Mandoulidou, E. (2022).** *PALIMPSEST Project: The Book*. University of Ioannina Press.

[5] **Champion, E. (2015).** *Critical Gaming: Interactive History and Virtual Heritage*. Routledge.

[6] **Grau, O. (Eds.) (2017).** *Museum and Archive on the Move*. Walter De Gruyter.

[7] **Ioannides, M., Patias, P. (Eds.) (2023).** *3D Research Challenges in Cultural Heritage III*, Springer.

[8] **Kremers, H. (2020).** *Digital Cultural Heritage*. Springer.

[9] **Bold, J., Larkham, P., Pickard, R. (Eds.) (2018).** *Authentic Reconstruction: Authenticity, Architecture and the Built Heritage*. Bloomsbury Academic.

[10] **Cameron, F., Kenderdine, S. (Eds.) (2007).** *Theorizing Digital Cultural Heritage: A Critical Discourse*. MIT Press.

[11] **Lowenthal, D. (2015).** *The past is a foreign country-revisited*. Cambridge University Press.

[12] **Smith, L. (2006).** *Uses of heritage*. Routledge.

[13] **Kalay, Y.E., Kvan, T., Affleck, J. (Eds.) (2008).** *New Heritage: New media and cultural heritage*. Routledge.

[14] **Manovich, L. (2018).** *Software takes command*. Bloomsbury Academic.

[15] **Thylstrup, N. B. (2019).** *The Politics of Mass Digitization*. The MIT Press.

[16] **Legene, S., van Den Akker, C. (Eds.) (2016).** *Museums in a Digital Culture: How Art and Heritage Became Meaningful*. Amsterdam University Press

[17] **Falk, J. H. (2016).** *Identity and the Museum Visitor Experience*. Routledge.

[18] **Papastergiadis, N. (2020).** *Museums of the commons: L'internationale and the crisis of Europe*. Routledge.

[19] **Walsh, K. (1992).** *The representation of the past museums and Heritage in the post-modern world*. Routledge.

[20] **Stone, P. G., & Molyneaux, B. L. (1994).** *The presented past: Heritage, Museums and education*. Routledge.

[21] **Golding, V., & Modest, W. (2013).** *Museums and communities: Curators, collections, and collaboration*. Bloomsbury.

[22] **Meyer, A., & Savoy, B. (2014).** *The museum is open: Towards a transnational history of museums 1750-1940*. De Gruyter.

[23] **Runnel, P. (2014).** *Democratising the Museum: Reflections on participatory technologies*. PL Acad. Research.

[24] **Barbuti, N. (2018).** From Digital Cultural Heritage to Digital Culture: Evolution in Digital Humanities. *Proceedings of the 1st International Conference on Digital Tools & Uses Congress*, 1–3. https://doi.org/10.1145/3240117.3240142

[25] **Benardou, A., Champion, E., Dallas, C., & Hughes, L. (Eds.) (2017).** *Cultural heritage infrastructures in digital humanities*. Routledge.

[26] **Ciula, A., & Eide, Ø. (2014).** Reflections on cultural heritage and digital humanities: Modelling in practice and theory. *Proceedings of the First International Conference on Digital Access to Textual Cultural Heritage*, 35–41. https://doi.org/10.1145/2595188.2595207

[27] **Mühlberger, G. (2016).** Research Infrastructures, or How Document Engineering, Cultural Heritage, and Digital Humanities can Go Together. *Proceedings of the 2016 ACM Symposium on Document Engineering*, 9. https://doi.org/10.1145/2960811.2967146

[28] **Munster, S., Apollonio, F. I., Bell, P., Kuroczynski, P., Di Lenardo, I., Rinaudo, F., & Tamborrino, R. (2019).** Digital cultural heritage meets digital humanities. *International Archives of the Photogrammetry, Remote Sensing and Spatial Information Sciences*, *42*(2/W15), 813-820.

[29] **Rauterberg, M. (2021).** *Culture and computing: Interactive culture heritage and arts: 9th International Conference, C&C 2021, held as part of the 23rd HCI international conference, HCII 2021, virtual event, July 24-29, 2021, Proceedings*. Springer.

[30] **Serres, B., Létienne, D., Roussey, O., & Venturini, G. (2023).** VISIT: A Content Management and Exploration System for Mobile Augmented Reality in the Context of Digital Humanities and Cultural Heritage. *Journal on Computing and Cultural Heritage*, *16*(2), 30:1-30:19. https://doi.org/10.1145/3582264

[31] **Smits, T., & Wevers, M. (2023).** A multimodal turn in Digital Humanities: using contrastive machine learning models to explore, enrich, and analyze digital visual historical collections. *Digital scholarship in the humanities: a journal of the Alliance of Digital Humanities Organizations. -Oxford, 2015, currens*, 1-14.

[32] **Terras, M. (2015).** Crowdsourcing in the digital humanities. *A new companion to digital humanities*, 420-438.

[33] **Beale, G., Smith, N., Wilkins, T., Schofield, G., Hook, J., & Masinton, A. (2022).** Digital Creativity and the Regional Museum: Experimental Collaboration at the Convergence of Immersive Media and Exhibition Design. *Journal on Computing and Cultural Heritage*, *15*(4), 78:1-78:23. https://doi.org/10.1145/3527620

[34] **Kocaturk, T., Mazza, D., McKinnon, M., & Kaljevic, S. (2023).** GDOM: An Immersive Experience of Intangible Heritage through Spatial Storytelling. *Journal on Computing and Cultural Heritage*, *15*(4), 59:1-59:18. https://doi.org/10.1145/3498329

[35] **Kumar, A., Kumar, A., Raja, L., & Singh, K. U. (2023).** Rediscovering the Traditional UNESCO World Heritage Hawamahal through 3D Animation and Immersive Technology. *Journal on Computing and Cultural Heritage*, *15*(4), 61:1-61:34. https://doi.org/10.1145/3524023

[36] **Meinecke, C., Hall, C., & Jänicke, S. (2022).** Towards Enhancing Virtual Museums by Contextualizing Art through Interactive Visualizations. *Journal on Computing and Cultural Heritage*, *15*(4), 62:1-62:26. https://doi.org/10.1145/3527619

[37] **Reunanen, M., Díaz, L., & Horttana, T. (2015).** A Holistic User-Centered Approach to Immersive Digital Cultural Heritage Installations: Case Vrouw Maria. *Journal on Computing and Cultural Heritage*, *7*(4), 24:1-24:16. https://doi.org/10.1145/2637485

[38] **Tsotsos G. (1997).** *Makedonika Gefyria. Topografia, architektoniki, istoria, laografia* [Macedonian Bridges. Topography, architecture, history, folklore]. Athens.

[39] **Mantas S. (1984).** *Ta Ipeirotika gefyria … gia na kalypsoun mia anagki, proekteinan ti fysi* [The bridges of Epirus ... to meet a need, they extended nature]. Athens.

[40] **Lampridis I. (1880).** *Peri ton en Ipeiro agathoergimata* [About the benevolent works in Epirus]. Athens.

[41] **Pouqueville F. (1994).** *Voyage de la Gréce* (trans. Panagiota Kotsou). Athens.

[42] **Leake W. (1835).** *Travels in Northern Greece*. London.

[43] **Lampridis, I. (1887).** Perigrafi tis poleos Ioanninon [Description of the city of Ioannina], in *Ipeirotika Meletimata* [Studies of Epirus], vol. A'. Athens.

[44] **Theocharidis, I. (1983).** Oi dioikites ton Ioanninon symfona me to Salname tou 1892- 1893 [The governors of Ioannina according to the 1892-1893 Salname]. In *Dodona*, vol. 12, Ioannina.

[45] **Aravantinos, P. (1856).** *Chronografia Tis Ipeirou Ton Te Omoron Ellinikon Kai Illyrikon Choron* [Chronography of Epirus of the Neighboring Greek and Illyrian Countries]. Athens.

[46] **Leake, W. (1835).** *Travels in Northern Greece*. London.

[47] **Holland, H. (1815).** *Travels in the Ionian isles, Albania, Thessaly, Macedonia & during the years 1812 and 1813*. London.

[48] **Turner, W. (1820).** *Journal of a tour in the Levant*. London.

[49] **Papastavros, A. (1994).** *Ta Giannena tou 19ou aiona, opos ta periegrapsan kai ta apeikonisan oi xenoi periigites* [Ioannina in the 19th century, as described and depicted by foreign travelers]. Ioannina.

[50] Wordsworth, W. (1839). *Greece: Pictorial, Descriptive, and Historical*. London.

[51] *Yanya-Ioannina Newspaper*, sheet 202/ 11 June 1873.

[52] **Kokkidis, I. (1880).** *Odoiporika Ipeirou kai Thessalias, ypo tou para to Ypourgeio ton Stratiotikon Epitelikou Grafeiou* [Expeditions of Epirus and Thessaly / under the Ministry of the Military Staff Office]. Athens.

[53] *Commercial Reports received at the foreign office from Her Majesty's Consuls between July 1st, 1863, and June 30th, 1864*, London, 1864.

[54] **Dupré, L. (1925).** *Voyage á Athènes et á Constantinople, ou Collection de Portraits, de Vues et de Costumes grecs et ottomans, peints sur les lieux, d' après nature lithographiés et colories… accompagné d' un texte,* Paris.

[55] **Papastavros, A. (2014).** *Edward Lear, zografizontas tin Ipeiro sta mesa tou 19ou aiona* [Painting Epirus in the middle of the 19th century]. Ioannina.

[56] **Papakosta-Siniki, N. (2002).** *Petrina Gefyria* [Stone bridges]. Ioannina.

[57] **Manopoulos, G. (2012).** *O evergetismos sta Katsanochoria sto 2o miso tou 19ou aiona. I periptosi tou evergeti Ioanni Z. Louli* [Beneficence in Katsanochoria in the second half of the 19th century. The case of the benefactor Ioannis Z. Loulis]. In (Th. Soultis & V. Kistis Eds.) I evergesia sta Voreia Tzoumerka [The beneficence in Northern Tzoumerka]. Ioannina.

VIII. ACKNOWLEDGMENTS

The project received funding from the Operational Program "Competitiveness, Entrepreneurship & Innovation" (EPAnEK), National Strategic Regional Framework (NSRF) 2014-2020.

IX. AUTHORS

Dr. Polyxeni Mantzou is a Dipl. Architect NTUA, PhD ETSAM, MSc ETSAM, and professor of architectural design and new technologies at the Department of Architecture, University of Ioannina. She has published articles and presented papers at congresses; she has published books. She has coordinated and participated in research projects, both national and European. She is an evaluator of national and European research projects. Her work has been awarded in architectural competitions, published, and exhibited. Her research interests are related to the theoretical comprehension and practical implementation of digital media in architectural and urban design and cultural heritage management.

Dr. Xenofon Bitsikas is an artist, professor at the School of Fine Arts, University of Ioannina, and director of the School's post-graduate program. Currently, he is Vice Rector of the University of Ioannina. He studied at the Athens School of Fine Arts. He completed postgraduate studies and his PhD at the School of Fine Arts, University Complutense of Madrid. His work has been awarded and exhibited in Greece and Europe and has been acquired by Museums and Private Collections. He has published papers in congress proceedings and reviews. He coordinates funded research projects and collaborates with Greek and European universities.

Anastasios Floros is a Dipl. Architect MArch, Democritus University of Thrace, Greece, holds a MArt from the University of Ioannina, Greece, and is currently a PhD candidate in architecture, D.U.TH. He has participated as a researcher in national and European research projects, and his research has been presented and published in conference proceedings and academic publications both in Greece and internationally. Additionally, his architectural work has received recognition through awards in architecture competitions and has been showcased in exhibitions. His primary research interests revolve around exploring the impact of digital media on architectural theory and practice.

Dr. Ioulia Papastavrou is a Dipl. Architect, a graduate of Cardiff University and the School of Architecture N.T.U.A. She holds a PhD in the School of Fine Arts of the University of Ioannina and since 2022 she has joined the School's Postdoctoral Researchers. She has been the curator of the archive of the academician V. Kouremenos and her studies are published in collective volumes.

Aris Panagiotidis-Diktampanis is a software engineer with a bachelor's in Computer Science. He is a postgraduate student in the "Data and Computer Systems Engineering" program of the Department of Computer Science and Engineering at the University of Ioannina. He has been participating in funded cross-border research projects that promote Cultural Heritage since 2021.

Journal of Integrated Information Management electronic journal

Digital Cultural Heritage Management for Local Heritage: Overcoming Barriers to Accessibility with Regional Digital Infrastructures

Mariana Ziku, Alexandros Teneketzis, Georgios Alexandridis, Yannis Christodoulou, Markos Konstantakis, Athanasios Drosopoulos, Elias Dritsas, Georgios Siolas, Konstantinos Paximadis, Fevronia Rousaki, George Caridakis

University of the Aegean, Department of Cultural Technology and Communication, Greece

mziku@aegean.gr [**ORCID:** 0000-0001-9139-6722], ateneketzis@aegean.gr [**ORCID:** 0000-0002-9550-5858], gealexandri@aegean.gr [**ORCID:** 0000-0002-3611-8292], yannischris@aegean.gr [**ORCID:** 0000-0002-1627-6760], mkonstadakis@aegean.gr [**ORCID:** 0000-0003-0656-693X], ndroso@image.ntua.gr, edritsas@ceid.upatras.gr [**ORCID:** 0000-0001-5647-2929], gsiolas@mail.ntua.gr [**ORCID:** 0000-0002-4839-7831], kpaximadis@gmail.com, f.rousaki@aegean.gr, gcari@aegean.gr [**ORCID:** 0000-0001-9884-935X]

Article Info

Article history:

Received: 12 April 2024

Received in revised form: 30 April 2024

Accepted: 18 May 2024

https://doi.org/10.26265/jiim.v9i1.38585

Abstract:

Purpose - *Digital transformation is often hindered for cultural heritage institutions operating in rural areas, due to factors including lack of digital literacy and/or digital readiness, limited capacity, underfunding and remoteness. The typology of these institutions varies, involving e.g. community-run folklore museums, cultural sites maintained by local associations, permanent thematic collections founded by collectors in their place of origin and enterprise initiatives showcasing historical information of local goods production within gallery settings. Due to their special traits and underlying factors, cultural heritage institutions operating in the periphery may remain outside the reach of central heritage infrastructures, such as aggregators of digital heritage content, and may fail to benefit from digital strategies and services.*

The paper describes the development of the "AegeanA" digital infrastructure for cultural heritage management in the region of the North Aegean, Greece, with the objective of overcoming those barriers by connecting with cultural heritage institutions across the region and supporting the wider sharing of their collections in open-access and semantically enriched ways. AegeanA is a digital repository and collection system for cultural heritage operating at the regional level, offering a single point of access for larger volumes of digital cultural heritage content previously dispersed in remote, offline or outdated databases.

The paper discusses key concepts related to the project on digitisation, innovation and sustainability in the cultural heritage field, highlighting the impact of regional development. Next, the framework and methodology of the digital infrastructure development is presented, and results are discussed in the context of user analysis, protocols of collaboration and technical infrastructure development. It particularly focuses on the backend development for achieving interoperability between the open-source system of AegeanA and the aggregator of digital heritage content of the National Documentation Centre in Greece. The paper further discusses the challenges and benefits of the project, in the context of digital heritage management and regional development

Design/methodology/approach - *Design and implementation of an open-source collection management system in the context of regional development. Focus is given on the components of user analysis and the development of the technological framework, especially in achieving interoperability with larger national and European digital heritage infrastructures. In addition, protocols of collaboration are established between the regionally operating institutions and the University of the Aegean.*

Findings - *i) Challenges in reaching out to the majority of the targeted institutions: Registration of 54 cultural institutions operating currently in the Region of the North Aegean, out of which 17 at least with digital heritage collections/artefacts, interested to take part in the project. A survey targeting regional institutions yielded 6 replies, containing insights on qualitative and quantitative data, including needs and challenges.*

ii) Specific user needs identification and technical development attuned to interoperability: A range of requirements related to access, functionality, usability, and support were identified, reflecting the diverse needs of regional institutions. Technical components include the configuration and customisation of the open-source collection management system selected for developing the digital infrastructure, especially in achieving interoperability with the national cultural aggregator with the implementation of the OAI-PMH and resolution of technical issues.

Originality/value - *The research addresses a significant gap in the digital transformation of cultural heritage institutions at the regional development level. The implementation of the digital infrastructure serves as a pragmatic solution for collecting, documenting and connecting otherwise non-accessible cultural collections and artefacts. The paper provides also insights for achieving interoperability between the open-source collection management system and the national aggregator of digital heritage content of the National Documentation Centre in Greece.*

Index Terms — digital cultural heritage management, regional development, digital infrastructures, barriers.

I. INTRODUCTION

Cultural heritage collections remain inaccessible by digital means to a substantial extent, despite the efforts for digital

transformation. While significant progress has been made, it is estimated that the vast majority of cultural heritage, estimated over 80%, hasn't been digitised yet **[1]**, **[2]**, **[3]**.

However, critical dimensions regarding the type of measurements on digital heritage are currently debated. The central question, as to whether the total percentage of digitised collections reflect the actual impact of digital heritage, is prompting for new directions. The need for more holistic indicators of impact and digital transformation has been recently stated **[4]**. Future impact measurements may thus bring forward more mindful digitisation processes based less on acquiring quantity and more on achieving sustainability, reuse, ethics and participation. The European Digital Cultural Policy, established in 2012 as a European Commission recommendation and benchmark on the digitisation, online accessibility, and digital preservation of cultural material, aims to enhance the availability of digital cultural heritage content. Among its goals are optimising the use of digitisation capacity and achieving economies of scale. **[5]**.

Based on a Consolidated Progress Report on the implementation of the 2011 Commission Recommendation **[6]**, the high-level overview of the planning and monitoring of digitisation progress among the member states, is provided through digitisation schemes at the national, regional and sectoral level. Reports from the regional level are thus contributing at large to the assessment of digital policies and strategies and their level of implementation. However, digitisation plans at the national level in the vast majority of the member states are not complemented by specifically tailored ones at the regional level, except in the cases of Belgium, Germany and Spain. A tailored digitisation plan addressing specific needs in regions, may be more useful in these countries due to their national structure (e.g., the federal states in Germany "Länder" with significant autonomy in areas such as culture).

In the European and national policy contexts, innovation is consistently addressed as a fundamental driver of economic growth and social progress. However, the focus on innovation in national policies without supporting organisational change or skill development may lead to slower growth of digital collection publications **[7]**. On the one hand, the capacity for innovation in cultural heritage institutions and other collection management organisations can be assessed from baseline indicators such as the digitisation and online publication of their heritage collections **[8]**. This can be seen as an initial sign of an organization's capacity to innovate in developing fresh heritage information services, broadening audience engagement, or generating added value for their collections. On the other hand, as innovation in this context often depends on technical expertise, i.e., technical innovation, this comes at a high cost, high risk and larger, established and sustainable funded institutions are recognised to have a higher ability to innovate. The New European Agenda for Culture published in 2018, reinforced the direction for digital heritage as one of the major areas of cultural policy at the European level **[9]**. In doing so, the Commission particularly addresses the European Committee of the Regions, an advisory body representing locally and regionally interests. Furthermore, the New Agenda prompts a threefold focus on three ecosystems, one of which are cities and regions. Regional support and strategies are especially highlighted in the cultural heritage field, underlining their capacity for culture-led development, social and economic innovation.

Moreover, sustainability is considered a critical indicator for assessing development in digital cultural heritage management, while the use of ICT in cultural heritage has been noted as a driver of sustainable development **[10]**. The need for reliable IT infrastructures and additional funding is highlighted, In order to promote sustainability in the cultural field **[11]**. In international initiatives such as the United Cities and Local Governments (UCLG), culture is placed as the fourth pillar of sustainable development, prompting regional governments to develop a solid cultural policy **[12]**. However, in the 2030 Agenda for Sustainable Development of the United Nations, culture and heritage has not succeeded to enter as a pillar. Nevertheless, under the Sustainable Development Goal No.11 "sustainable cities and communities", the Target 11.4 states: "Strengthen efforts to protect and safeguard the world's cultural and natural heritage". Cultural heritage is thus addressed as part of national and particularly local authority level for achieving global sustainability goals. In addition, sustainable development is increasingly being discussed in the context of Intangible Cultural Heritage (ICH). ICH is emerging as a driver and enabler of innovation and sustainable development. In particular, practical guidance for the implementation of sustainable development has been provided in the form of Operational Directives in the context of the UNESCO Convention for the Safeguarding of the Intangible Cultural Heritage **[13]**. The chapter added in 2016 in the operational directives titled "Safeguarding Intangible Cultural Heritage and Sustainable Development at the National Level", spurs state parties to acknowledge safeguarding efforts in both urban and rural contexts, facilitating cooperation with relevant experts, culture brokers and mediators through a participatory approach **[14]**.

In the wider European landscape, several initiatives at national level are implemented for the management and preservation of cultural heritage documentation. Existing literature points out how digital cultural heritage management is being put forward at national level, focusing on diverse aspects and objectives. The necessity for standardisation and interoperability has been stressed in Serbia, towards the development of a national information system **[15]**. In Italy digitisation techniques and web infrastructures **[16]** have been analysed, towards the enhancement of universal access to cultural heritage with a focus on public historic archives, noting that fragmentation of available resources and missing of ICT undermine the

efforts. In addition, Guccio et al. note the importance of relevant data collection that provide metrics over the field, which is critical for developing effective policies and programmes based on pragmatic conditions. A study in Romania stresses the cultural strategies at national level, which align with the European digital agendas, however noting Romania as part of the cluster of low performing countries, based on the Digital Economy and Society Index (DESI) 2017. In addition, several issues are pinpointed, such as the risk of an excess of quantity over quality **[17]** and the hazards of underfunding that hinder capacity and cultural heritage sustainability, for which digitisation is an important driving force.

In Greece, the management and growth of digitisation efforts have been carried out through two main schemes in the past years, the Operational Programme "Digital Convergence" 2013-2017 National Programme for Digital Convergence 2012-2015 and the new Operational Programme Competitiveness, Entrepreneurship and Innovation 2014-2020 (EPAnEK) (European Commission, 2018). Notably, two Member States, Greece and Cyprus reported that no measures were adopted to allow preservation of web content, as of 2018. Currently, the vision of a digital transformation plan in Greece has been analyzed in the Digital Transformation Bible 2020-2025 (Ministry of Digital Governance, 2021), which includes the cultural sector as one of the 17 pillars of digital transformation in the Greek economy. Among the six general objectives of digital transformation for culture are the improvement of quality, interoperability, and access to data, the utilization of digital cultural content as open data, as well as the reinforcement of digitization of cultural entities for consistent implementation of generally accepted international standards and best practices for digitisation and documentation of content. (ibid., 297-305). At regional level, strategic planning for the Cultural and Sports Sector focuses on Priority Axis 1: the development of technologies and methods for conserving artworks from archives and collections of artistic and cultural heritage.

II. AEGEANA DIGITAL INFRASTRUCTURE

A. Framework

The paper presents the development of a digital heritage infrastructure and project with educational components for the management of cultural heritage and for capacity building in the field, in the Region of the North Aegean, Greece. The project is part of the programme "Interregional Digital Transformation of the Aegean Archipelago in Culture and Tourism (e-Aegean CulTour)", supporting the Regional Excellence of the Operational Program "Competitiveness, Entrepreneurship and Innovation" of ESPA 2014-2020, funded by the European Regional Development Fund (ERDF) and national resources. Within this context, 10 research teams with the participation and collaboration of 14 laboratories from 9 different Departments of the University of the Aegean on the islands of Lesvos, Chios, and Syros, worked on more than 10 large-scale projects.

The programme with a three-year implementation horizon (2020-2023) presented multiple benefits for the North Aegean Region, for institutions and industries active in the field of culture, as well as for citizens or visitors, through the collection, documentation, intelligent management and promotion of digitised cultural content. The programme was included in the list of "Good Practices - Success Stories in the Exploitation of Operational Program Resources". It actively contributed to achieving specific goals of the Smart Specialization Strategies of the Aegean Regions, which include: a) the protection and promotion of cultural heritage and identity through innovative applications, b) the development of skills to support the tourism and cultural products of the regions, c) sustainable development through the integration of academic research with the needs of local communities. The e-Aegean CulTour aimed at supporting authorities in fulfilling their strategic objectives for regional innovation, entrepreneurship, employment, and human resource skills acquisition in all priority areas of the Smart Specialization Strategies for 2014-2020, as well as through solid planning within the framework of 2021-2027: through Entrepreneurial Discovery Actions in the fields of Tourism, Culture, and Creative Industries, of the two regions of the Aegean Archipelago and their direct connection with the research laboratories of the University of the Aegean for collaborative efforts.

The actions of the project were articulated around the axis of services, structures, and networks of cultural communication and interculturality, as well as the creation of a digital mechanism for collecting cultural content. The action ”AegeanA-Digital Heritage Management Centre”, within the “e-Aegean CulTour”, has been developed by the Intelligent Interaction Research Group, Dept. of Cultural Technology and Communication, University of the Aegean. The action aims to develop a digital infrastructure for the collection, harmonisation, documentation, and disposal of the tangible and intangible cultural heritage of the North Aegean Region, operating in connection with SearchCulture.gr, and the Greek national aggregator for digital cultural content of the National Documentation Centre and with Europeana, the European web portal for digitised cultural heritage. AegeanA aimed to support the collection of cultural resources that are scattered in remote, offline or non-interconnected databases, with the objective to offer interoperability services for digitised cultural resources and "smart" management through semantic web technologies to collaborating institutions of the North Aegean related to the cultural, environmental or tourism promotion of the region. The action also provides expertise and training for the development of ICT skills to participating local cultural institutions and individual users through the release of Open Educational Resources (OER) in the field of digital heritage management. The action aims to cover the life cycle of digital cultural data management, from collection, validation and semantic enrichment to primary

disposal and preservation of digital cultural resources.

B. Methodology

The project is based on a research and development framework, including a twofold approach, a technical development and a policy-supportive approach.

First, a user analysis report was conducted for the identification of relevant user groups and target audience. This followed a classification of how to design for and evaluate Cultural User Experience (CUX), on the basis of UX evaluation methods in cultural technology **[18]**. The requirements specification methodology formed included the steps for user needs identification, further breaking down prioritisation of user requirements. Focus group findings were recorded through usage scenarios with the digital infrastructure. Lastly, identification of evaluation indicators was performed.

Next, the methodology included the formulation and agreement of collaboration protocols, between the higher education institution (i.e., University of the Aegean) and the collaborating cultural institutions in the Region of the North Aegean. First, a survey for data collection was designed and published, aimed at regional institutions interested to participate. A draft template of collaboration agreement in the form of a Memorandum of Understanding was set, addressing key passages of the agreement such as on intellectual property rights and on protection of personal data. Communication with the National Documentation Centre was established in this phase stipulating the field of action and the signing of the agreements with stakeholders.

Next step included the technical infrastructure development, with backend components and the development of interoperability between the digital infrastructure and the national aggregator of digital heritage content of the National Documentation Centre in Greece. The objective was to develop a data collection and storing mechanism so that its functionality aligns with similar content collection mechanisms, enabling the coverage of the entire content aggregation lifecycle, from harvesting, validation, and semantic enrichment, to central distribution and secure preservation of digital resources.

C. Results

C1. User Analysis

The user groups of the system were presented, followed by the methodology employed to determine the system requirements, addressing both its theoretical background and its application within the project framework. Furthermore, the analysis findings were presented, including descriptions of existing workflows targeted for enhancement by the system, responses to the analysis queries, and specific usage scenarios for the system's core functionalities. Finally, the system evaluation metrics were introduced.

The classification of user groups within the AegeanA system is based on distinct categories. In total, six user groups were analysed within the AegeanA system. These include administrators, who have full access and editing rights, as well as internal end-users, who also possess comprehensive access and editing capabilities. Additionally, there are users with restricted access and editing permissions, catering to specific roles or functionalities within the system. External end-users constitute another group, comprising individuals who access the system's services from outside the organisation. Furthermore, there are non-registered users who interact with the system without creating an account, as well as registered users who have created accounts to access personalised features.

In the process of determining system requirements, two main categories are identified: functional and non-functional requirements. Functional requirements delineate the system's interaction with its environment in detail, while non-functional requirements specify the system's specifications, essentially framing the functional requirements. These non-functional requirements are crucial as they impose constraints on the choices available to designers during the design and implementation stages. Non-functional requirements are further analyzed into specific categories, with key areas including security, performance, reliability, usability, and support. The foundation for applying different user requirement analysis methods lies in a straightforward process encompassing four fundamental stages: information gathering, user needs identification, envisioning and evaluation, and requirements specification. Key methods for determining final requirements include task/function mapping, requirements categorization, prioritization of user requirements, and criteria setting. These methodologies provide a structured approach to comprehensively identify and prioritize user needs, ensuring the successful development and implementation of the system.

For identifying user needs, the methodology of Focus Groups and questionnaires was considered an efficient approach for this particular case. Within this framework, necessary data regarding the different user types identified were collected, and subsequently, user needs were recognised.

The focus groups served as a method for collecting opinions and experiences. Each group typically consisted of five to twelve participants, while the discussion was guided and facilitated by a moderator. In addition, questionnaires were used which consisted of predefined questions provided to the participants, who then recorded their answers or marked a subjective satisfaction rating for certain system parameters. Based on the discussions held during the focus group and the information provided in the questionnaire, the fundamental user requirements were identified for both the collection of cultural assets and the presentation of content through the AegeanA system.

Detailed use-case scenarios of the AegeanA digital repository were recorded based on the major functionalities of the system as identified during the focus group meetings.

Performance metrics of the system were categorized into three categories i) performance metrics measuring the performance (response time, availability, etc.) of the AegeanA system, ii) support metrics measuring how effectively the workflow of collecting cultural assets is supported by the AegeanA system, and iii) engagement metrics measuring the level of user engagement.

C2. Protocols of Collaboration

The collaboration with cultural institutions in the Region of the North Aegean was one of the main objectives of the research project. The development of digital infrastructures for the digital management of local cultural heritage was pursued, acknowledging the prominent role of regional institutions in maintaining and preserving historical evidence, technological knowledge, resources, practices, and communities. The protocols of collaboration aimed to establish a reliable foundation for cooperation between academic institutions (e.g., research laboratories, working groups) and cultural, tourism, or environmental organisations involved in the study and promotion within the region.

A desktop-based survey was conducted to identify cultural institutions in the North Aegean Region. The selection criteria for these institutions in the region were based on their cultural, touristic, or environmental involvement in the promotion of the region, encompassing from museums and art galleries to cultural centres and multipurpose venues. The survey yielded 54 cultural institutions operating in the region. The typology of these institutions encompasses a variety of categories, including archaeological museums, municipal museums, digital museums, cultural centers, ethnographic museums, visitable monuments, art galleries, Byzantine museums, exhibition centers, and natural history museums. The most prominent categories with the most occurrence are arhaeological museums, ethnographic museums and municipal museums.

To approach these institutions, a web questionnaire with 31 fields was created to record the institutions and their characteristics, in order to capture a better picture of the potential participation of the institutions. A series of telephone calls were made for initial briefing of the institutions and to clarify if they have digital/digitised collections, in order to establish a general understanding of their potential participation. Some institutions did not possess digitised collections, and communication with certain institutions was not feasible as their contact information could not be found or there was no response. The majority of the institutions responded positively regarding participation and integration of their collections in the digital infrastructure, and expressed interest in the educational materials. Subsequently, emails containing relevant information and credible links for the programme were sent out. The questionnaire remained open for three months and was filled in by only six institutions. Based on the information gathered, 5 out of 6 organisations don't operate a collection management system and none is interconnnected with the national cultural aggregator or Europeana. 4 out of 6 didn't have professional digitisation of their collections but still have photographs of average quality of many artefacts. 2 out of 6 institutions don't have any personnel and rely on volunteering and support from other institutions, including schools and municipal personnel. Others have personnel on an irregular and short-term basis, depending on national employment programmes.

A document in the form of a Memorandum of Understanding (MoU) was sent to institutions that expressed interest and possess digital/digitised assets. The collaboration protocols aimed to establish a reliable basis for cooperation between academic infrastructures (e.g., research laboratories, working groups) and cultural institutions within the region. The purpose of establishing collaboration protocols between the University of the Aegean and local cultural institutions within the framework of the AegeanA project was to formalise a cooperative agreement for the benefit of the local stakeholders, in connection with broader national and European cultural infrastructures, to make local cultural content more accessible. The collaboration protocols aimed to establish new networks among the regional institutions and the university that can remain active even after the conclusion of the initiative.

C3. Technical Infrastructure Development

The AegeanA platform is developed as a repository for digital cultural heritage based on a system for collecting, documenting, and publishing collections from multiple institutions. The selection of suitable software was evaluated against 20 criteria from among 70 different software options. Positive responses were noted in areas of open-source nature and overall openness, support for public access through a web portal, availability of APIs, IIIF compatibility, and user-assigned tasks. Data analysis partially relied on Ashley Blewer's "Management System Collection" spreadsheet. With reference to this spreadsheet, the Omeka software received positive evaluation, leading to the decision to install Omeka-S, the latest version supporting linked data and enhanced usability.

By analysing the user requirements for the software of the infrastructure, the development and configuration of the collection management system began as part of the AegeanA's Backend system deliverable. Omeka software was positively evaluated based on the table and selected for installation, specifically the new version Omeka-S, which supports linked data and offers enhanced usability. User roles (global administrator, supervisor) were added for the software's operation. Subsequently, a metadata template was created based on the specifications of the National Documentation Centre (EKT), validated by EKT for field accuracy, and a digital resource template was developed with selected metadata fields, successfully applied as a template. Additionally, structured vocabularies were

installed and utilized to enrich metadata fields, allowing terms from the lexicon to appear in a drop-down menu during data entry. Successful testing was conducted for displaying structured vocabulary terms during data entry. Functionality was further enhanced through the installation of add-ons, and integration with EKT was achieved through the installation of the additional module for initiating the Open Archives Initiative Protocol for Metadata Harvesting (OAI-PMH). The protocol allowed the automated system of EKT to access and collect Aegeana's metadata records from its repository in a standardized format, facilitating interoperability between the systems and services.

The Omeka S software was selected for its features, capabilities, and performance in the context of managing digital cultural heritage for the development of the AegeanA digital infrastructure. Specifically, Omeka S supports the aforementioned evaluation criteria with additional support for Semantic Web and RDF triple-store standards and vocabularies. The Omeka S database is developed in MySql, and the programming language used is PHP. Furthermore, for small to medium-sized institutions with limited technical expertise, characteristics related to potential collaborating institutions, Omeka S is a good choice due to its user-friendliness compared to more specialized systems requiring greater technical knowledge, such as Arches.

Omeka S provides an application programming interface (API) that allows CRUD operations (create, read, update, and delete). The integration of the backend of the AegeanA digital repository with SearchCulture.gr was achieved through collaboration with the Department of Electronic Infrastructure and Information Systems of the National Documentation Center (EKT). The integration involved resolving technical issues and adapting system compatibility in two directions: i) Dynamic retrieval of EKT vocabulary (in JSON-LD format via a corresponding endpoint), and ii) Provision of metadata via OAI-PMH (supporting Dublin Core and EDM schema). Tests with the query of the "ekt-item-types" vocabulary in Omeka-S initially did not work as expected. The issue was identified in Omeka-S's capability to search only key values and not nested ones, while EKT has a nested structure and not a flat one. Following the communication between the research team and EKT, a new notation of json-ld generated by the library was defined by the Electronic Services Unit, which aligns with the capabilities of Omeka S. The use of the vocabulary became feasible, and the search now returns results in a drop-down menu format within the metadata field utilized, specifically applied to the "Type" field of the template.

The Open Archives Initiative Protocol for Metadata Harvesting (OAI-PMH) is a mechanism for collecting documents containing metadata from content dissemination infrastructures (e.g., repositories, digital libraries). OAI-PMH enables data providers to make metadata available to harvesters based on open standards such as HTTP and XML. To disseminate AegeanA's metadata to the EKT, the OAI-PMH Harvester module (plugin) was installed with the OAI-PMH URL. The retrieval of metadata was successful, with the only requirement being the adaptation of the Dublin Core "identifier" field.

After the EKT retrieves metadata from AegeanA via OAI-PMH, the API call of Omeka S for items presents an issue with the first URI of the dc:identifier field. Instead of leading to the document presentation page, it directs to an API call of Omeka S for that specific item. To ensure the correct retrieval of metadata from the EKT, the URI of the dc:identifier needs to redirect users of searchculture to the document pages. For resolving this issue, an additional field dc:identifier was added, returning the document presentation page.

III. DISCUSSION

In the context of managing local cultural heritage, particularly within regional settings, institutions often face significant challenges in responding to innovation and sustainability planning. These obstacles are compounded by limited resources and expertise, making it difficult for regional institutions to effectively preserve and promote cultural heritage. However, the study aimed to provide a paradigm of digital infrastructure implementation that functions as a crucial mediator in overcoming these barriers. By providing the digital components for collecting, storage, and dissemination of digital cultural artefacts and resources, the digital infrastructure enabled regional institutions to enhance accessibility and visibility of local heritage. Despite the potential benefits, communication and collaboration with these institutions proved to be challenging. Many lack the necessary personnel and expertise to fully leverage digital tools and platforms. Moreover, some institutions are driven by passionate individuals dedicated to supporting local cultural heritage, yet they often grapple with a lack of knowledge and skills in digital heritage management. Overcoming these barriers requires concerted efforts to provide training, technical assistance, and capacity-building initiatives tailored to the needs of regional institutions. In this context, provided services of the digital repository and related tools were accompanied by training and digital skills development activities. After all, the goal was not solely the development of infrastructure but primarily raising the awareness of the possibilities they offer, their implementation, and their future, continuous utilisation by the community for which they are intended. A fundamental component of the project involves developing digital educational materials in the form of Open Educational Resources (OER) and organising training workshops. These workshops aimed to enhance users' proficiency in utilising the digital infrastructure, for tasks like data search, retrieval, documentation and presentation. The objective is to familiarize participants with these tools and facilitate discussions on their practical applications. Additionally, webinars were conducted to provide insights into the evolving technologies and methodologies employed in the programme. These webinars served to disseminate

knowledge and foster a deeper understanding of the project's advancements.

In addition, by partnering with the Aegeana infrastructure and project, the National Documentation Centre facilitated the establishment of interoperability and a robust backend system for the open-access digital repository. This collaboration ensured seamless integration of the regional digital infrastructure with broader national and international networks, enhancing the visibility and accessibility of local cultural heritage resources. The National Documentation Centre's expertise and resources bolstered the technical capabilities of the project, enabling the implementation of standardized protocols and best practices in digital heritage management. Overall, the collaborative efforts between the project and the National Documentation Centre underscored the significance of cross-institutional partnerships in advancing digital cultural heritage management initiatives and overcoming technological barriers for the benefit of regional communities and broader audiences alike.

AegeanA collected cultural content in the Region of North Aegean, operating in full compliance with the national cultural aggregator SearchCulture.gr of the National Documentation Centre and through it with the European portal of cultural content Europeana. The project will develop a digital repository for the collection, organization and promotion of cultural heritage artefacts, by providing relevant services to the cultural institutions in North Aegean, as well as to other institutions of the Region related to the cultural, environmental, pedagogical development and touristic visibility of the area.

The AegeanA project aimed to offer a technological infrastructure to cultural institutions, supporting regional development in fulfilling their strategic objectives for regional innovation in the field of cultural heritage. The strengthening of the outreach of cultural institutions and enterprises operating in the field of culture, extended to the national and European levels, as the services provided by the digital infrastructure allowed interconnection with platforms. Although the majority of the cultural institutions expressed an interest in integrating their collections into the digital infrastructure, the process of formalising the Memorandum of Understanding (MoU) and commencing collaborative efforts is progressing at a slower pace than anticipated. Numerous regional cultural institutions rely on the voluntary contributions of individuals or associations dedicated to advancing local heritage, albeit often possessing limited digital literacy.

In addition, AegeanA was also envisioned as an online point of open access to the general public with enriched cultural content focusing on the geographical area of the Aegean. The project aimed to provide know-how to cultural professionals and museum personnel, related to digital cultural heritage management, as well as to make available upgraded resources and information of open cultural content to the general public.

The project supported a series of actions with four main directions: i) networking, by developing a credible and sustainable network of communication and cooperation of the involved bodies, ii) training, conducting workshops, seminars and webinars in the field of digital cultural heritage management and for the practical presentation of the Aegeana digital infrastructure, iii) technical development, of the digital infrastructure hosting and documenting regional collections that were previously inaccessible and iv) Policies and guidelines: Implementing good practices and policies for the management of cultural heritage data. Towards these directions, recommendations for future work may include actions for sustaining and broadening the collaboration network between the university and local institutions, finding efficient ways to mitigate the barriers of the under-functioning institutions and the digital literacy gaps among its associates. Improving the openness of the participating agencies, thereby fostering broader accessibility to local cultural heritage.

In addition, provision to release the OERs developed within the project and maintaining updates for the open-source software to ensure the current, long-term and optimal functionality of the digital infrastructure.

In terms of innovation and impact, the development of a regional digital infrastructure for collecting, documenting, and enhancing the interoperability of fragmented or previously inaccessible local heritage collections was executed as a pragmatic solution toward fostering regional development in the field of digital transformation. In addition, the technical development of the interoperability framework between the AegeanA digital infrastructure and the National Documentation Centre (and through it with Europeana), provided the first testing and implementation of the OAI-PMH between the open-source Omeka S software and the national aggregator of digital cultural content searchculture.gr.

IV. REFERENCES

[1] **European Commission**, Directorate-General for Research and Innovation, Brunet, P., De Luca, L., Hyvönen, E. et al., Report on a European collaborative cloud for cultural heritage – Ex – ante impact assessment, Publications Office of the European Union, 2022. https://data.europa.eu/doi/10.2777/64014

[2] **G.J. Nauta, W. van den Heuvel, and S. Teunisse**, "D4.4 report on ENUMERATE core survey 4. Europeana DSI 2 – Access to Digital Resources of European Heritage," Europeana, 2017. https://pro.europeana.eu/files/Europeana_Professional/Projects/Project_list/ENUMERATE/deliverables/DSI-2_Deliverable%20D4.4_Europeana_Report%20on%20ENUMERATE%20Core%20Survey%204.pdf

[3] **Toma Tasovac, Sally Chambers, Erzsébet Tóth-Czifra**. Cultural Heritage Data from a Humanities Research Perspective: A DARIAH Position Paper. 2020. https://hal.science/hal-02961317

[4] **F. Mowat and N. McNeilly**, "Report from the Czech Presidency Europeana conference," Europeana, March 15, 2023. [Online]. Available: https://pro.europeana.eu/post/report-from-the-czech-presidency-europeana-conference

[5] Commission Recommendation on the digitisation and online accessibility of cultural material and digital preservation. 2011. https://eur-lex.europa.eu/legal-content/EN/TXT/HTML/?uri=CELEX:32011H0711

[6] Implementation of Commission Recommendation on the Digitisation and Online Accessibility of Cultural Material and Digital Preservation Consolidated Progress Report 2015-2017. 2018. https://www.digitalmeetsculture.net/wp-content/uploads/2019/06/ReportonCulturalHeritageDigitisationOnlineAccessibilityandDigitalPreservation.pdf

[7] **Trilce Navarrete**. Becoming Digital: A Dutch Heritage Perspective. Journal of Arts and Management, volume 44, issue 3 , p. 153 - 168. 2014.

[8] **K. Borowiecki and T. Navarrete**, "Digitization of heritage collections as indicator of innovation", SSRN Electronic Journal, 2015. https://doi.org/10.2139/ssrn.2654167

[9] Communication from the Commission to the European Parliament, the European Council, the Council, the European Economic and Social Committee and the Committee of the Regions. 2018. https://www.cultureinexternalrelations.eu/wp-content/uploads/2018/06/commission_communication_-_a_new_european_agenda_for_culture_2018.pdf

[10] **E. Macrì and C. L. Cristofaro**, "The Digitalisation of Cultural Heritage for Sustainable Development: The Impact of Europeana," in Cultural Initiatives for Sustainable Development, P. Demartini, L. Marchegiani, M. Marchiori, and G. Schiuma, Eds. Springer, Cham, 2021. https://doi.org/10.1007/978-3-030-65687-4_17

[11] **U. Preuß**, "Sustainable digitalization of cultural heritage—report on initiatives and projects in brandenburg, germany", Sustainability, vol. 8, no. 9, p. 891, 2016. https://doi.org/10.3390/su8090891

[12] **United Cities and Local Governments**. Culture: Fourth Pillar of Sustainable Development. 2010. Available online: http://www.agenda21culture.net/sites/default/files/files/documents/en/zz_culture4pillarsd_eng.pdf

[13] **UNESCO**, "Convention for the Safeguarding of Intangible Cultural Heritage," Paris, France, 2003. https://ich.unesco.org/doc/src/2003_Convention_Basic_Texts-_2022_version-EN_.pdf

[14] **UNESCO**, "Operational Directives for the Implementation of the Convention for the Safeguarding of the Intangible Cultural Heritage," Chapter VI, 170. 2016. https://ich.unesco.org/doc/src/ICH-Operational_Directives-6.GA-PDF-EN.pdf

[15] **Z. Ognjanović, B. Marinković, M. Šegan-Radonjić, & D. Maslikoviić**, "Cultural heritage digitization in serbia: standards, policies, and case studies", Sustainability, vol. 11, no. 14, p. 3788, 2019. https://doi.org/10.3390/su11143788

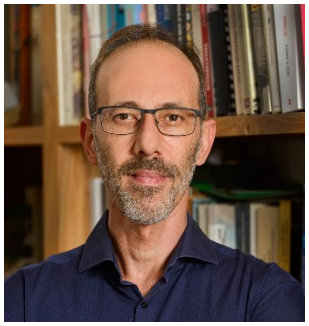
[16] **C. Guccio, M. Martorana, I. Mazza, & I. Rizzo**, "Technology and public access to cultural heritage: the italian experience on ict for public historical archives", Cultural Heritage in a Changing World, p. 55-75, 2016. https://doi.org/10.1007/978-3-319-29544-2_4

[17] **Fanea-Ivanovici, M.**, "Culture as a Prerequisite for Sustainable Development. An Investigation into the Process of Cultural Content Digitisation in Romania," Sustainability, vol. 10, no. 6, p. 1859, 2018. Available: https://doi.org/10.3390/su10061859

[18] **Markos Konstantakis and George Caridakis**, "Adding Culture to UX: UX Research Methodologies and Applications in Cultural Heritage," *J. Comput. Cult. Herit.*, vol. 13, no. 1, Article 4, pp. 17, February 2020. Available: https://doi.org/10.1145/3354002

V. AUTHORS

Mariana Ziku, Researcher in the e-Aegean CulTour project, is a PhD candidate at the Intelligent Interaction Research Group, Dept. of Cultural Technology and Communication, University of the Aegean. She is also staff member of the Master's Programme Folk/Popular Culture and Modern Cultural Heritage at the Hellenic Open University. Her research is in Digital Cultural Heritage/Cultural Informatics, particularly in the field of Intangible Cultural Heritage (ICH) and Traditional Cultural Expressions (TCE). She holds a BA in Art Sciences, an MA in Theory/History of Art and Curation (University of Ioannina, Greece), and an MSc in Digital Humanities (KU Leuven, Belgium).



Alexandros Teneketzis, Researcher on the project, is Assistant Professor of Art History at the Department of History and Archaeology, University of Patras, Greece. He also teaches Public History at the Hellenic Open University as an Adjunct Lecturer. He has published widely on public art and memory, the history of digital art and the history of museums.

Georgios Alexandridis received the M.S.E.E. degree from the Department of Electrical and Computer Engineering, University of Patras, Greece, in 2005 and the Ph.D. degree from the School of Electrical and Computer Engineering (ECE), National Technical University of Athens (NTUA), Greece, in 2015. From 2018 to 2023, he was Laboratory Teaching Staff at the Artificial Intelligence & Learning Systems Laboratory of ECE, NTUA. Since 2023, he has been an Assistant Professor with the Department of Digital Industry Technologies, School of Science, National & Kapodistrian University of Athens, Greece. He is the author of one book chapter, more than 20 journal articles and more than 35 conference articles. His research interests include natural language processing, the development of large language models for tasks such as sentiment analysis, as well as the application of deep learning techniques on a wide range of domains, such as video and image processing.

Dr. Yannis Christodoulou holds a PhD from the National Technical University of Athens (School of Electrical & Computer Engineering) in Knowledge Representation and Web Ontologies, an M.Sc. in Advanced Computing – Global Computing & Multimedia from the University of Bristol, and a B.Sc. in Informatics from Athens University of Economics & Business. His research interests and experience lie within the fields of Knowledge Representation, Web Ontologies and Conceptual Modeling. Furthermore, he has studied and proposed methods of visual knowledge representation (semantic visualization, visual languages, interactive visualization, geo-visualization), as well as knowledge acquisition methods. In the context of his research he has followed a deeply interdisciplinary Digital Humanities approach by studying various knowledge domains, all falling into the Humanities and Social Sciences, such as Filmmaking, Dance, Cultural Heritage and Human Geography. He has worked as a researcher in several funded research projects –among them three European (FP7, H2020) and one British (ESRC)– where he has conducted deep interdisciplinary research focusing on conceptual analysis and modeling, ontology engineering and semantic visualization.

Markos Konstantakis serves as an Adjunct Lecturer and as a Postdoctoral Researcher at the Department of Cultural Technology and Communication, University of the Aegean, where he is a member of the Intelligent Interaction research group (ii.aegean.gr) and the I-Lab Intelligent Systems laboratory, active in the research fields of Intelligent Systems, Human Computer Interaction, and Digital Management of Cultural Heritage. He received a Ph.D. in the same department, entitled: "Augmented Cultural User Experience (ACUX)" and a master's degree in "Specialization in Information Systems, Networks, and Telecommunications" from the Faculty of Sciences and Technology of the Hellenic Open University (HOU). Markos completed a degree and a master's degree as a Marine Mechanical Engineer at the National Technical University of Athens (NTUA). His research on various aspects of intelligent human computer interaction and cultural informatics has been published in more than 25 journal articles and more than 20 papers in conferences and workshops and has been well recognized by the scientific community by being cited more than 380 times with an h-index of 13. He has participated in more than 10 research projects during the past 15 years at the Regional, National and European level as a Researcher and Academic Fellow.

Athanasios Drosopoulos received the degree in Computer Science from the University of Ioannina, Greece in 1998, and the PhD in the field of computer vision from the Elec. & Comp. Eng. school of the National Technical University of Athens (NTUA) in 2005. He has worked as a senior researcher, software engineer and project manager for NTUA, in more than 20 Greek and EC projects in the fields of neural networks & machine learning, emotion analysis & human-computer interaction, knowledge technologies and digital archives. He is currently involved in research activities and projects concerning metadata modelling and aggregation, interoperability and access to digital cultural heritage content and, semantic web technologies.

Elias Dritsas received his Diploma, M.Sc and PhD degrees in Computer Science and Informatics from the Department of Computer Engineering and Informatics, University of Patras, Greece. Also, he received his MBA from the University of Derby, United Kingdom. His research interests focus on AI and Machine Learning, Big Data, Databases, Data Mining, Human-Computer Interaction, Cloud Computing, Security and Trust. He is the author and co-author of publications in the area of Machine Learning and Data Analysis. He participated in many development projects funded by the EC and the Greek Secretariat of Research and Technology. He serves as a regular reviewer for several technical journals and conferences. He is a member of the Technical Chamber of Greece, Association for Computing Machinery, and IEEE.

Georgios Siolas graduated from the School of Electrical and Computer Engineering of the National Technical University of Athens (NTUA) in 1998. In 1999 he obtained a Master's Degree in Cognitive Science at the Sorbonne Université Campus Pierre et Marie Curie in Paris, France. In 2003 he obtained his Ph.D. in Computer Science from the same university. Since 2007 Dr. Siolas has been a Senior Researcher at the Artificial Intelligence and Learning Systems Laboratory of the School of Electrical & Computer Engineering NTUA. He is the author

of one book, two book chapters, 18 journal articles and 40 conference articles. His research interests include: machine learning, text mining, information retrieval, recommender systems, social network analysis, semantic web technologies, computer vision, and design patterns.

Konstantinos Paximadis received the BSC from the Computer Engineering and Informatics Dept (CEID), University of Patras, Greece in 1989 and the PhD from the same department in 1998. He has served as a faculty adjunct member in University of Patras and Hellenic Open University for more than twenty years and has taughed more than twenty lessons and labs. He also directs a private company in Greece, specializing in computers and communications. His research interests include network planning and performance evaluation in optical networks and ML in computer networks. In his free time he likes to fly, he holds a JAR-PPL license and has over 350 hours on light single engine aircrafts.

Fevronia Rousaki is an experienced project manager specializing in e-learning and classroom-based educational programs. She is a Computer Science Teacher and has served as the Head of the Training Services Unit at the Institute of Entrepreneurship Development (iED). Fevronia holds an MSc in ICT Applications on Education and a Bachelor's Degree in Cultural Technology & Communication from the University of the Aegean, focusing on Educational Technology & Intercultural Communication.

George Caridakis is an Associate Professor at the University of the Aegean, coordinating the Intelligent Interaction research group, and affiliated with Athena RC and NTUA. His research spans Intelligent Systems and Human-Computer Interaction with applications in Creative and Cultural Heritage. He has over 130 publications and over 3,000 citations with an h-index of 27. He has taught and supervised students at various levels and served on numerous academic boards. Caridakis has participated in over 40 research projects and evaluated multiple European research frameworks, including Horizon 2020 and Horizon Europe. He is also the Chair of ACM SIGCHI Greek chapter and the National Council for Research, Technology, and Innovation in Tourism, Culture, and Creative Industries.

Journal of Integrated Information Management electronic journal

OpenLab Evaluation of CAnTi: Advancing Conservation of Ancient Tiryns through Virtual and Mixed Reality Interactive Applications

Markos Konstantakis[1], Angeliki Chrysanthi[1], Efthymia Moraitou[1], Konstantinos Kotsopoulos[2], Nikolaos Papastamatiou[3], Alkistis Papadimitriou[4], George Caridakis[1]

[1]University of the Aegean, Department of Cultural Technology and Communication, Greece
[2]University of the Patras, Department of Computer Engineering and Informatics, Greece
[3]SenseWorks Ltd, Research Department, Greece
[4]Ministry of Culture and Sports, Ephorate of Antiquities of Argolida, Greece
mkonstadakis@aegean.gr [**ORCID:** 0000-0003-0656-693X], e.moraitou@aegean.gr [**ORCID:** 0000-0001-9384-1105], a.chrysanthi@aegean.gr [**ORCID:** 0000-0002-1023-9336], kkotsopoulos@upatras.gr, papastamatiou.nikos@gmail.com, azpapadimitriou@culture.gr, gcari@aegean.gr [**ORCID:** 0000-0001-9884-935X]

Article Info

Article history:
Received: 20 April 2024
Received in revised form: 10 May 2024
Accepted: 15 May 2024

https://doi.org/10.26265/jiim.v9i1.37818

Abstract:

Purpose *- The Conservation of Ancient Tiryns (CAnTi) research project aims to improve the presentation and understanding of conservation and restoration (CnR) data for the Acropolis of Ancient Tiryns. To achieve this goal, the project focuses on designing and implementing virtual and mixed reality interactive applications. These applications serve as innovative tools for visualizing and communicating crucial CnR data, bridging the gap between specialists and the public while enhancing visitors' engagement and experience.*

Design/methodology/approach *- Apart from the finalization of the design and the development of the interactive applications, the evaluation in terms of their efficacy along four fundamental axes presents a field of interest. Firstly, the engagement of the public with the CnR domain will be assessed through the utilization of an OpenLab approach, which enables users to interact with and explore the applications in a user-friendly manner. Secondly, the comprehension of the information material regarding CnR interventions presented through the applications will be evaluated to ensure that the conveyed knowledge is clear and accessible to a wide range of audiences. Thirdly, the user-friendliness and efficiency of the virtual and mixed-reality applications will be closely scrutinized to optimize the overall visitor experience and ensure seamless navigation. Lastly, the satisfaction of specialists, who must be able to communicate complex CnR data with the public supported by the applications, will be gauged to understand how well the proposed approach facilitates their interactions.*

Findings *-Through this comprehensive evaluation, the research team aims to gain valuable insights into the extent to which the developed applications can effectively present and communicate CnR data on behalf of specialists. Additionally, this study aims to identify areas for improvement that can enhance overall visitor engagement and experience during their interaction with the Acropolis of Ancient Tiryns.*

Originality/value *- The findings of this evaluation will contribute to refining the virtual and mixed reality applications and offer new perspectives on engaging the public with the CnR of historical landmarks.*

Index Terms — open lab, mixed reality, conservation, restoration, interactive applications, cultural heritage.

I. INTRODUCTION: OPEN LABS

The Tangible Cultural Heritage (TCH) encompasses monuments, buildings, spaces, and objects with historical, artistic, aesthetic, scientific, ethnological, or anthropological value, serving as a unique and irreplaceable source of knowledge and inspiration. The recognition of the universal value of TCH results in an increased focus on its study, protection, and preservation **[1]**. These processes ensure access to TCH for the wider public, fostering knowledge that can be shared and exchanged with both specialized and general audiences.

While the results of studies, protection, and preservation efforts are often presented to the public through thematic exhibitions or guided tours, the practical aspects of these processes and their significance for TCH are frequently shrouded in mystery. How objects, monuments, buildings, and TCH spaces are studied, how the events related to them are uncovered, and how actions for their protection and preservation are planned and executed are processes that are typically not included in exhibitions or tours. Similarly, the individuals involved in these processes are often overlooked **[2]**. Concurrently, research has indicated a strong interest among visitors in the excavation, maintenance, and restoration processes of monuments. The presence of scientific teams at these sites enhances visitors' experiences **[3]**.

Open labs represent an effective practice for showcasing what happens “behind the scenes”, challenging the

traditional presentation of TCH and highlighting the work of institutions and organizations in the field of TCH. The live presentation of study and maintenance work to visitors is a contemporary trend gaining momentum **[4]**. Allowing visitors access to previously isolated workspaces and laboratories or integrating labs into exhibition spaces (e.g., labs with glass walls) makes the work of specialists visible to visitors. In cases involving interactive participation from the public, open labs provide an opportunity for discussions between visitors and scientists or professionals, offering a more immediate and experiential understanding of scientific processes and practices **[4]**. This represents a new way to enhance public interest in TCH, creating new experiences that differ from traditional visits to cultural heritage sites (such as museum tours or archaeological site visits) and allowing more democratic access to archaeological collections **[5],[6]**. Moreover, open labs can continuously change and renew themselves; the processes and projects of an open lab evolve regularly, following the schedule of each conservation or excavation project.

II. Related Work

Open laboratories have become an increasingly popular practice in museums abroad, adopting various forms. As previously mentioned, an open laboratory can be made visible to the public through a glass wall, showcase, or even be physically accessible to visitors. Additionally, an open laboratory may focus on the conservation of a specific object (e.g., the preservation of a well-known painting) or involve multiple conservation interventions on different objects of the same type or with similar types of damage (e.g., the conservation of a column's vertebrae and its restoration). Today, open laboratories are more commonly found in closed and controlled spaces, such as conservation labs and museums, and less so in open and archaeological sites, as explained below, due to the challenges associated with their smooth operation.

A characteristic example of open conservation laboratories is the Visible Conservation Laboratories at the Smithsonian American Art Museum & National Portrait Gallery, Lunder Conservation Centre **[7]**. Visitors have the unique opportunity to observe conservators at work. The center features glass walls that allow the public to witness all aspects of the conservation process. Visitors can observe the work and learn more about it by listening to related audio tour materials. Another analogous example is the Artifact Lab at the PENNMUSEUM **[8]**. This glass-enclosed laboratory serves as both a traditional active workspace and a part of the exhibition. Visitors can see the tools used in the work and observe conservators preparing different objects for the museum's exhibition. The visitor has the opportunity to witness conservators at work, contributing to the preparation of various objects for display in the museum.

Another case of an open conservation laboratory that focuses on a specific object is Project “Blue Boy” at the Huntington Art Gallery **[9]**. The first significant technical examination and conservation intervention of the “Blue Boy” took place in public view in a specially designed conservation studio created specifically for the project within the Huntington Art Gallery space. A similar case is Operation NightWatch at the Rijksmuseum **[10]**, which is perhaps the largest research and conservation project conducted live within the museum, providing visitors with the opportunity to observe its progress. Essentially, the project can be divided into two main phases: the examination of its preservation condition and the interventionist conservation and restoration processes.

III. CAnTi project open lab

The design of the OpenLab within the framework of the CAnTi project, taking into account relevant international and national examples as well as successful strategies developed to date, primarily in the field of the conservation of cultural heritage, aims to find innovative solutions for the substantial and effective dissemination of information dissemination to the public regarding the conservation and restoration of monuments of cultural heritage. At the same time, it aims to address the disadvantages and risks associated with such projects, both in terms of safety and the experience of visitors and specialists, as emerged from the research presented in a previous section.

The OpenLab in the context of this project is perceived as a set of actions, events, and services related to the promotion and information about interventions at the archaeological site of Tiryns.

The workshop's goal was to familiarize the general public with the process of conserving and restoring the monument. Through specially designed interactive and participatory programs involving both specialized personnel and the monument itself, the workshop aimed to generate knowledge and appreciation for the monument. Public knowledge about the specialized field of monument conservation and restoration enhances the sense of responsibility for the preservation of cultural heritage and, consequently, creates a community with a personal interest in these issues **[11], [12], [13]**.

IV. CAnTi open lab evaluation methodology

The OpenLab will be evaluated by a) participants, i.e., the audience physically present in the open workshop activities, who will use the applications before, during, and after their visit to the archaeological site, and b) specialized scientists from the CAnTi project, who will be responsible for creating and publishing informational material about the interventions. Additionally, they will present relevant processes and information during the scheduled activities of the open workshops.

More specifically, the steps we followed are as follows:

- Test usage of digital applications by the CAnTi project team: This involved trying out the digital applications to identify and correct any functional issues and content-related concerns.

- Creation of material (in PowerPoint and video format) for presenting the individual functions of the applications: Develop content that explains the various features and functions of the applications.
- Installation of the mobile application by users on their personal devices for test use: Users installed the mobile application on their own devices to test its capabilities.
- Evaluation of the applications using structured questionnaires with access through a specific link: Users provided feedback and responses to structured questionnaires, likely delivered through a specific link.
- Statistical analysis of the results: The collected data and feedback were subjected to statistical analysis to derive meaningful insights and conclusions.

More specifically, before collecting research data, the CAnTi project team conducted on-site tests of the application at the actual archaeological site of Tiryns, using different mobile devices to identify any technical issues. After completing the necessary corrections regarding the functionality of the virtual and mixed reality applications, modifications were made to the quantitative research questionnaire, and the research methodology was finalized.

Regarding the evaluation process, initially, the VR application was used at the offices of the Ephorate of Antiquities of Argolida in Tiryns, followed by the use of the AR application at the monument. Finally, a guided presentation of the restoration interventions took place in situ at the monument.

For the VR application, it took approximately 10-20 minutes per person, depending on whether they viewed the entire content in detail and spent time processing the material (transition time between different information and observation of 3D models). About 1–3 minutes were needed for an explanation and familiarization with the use of glasses and controllers. Additionally, the intervention of the Optimum Company's specialist was required to resolve application issues and guide individuals, especially those less familiar with VR applications, as shown in **Fig. 1** and **2**.

Figure 1. VR application during CAnTi Open Lab evaluation

Figure 2. Using the VR applications during CAnTi evaluation

Regarding the MR application, the members of the research team proceeded to the archaeological site for a brief guided tour. During the tour, they showed the visitors points of intervention and addressed questions about the archaeological site.

Finally, the research questionnaire was used with the participants. The final questionnaire for the quantitative research is available online[1].

[1] https://docs.google.com/forms/d/e/1FAIpQLSfy5knoOMVYNRpILbVGSTOF6tVfPZlk7lCAVhiDisloVXzlzw/viewform

V. OPEN LAB EVALUATION RESULTS

A. Quantitative Research Results on Virtual Reality and Mixed Reality Applications

This section presents the overall results of the quantitative research conducted for the project on educational applications of virtual reality and mixed reality. The study involved 30 potential end-users from the Department of Performing and Digital Arts at the University of the Peloponnese, alongside 2 professors and 5 professionals with extensive experience in AR/VR technologies and emerging technologies in cultural heritage **[14]**. Following the presentation of the participants' general opinions and behaviors based on prior experiences, their demographic characteristics are next. Subsequently, the evaluation of the applications is presented, covering their basic features and functions, the services they offer, and the possibility of adding additional services. Finally, the overall attitude and intentions of the respondents towards the application are presented. We provide indicative results from the users' responses to the questionnaire (**Fig. 3-6**).

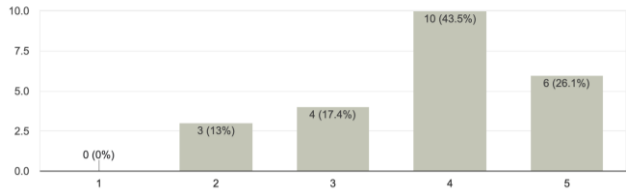


Figure 3. "How satisfied were you with the range of functions offered by the VR application?" (1=low, 5=high)

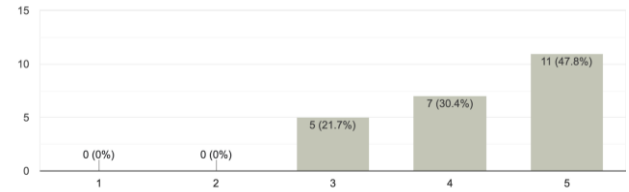


Figure 4. "How interesting was the audiovisual material of the VR application?" (1=low, 5=high)

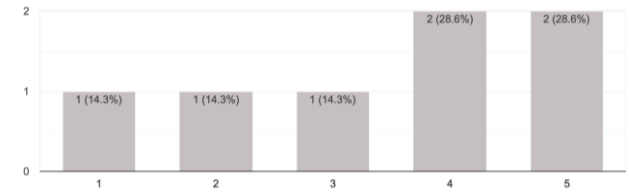


Figure 5. "How satisfied were you with the usability of the MR application?" (1=low, 5=high)

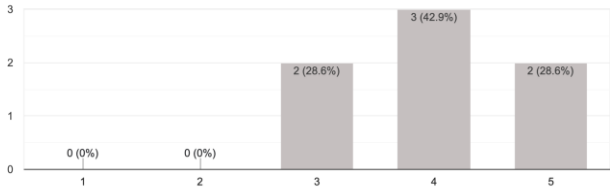


Figure 6. "Did the MR application help you access information about the monument?" (1=low, 5=high)

From the open-ended questions asking users to mention three elements they liked the most and the least about the presentation of the conservation and restoration works on the monument through the VR application, we received a total of 23 written responses from users, which were subjected to thematic analysis. The results of the analysis are reported below.

In the positive aspects of the presentation of works on the monument, a total of thirteen users commented. Four users generally referred to the presentation of the conservation process. User #3 specifically mentions that through the VR application and the presentation approach, "you better understand how the process of conservation works," while user #5 is impressed more specifically with the "process with the soil, they used to make it look like the ancient." Six users commented on the depiction of Tiryns with three-dimensional models. Specifically, user #14 said, "I liked the detail in the models; they looked so realistic that I wanted to touch them." and user #16 mentioned the "freedom to navigate around the three-dimensional models." Additionally, five users specifically mentioned the photographic and audiovisual material, while another five positive references are made to the user interface, highlighting its usability, practicality, and ease of image switching. Finally, four users specifically mentioned the successful narration of the application, its immediacy, and its explanatory character. As user #23 states, "I liked the vocal explanation of the process."

A total of ten users referred to the negative aspects of the experience. The majority of the negative elements focus on the design of user interaction and the lack of participation in the events presented during the experience. Six users refer to deficiencies in focusing functions (zoom) and interaction with the application, while another six negative comments focus on the lack of user interaction with the space and narration in general. As user #8 explicitly states, "I would like more movement and interaction options in the space" of the experience, while user #21 similarly mentions, "I expected to be part of this story and somehow to be able to interact." Among the negative comments, the use of unknown terms, the short duration of the experience, and the excessive information provided during the experience are mentioned. However, these comments are quite isolated and would require further investigation to ascertain whether they have a significant impact on the user experience or not.

In terms of the respective open-ended questions for the

AR experience, we only received comments from four users, as reported below. Two user's commented positively on the narrative aspects of the application, mentioning the vivid dialogues and the fact that the story of Melabus provides a unique vehicle for the participant to become part of the story along the visited path. A negative comment refers to the lack of integration of the narrative with conservation works, and as a user characteristically writes, "It would have been very nice and more helpful if, for example, when analyzing the interior decoration of the walls, there could also be a reconstruction for 1-2 minutes while the monologue at the top is being narrated". Finally, the spatial registration of the content as well as issues with multiple OS support for the experience are also mentioned.

B. Qualitative Research Results on Virtual Reality and Mixed Reality Applications

This section focuses on user observation conducted to collect data regarding the acceptance of virtual and mixed-reality applications by potential users and the prospects for future collaborations. Initially, the participants for evaluation were divided into groups of 2 or 3 people. During the use of the tools and applications, members of the research team observed and recorded the reactions and actions of the participants. At the end of each group session, after a reminder to complete the evaluation questionnaire, a brief discussion and dialogue took place regarding impressions, questions, and comments about the use of the application.

Specifically, the first group appeared to participate with a lot of enthusiasm during the use of the application, a fact that was confirmed at the end, where they showed a very positive reaction, mentioning that they found the content and tools they used very interesting. They also asked if they could go to the point of interest to see firsthand what they observed in the application.

The members of the second group were also enthusiastic during the use of the application. They mentioned at the end that they had used VR applications before, but not with Joysticks. One user mentioned that initially (until getting used to the controller), they skipped some images and videos by mistake and had to watch them again; however, this did not seem negative to them since it was easy to revisit material they initially skipped.

Regarding the third group, we also observed significant interest, as they stayed in the virtual world for a considerable amount of time. At the end, we received positive comments, mentioning that they liked seeing details about interventions they didn't know about. One member of the group mentioned that they really liked the 3D models; they found them very explanatory for understanding the space and appreciated the ability to zoom in and out to see details. They also particularly liked the slideshow in addition to the models.

The 4th group was also excited, finding the material and the application very explanatory. They did not make many comments aboucst the intervention point and the maintenance stages. Similarly, the 5th and 6th groups had a very positive reaction, without particularly commenting on the intervention points and maintenance stages.

Subsequently, the 7th group expressed a particular interest in the application, stating that they especially liked the maintenance part. Next was the 8th group, which had a positive reaction, but one member of the group mentioned feeling dizzy during the use of the virtual navigation helmet.

Then, the 9th and 10th groups stated that they liked it a lot, specifically mentioning that they liked the voice explanation during the navigation. Finally, the 11th and 12th groups had a positive reaction without particularly commenting.

VI. CONCLUSION

The research conducted within the CAnTi project open lab undoubtedly provided rich conclusions beneficial for both the business exploitation of digital applications after the completion of the research project and academic research, which could be the subject of future studies or publications.

Specifically, the quantitative research indicates a significant interest in mixed reality applications, especially among Millennials and Generation Z, with a higher interest from women compared to men. Approximately two-thirds of the participants in the research expressed a high level of interest in experimenting with new applications. Also, the evaluation of the application by users in relation to their expectations is a crucial indicator for the business utilization of the platform. It is encouraging that only 8.7% of the participants found the application to be below their expectations, while 74% stated that the application either met or exceeded their expectations.

Furthermore, participants generally rated the content, design, and audiovisual material of the application positively. However, the weakest aspect of the application appears to be the interaction element. Therefore, improving the interaction features of the application could enhance its business potential. Participants expressed particular interest in 3D models but wanted greater ease in focusing on or zooming in on them. Also, a significant majority (72%) found the application suitable for themselves, and an even higher percentage (79%) expressed intentions to use it in future visits to the location.

In conclusion, for more comprehensive conclusions, future testing and evaluation of the digital tools from a broader sample are deemed useful. Additionally, a deeper investigation into technical issues users may encounter, depending on their devices, application versions, location, and previous experience with similar applications, is required.

VII. REFERENCES

[1] **Addison, A., Santana Quintero, M., & Severo, M. (2008).** Cultural heritage repositories: Digital archives for conservation and management. Browsing Architecture. Metadata and Beyond. Hrsg.: MACE Consortium, 2008, 306-317.

[2] **Wylie, C. D. (2020).** Glass-boxing science: Laboratory work on display in museums. Science, Technology, & Human Values, 45(4), 618-635.
[3] **Chrysanthi, A. (2015).** Augmenting archaeological walks. Theoretical and methodological considerations. Diss. University of Southampton.
[4] **Meyer, Morgan**. "Researchers on display: moving the laboratory into the museum." Museum management and curatorship 26.3 (2011): 261-272.
[5] **Nancarrow, J. H. (2016)**. Democratizing the digital collection: new players and new pedagogies in three-dimensional cultural heritage. Museum Worlds, 4(1), 63-77.
[6] **Maschner, H. D., Schou, C. D., & Holmes, J. (2013, October).** Virtualization and the democratization of science: 3D technologies revolutionize museum research and access. In 2013 Digital Heritage International Congress (DigitalHeritage) (Vol. 2, pp. 265-271). IEEE.
[7] **Lunder Conservation Center, (2021).** [online] Available at: https://americanart.si.edu/art/conservation, [Accessed on 17 December 2023].
[8] **The Artifact Lab, (2021).** [online]. Available at: https://www.penn.museum/on-view/galleries-exhibitions/the-artifact-lab, [Accessed on 17 December 2023].
[9] **The Hantington, (2021).** Project Blue Boy, [online]. Available at: https://www.huntington.org/project-blue-boy, [Accessed on 17 December 2023].
[10] **Rijksmuseum, (2021).** Operation Night Watch, [online] Available at: rijksmuseum.nl/en/nightwatch, [Accessed on 17 December 2023].
[11] **Nardi, R. (2008).** "Conservation for presentation: a key for protecting monuments." Studies in Conservation 53.sup1, 22-26.
[12] **Moraitou, Efthymia, et al. (2023).** "Supporting the Conservation and Restoration OpenLab of the Acropolis of Ancient Tiryns through Data Modelling and Exploitation of Digital Media." Computers 12.5. 96.
[13] **Moraitou, Efthymia, et al. (2022).** "Supporting conservation and restoration through digital media modeling and exploitation-the example of the Acropolis of Ancient Tiryns." 2022 17th International Workshop on Semantic and Social Media Adaptation & Personalization (SMAP). IEEE.
[14] **Konstantakis, M., Michalakis, K., Aliprantis, J., Kalatha, E., & Caridakis, G. (2017, July).** Formalising and evaluating cultural user experience. In 2017 12th International Workshop on Semantic and Social Media Adaptation and Personalization (SMAP) (pp. 90-94). IEEE.

VIII. AUTHORS

Markos Konstantakis serves as a Postdoctoral Researcher at the Department of Cultural Technology and Communication, University of the Aegean, where he is a member of the Intelligent Interaction research group (ii.aegean.gr). He received a Ph.D. in the same department, entitled: "Augmented Cultural User Experience (ACUX)" and a master's degree in "Specialization in Information Systems, Networks, and Telecommunications" from the Faculty of Sciences and Technology of the Hellenic Open University (HOU). Markos completed a degree and a master's degree as a Marine Mechanical Engineer at the National Technical University of Athens (NTUA).

Dr. Angeliki Chrysanthi currently serves as an Lecturer at the Department of Cultural Technology and Communication of the University of the Aegean, in Greece. Her background is in Art History and Archaeology (BA, National and Kapodistrian University of Athens, Greece), in Protection of Monuments (M.Sc., National Technical University of Athens, Greece), and she holds a doctoral degree from the University of Southampton, UK. Her thesis entitled "*Augmenting Archaeological Walks. Theoretical and Methodological Considerations*", examines the role of interpretative design in visitor movement and behaviour in spaces of cultural significance, and the contribution of qualitative research alongside computation and novel technologies to this research inquiry. During and after her postgraduate studies, she worked in her capacity as a Digital Heritage expert and researcher in Greece and mainly abroad. In 2016, she was appointed as Digital Humanities Postdoctoral Research Associate at the University of Sheffield and Visiting Research Fellow at the University of Chester in the UK before moving to Greece in 2017.

Efthymia-Themis Moraitou graduated from the Department of Conservation of Antiquities and Works of Art of the Technological Educational Institute (T.E.I.) of Athens in 2014. As a student, volunteer and finally professional she worked in organized laboratories on artworks conservation, as well as in situ on historic buildings wall paintings preservation and restoration. Due to her strong interest on the application of new technologies on Cultural Sector, she continued her studies and in 2017 she received the MSc in Cultural Informatics and Communication from the Department of Cultural Technology and Communication of the University of the Aegean, majoring on the Design of Digital Cultural Products. Her dissertation focused on the knowledge representation and semantic search using ontology on the domain of artworks conservation. Today, she is a PhD candidate of the Department on the field of semantic technologies on the Cultural Heritage Preservation domain. She is interested in knowledge representation, ontological engineering, semantic web and services, metadata, LOD and digitization applications on Cultural Heritage.

Konstantinos Kotsopoulos is a seasoned project manager and technology consultant with a track record of success in the information technology and services industries. IT strategy, management, software system analysis and design, 2D-3D digitization of cultural

assets, multimedia, gamification, and extended reality are all areas of expertise. A strong research professional with a Master of Science degree in Geoinformatics from the National Technical University of Athens and a Ph.D. candidate at the Department of Computer Engineering & Informatics, University of Patras.

Nikolaos Papastamatiou is an Application Developer and Software Project manager. Graduated from Aegean University in 1998 with a Bachelor's degree on Mathematics. Masters degree in Distributed and Multimedia Information Systems from Heriot-Watt University, Scotland in 1999. Vocational Training in Project Management from National and Kapodistrian University of Athens. Research interests in the fields of Web Development, Virtual Worlds, Grid Computing, ontologies, semantic web and Natural Language Processing. Specialties: Expertise on information system methodologies, Relational Database Systems, multimedia and hypermedia, distributed systems design, artificial intelligent, networking and interactive systems.

Alkistis Papadimitriou is a graduate of the History and Archeology Department of the University of Athens and a PhD in Classical Archeology from the Albert Ludwig University of Freiburg, Germany. He worked for a number of years on the excavation of the German archaeological institute in the Lower Acropolis of Tiryns and was a scientific assistant to the late excavator Klaus Kilian. Today he is the Superintendent of Antiquities of Argolis.

Associate Prof. George Caridakis (http://ii.ct.aegean.gr/) serves as a faculty member, Assistant Professor, the Department of Cultural Technology & Communication, University of the Aegean where he founded and coordinates the Intelligent Interaction Research Group (ii.aegean.gr), a recently established but dynamic research group already making an impact attracting Regional and National funding and participating in numerous International conferences and workshops. He is also affiliated as an Adjunct Professor at the Athena RC (athenarc.gr/en) and as a Senior Researcher with the Intelligent Systems, Content and Interaction Laboratory, National Technical University of Athens. He offers courses offered in undergraduate and postgraduate levels in different institutions and supervises PhD, MSc and undergraduate theses. He has served in boards and committees and as a reviewer in numerous international scientific journals, conferences and workshops and is a member of the Association for the Advancement of Affective Computing and the board of the Greek ACM SIGCHI Special Interest Group in Computer-Human Interaction.

Journal of Integrated Information Management electronic journal

The Digistoryteller project: walking around refugee Attica

Angeliki Antoniou[1], Christos Chrysanthopoulos[2], Foteini Efthimiou[1], Konstantinos Papastathis[1], Stathis Theodosis[1], Afroditi Kamara[3], Ioannis Triantafyllou[1]

[1]University of West Attica, Department of Archival, Library & Information Studies, Greece

[2]National Hellenic Research Foundation, Institute of Historical Research, Greece

[3]Time Heritage, Greece

angelant@uniwa.gr [**ORCID:** 0000-0002-3452-1168], cchrysan@eie.gr [**ORCID:** 0000-0001-9900-1342], feuthim@uniwa.gr [**ORCID:** 0000-0002-7970-0856], papastathiscr@gmail.com [**ORCID:** 0009-0000-0685-4830], egtheodosis@gmail.com [**ORCID:** 0009-0005-3675-0887], aphroditekamara08@gmail.com [**ORCID:** 0000-0002-6380-6402], triantafi@uniwa.gr [**ORCID:** 0000-0001-5273-0855]

Article Info

Article history:

Received: 12 April 2024

Received in revised form: 20 May 2024

Accepted: 30 May 2024

https://doi.org/10.26265/jiim.v9i1.38586

Abstract:

Purpose *- The present work focuses on an app that supports historical exploration of city neighborhoods. The particular work focuses on the refugee crisis resulting from the Greco-Turkish war in 1922 and the traces it left behind in the formations of different places across Attica. To present the past, we developed digital storytelling features, and to engage users further, we provided them with crowdsourcing functionalities allowing them to create their own content.*

Design/methodology/approach *- The digital storytelling and the crowdsourcing features were tested with users in multiple events, using a mixed methodology that allowed the collection of qualitative and quantitative data from the public, policy makers and experts.*

Findings *- Most users provided very positive feedback and imagined further educational uses.*

Originality/value *- The different features of this mobile approach, allow an in-depth engagement with the past while the user is mobile.*

Index Terms – Digital storytelling, cultural heritage apps, crowdsourcing, city exploration.

I. Introduction

In 2022 Greece was commemorating the centenary of the end of the Greco-Turkish war in Asia Minor. During 1922 and 1924, over one million Christians, primarily ethnic Greeks, who had previously resided in territories of the Ottoman Empire, migrated to Greece. Simultaneously, around 500,000 Muslims, predominantly ethnic Turks, moved to the newly established Turkish state. This population exchange was a result of efforts to address ethnic tensions and territorial disputes between Greece and Turkey following the war. The agreement aimed to create ethnically homogeneous nation-states by facilitating the relocation of minority populations to their respective countries of ethnic origin. The mass migration of Christians to Greece and Muslims to Turkey during this period significantly reshaped the demographic landscape of both nations and had lasting cultural, social, and political ramifications. **[1]** About 300.000 refugees eventually ended up in the Region of Attica and started a new life all over. The Digistoryteller project (https://digistoryteller.eu/) is dedicated to this refugee crisis and aims at telling stories and revealing refugee settlement attempts and challenges in the area of Attica.

Digistoryteller for Refugee Attica is a repository of information and material related to the arrival, settlement and gradual integration of Asia Minor refugees in Attica. The reference period is, therefore, the period 1914-1949, with an emphasis, however, on the period 1922-1928. Despite the repeated tributes to the Asia Minor Disaster, mainly by Asia Minor refugee associations, the emphasis is usually placed on the disaster itself and not so much on the development of refugee settlements which became municipalities from 1934 onwards. Only recently has research been started on the first phases of the settlement of these people: their constant movements until they found suitable living and working conditions, their micro-entrepreneurship, the lack of access to basic goods, resources and the mutual support and social organization bodies they created. Many elements concerning urban planning and its political ramifications, relations with the natives, and the process of economic integration are illuminated through archival research and the development of new questions. Within the framework of the project, a guiding app spreading over two levels has been developed:

1. Itineraries designed with the help of documents and archival material that have been collected, selected and registered by the research team of the project and forming routes through each

municipality, supplementing the historical information for each point of interest with multimedia material (photos, music, recorded testimonies, video interviews and recipes).

2. A crowdsourcing system, where the public (citizens, residents, visitors) can upload their own evidence and information from their family record or even simple testimonies of grandparents, parents, etc. also supporting the uploading of multimedia.

The digital storyteller was complemented by a series of paper-based "products" which were enhanced through the digital environment and produced a "phygital" result, suitable particularly for educational purposes and class or museum activities: a 3D paper puzzle of an old Town Hall, coloring cards and books based on photographic material, maps etc.

The rest of the paper is organized as follows: section 2 presents a short literature review on storytelling apps and crowdsourcing apps used in cultural heritage, section 3 presents the app, section 4 provides initial results from user testing and section 5 discusses findings and summarizes with conclusions.

II. Digital Storytelling and Crowdsourcing in Cultural Heritage

The use of technology has changed the way we deal with history, heritage and culture both in terms of research but also in terms of receiving information and getting to know the historical phenomena. Technology changes the very nature of the experience and allows for multiple types of content presentation in various levels, covering diverse needs of different audiences. In fact, technology and digital storytelling allows in-depth visitor reflection, association discovery, the emergence of new forms of interpretations and the understanding that historical phenomena are social phenomena in essence **[2], [3]**.

Digital storytelling can take numerous forms and use first or third person narrations and presentation through fictional characters, like the animated digital storytelling experience created for the Athens University History Museum. During the experience, the user followed the narrations of a fictional character that told his story while presenting some of the key museum items **[2]**. Another form of digital storytelling is the interactive documentary where the full range of multimedia tools are used to document a theme and engage people with certain aspects of reality **[4]**.

In addition, digital storytelling can be delivered through different means which span from mobile apps to virtual and augmented reality applications. For example, an interactive virtual reality application that used 360° storytelling was used with lab participants to present an archaeological site while recording their brain activity. The physiological data collected showed that users were able to engage effectively with the digital material **[5]**. Recently 360° immersive applications are getting popular and they are used in cultural heritage supporting virtual tours of heritage sites. The multiple variations of such applications lead to the formation of theoretical categorizations of tools and design methodologies **[6]**.

Furthermore, we also observe a shift in focus from digital storytelling to interactive digital storytelling that allows the active engagement of users **[7]**. Digital storytelling seems to be a very promising tool in presenting tangible and intangible heritage. Going beyond simple interaction tools and techniques, contemporary digital storytelling includes 3D reconstructions of historical sites and monuments, virtual and augmented reality elements, incorporates games as well as carefully designed content able to trigger cognitive and emotional responses **[8]**. For example, digital storytelling was also used as a tool to preserve cultural heritage, as it was used by Indigenous communities in Canada's Western Arctic region to preserve their intangible heritage, engaging the local community in the process **[9]**.

Recent studies also reveal the result of the use of digital storytelling. One main benefit from its use is the fact that stories and narratives allow people to make meaning, understand cultural heritage better and go beyond facts. In addition, digital resources alone simply provide information, while digital storytelling goes beyond the information assisting people in interpretation processes **[7]**. Thus, cognitive benefits have been already recorded by different studies which support the use of digital storytelling for both students and teachers during their interaction with heritage. These benefits are maximized when students are asked to create their own digital narratives which can be a rather easy and accessible process using widely available tools, like mobile phones **[10]**. Moreover, digital storytelling seems to be very effective when it engages groups of visitors rather than only individuals and it can decrease the isolation powers of technology. Carefully designed collaborative interfaces delivering digital narratives can increase user collaboration and communication and enhance learning processes **[11]**.

Finally, digital storytelling can be beneficial for cultural institutions and organizations since it can also support sustainability. Different studies have already focused on the sustainability aspects of digital storytelling (e.g. following FAIR data principles, allowing easy exchange of content among museum networks, etc.) and it seems that cultural heritage organizations can further exploit it to maximize gains **[3]**, **[4]**.

Another form of technology that is currently used for cultural heritage purposes is crowdsourcing. Crowdsourcing is not yet as common as digital storytelling although its popularity is steadily increasing **[12]**. In fact crowdsourcing has been used in European projects as a way to engage users and enhance city exploration and learning **[13]**, **[14]**. As in digital storytelling, crowdsourcing is also used both with tangible and intangible heritage. Especially with regards to intangible heritage, crowdsourcing could be a valuable tool for its conservation, since the crowd can provide information and record rare customs and forgotten traditions **[15]**.

In addition, crowdsourcing can help with the effective annotation of cultural data that have resulted from the recent efforts in digitizing cultural heritage, thus improving metadata quality. In this manner, the annotation processes can significantly decrease their cost and depending on the way the crowdsourcing task is designed, volunteers could help in a cost-effective and entertaining way **[16]**. Thus finding and engaging volunteers is crucial for successful crowdsourcing efforts. Recent research efforts resulted in methodologies for the effective engagement of crowdsourcing participants and their motivation **[17]**. Motivation techniques include making clear to participants how their efforts contribute to the preservation of heritage and the wellbeing of society. It is also very important to create communities of contributors and a sense of belonging, while the crowdsourcing tool is easy to use **[18]**.

Crowdsourcing tools could also allow geolocated information to be gathered, usually through the use of the mobile devices of participants. In different examples, participants used their mobile phones to provide information about specific locations around the city, historical buildings and monuments **[13]**, **[14]**, **[19]**. By providing content, participants benefit at the individual level as well since they have a deeper understanding of cultural heritage, connecting it to personal experiences and creating personal meaning **[20]**.

Finally, crowdsourcing is a tool to promote open culture and science and enhance democratic processes in societies **[21]**, **[22]**. Therefore, the gains for societies and individuals are numerous. The present work focuses on the use of crowdsourcing as a tool to reveal untold refugee stories and make known new elements about their past.

III. DIGISTORYTELLER

The application can be downloaded from Google Play Store at: https://play.google.com/store/apps/details?id=com.digistory.expomobilefrontend&hl=en&gl=US.

Users can download the app on their mobile phones and create an account if they wish to contribute with content. If they want to only receive content, then they can log in as guests. As users move around the city, they see points of interest on the map that they can choose to select and receive the content. Content can be of two types: content created by curators in the form of digital storytelling and content by the crowd that could take any form (text, video, audio). **Fig. 1**-**2** show the application screens, including a screenshot of the map, a screenshot of the content creation screen and one ore of the content screen.

The stories, curated by Digistoryteller experts, include important archival material in text, images and historical videos revealing the first attempts of the refugees to start a new life in Attica. Many of the stories told are becoming known for the first time and carry emotional elements, since they focus on individual life stories. Users can choose a location on the map to access these stories. In addition, users can choose to add their own content and upload audio, text or video files.

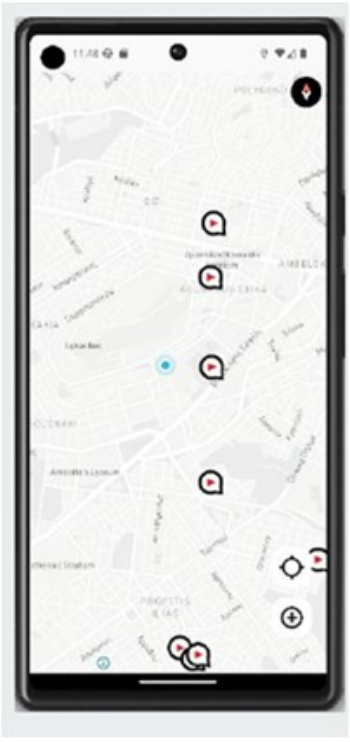


Fig. 1. The map with Points of Interest

Fig. 2. Content delivery screen

IV. User Testing

The app was tested in multiple sessions by users and both qualitative and quantitative data were collected. Researchers first obtained an ethics approval from the University of West Attica Ethics Committee (#95721-17/10/023) and all participants had to provide their written consent.

Overall there were 5 different evaluation sessions combined with guided walks around refugee neighborhoods in Attica. For each one, there was a call for participation in social media and an announcement through the communication networks of municipalities. The walks lasted about 1,5 hours each time and historians were there to guide participants through the neighborhoods, while participants were also using their apps to get extra material, like images, videos, etc. Participants could also provide their own content, if they wished. For practicality purposes, digital storytelling features and crowdsourcing features were tested separately (2 times each) and only once the entire spectrum of features (crowdsourcing and digital storytelling) was tested simultaneously, allowing participants to use any feature they liked. Four out of five times the evaluation sessions were open to the public, but once the evaluation session included only municipality officials and cultural heritage experts to provide more in-depth information.

In addition, there were three types of tools to collect data. There was an extended questionnaire, a short questionnaire (designed to collect data on the go) and a set of questions to be used in focus group sessions.

The extended questionnaire asked questions regarding usability, navigation, technical issues, content quality, aesthetics and ways to improve the app. The short version used emojis to quickly gather data from tour participants (standing on the road). The questions asked about the quality of the technology, the quality of content and the overall experience providing emojis describing different emotional states (I like it, I did not like it, I was bored, I helped me learn, I found it interesting, It helped me reflect about history, I got confused). Finally, the focus group questions asked groups of participants to record the ways they prefer to explore a new area, the ways they prefer to learn new historical elements, ways to improve the app, was to use the app for educational purposes, ways to use the app collaboratively, new uses of the app and possible ethical implications from its use. Overall, the app (storytelling and crowdsourcing features) were tested by more than 100 users (**Fig. 4, 5, 6**).

Fig. 4. User testing at Vyronas.

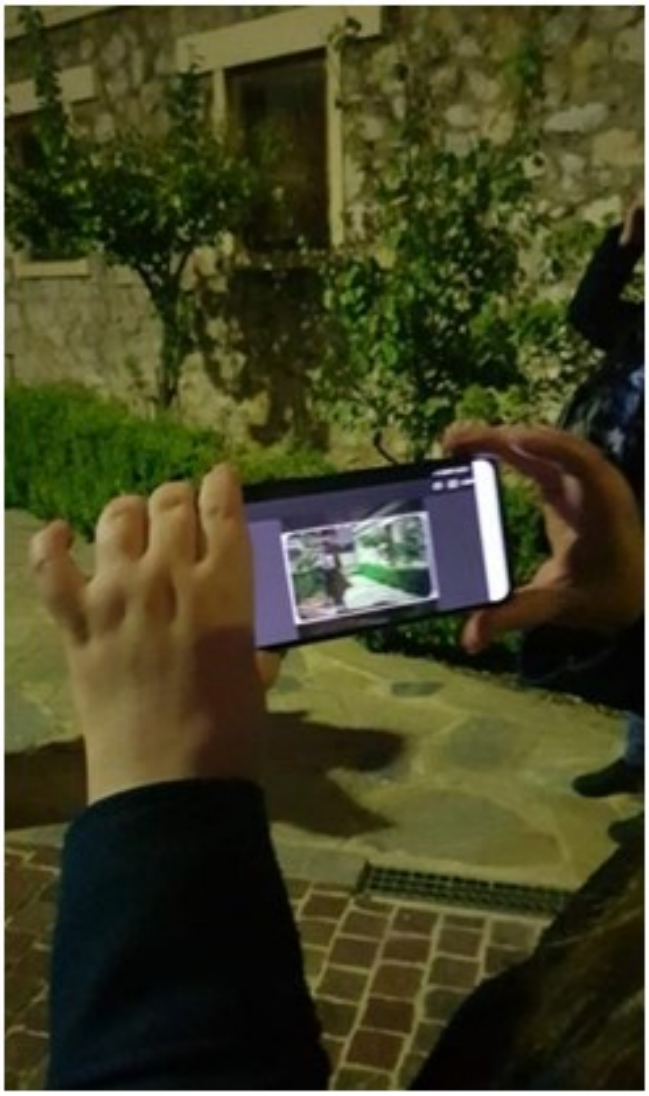


Fig. 5. User testing at Aegaleo.

Figure 6. Focus groups

In summary, most participants were very satisfied with the use of the app, the content and the overall experience. There were a few comments regarding the aesthetics of the app, since some participants mentioned that they like more colors to be used. However, we mainly used black white, gray and red, trying to keep the design neat and simple. Moreover, most participants agreed that such apps have a clear educational aspect and they should be further exploited in the educational domain. Finally, ethical implications of the app were discussed and users were concerned about the validity and soundness of the crowdsourced content. However, all crowdsourced content is monitored by the administrators and approved before appearing in the app.

V. CONCLUSIONS

From the discussion with users and their answers to the questionnaires, the following elements emerged:

1. The app is very interesting, useful and easy to use.
2. Due to the volume of media, it is useful to download media from a Wi-Fi connection and store it locally before using it on the go.
3. Such apps are best used by individual users rather than groups, since visitors prefer to listen to the storytellers rather than see the in-app media. However, many users said they would to the neighborhood again on their own to access all the media, or access the media from home, since they were very interested in the collected historical material and the developed narratives.
4. For the crowdsourcing features, users stated that they can have a significant educational benefit. In fact, due to these answers by multiple users, we proceeded with the planning and implementations of large scale educational activities and many high schools from all over Attica are currently participating.
5. It became clear that refugee identity changes over time and obviously this identity is very different for third and fourth generation refugees. For this reason, the crowdsourcing features can record not only the memories and stories of first and second generation refugees, but also record the feelings and reflections of subsequent generations.

Digistoryteller continues its journey around the neighborhoods of Attica, engaging locals and visitors that want to discover the past and make connections to their present. In addition, the large scale educational actions wish to also involve the younger generations and invite them to create new digital content and narrative, inspired by the past.

VI. REFERENCES

[1] **Kyramargiou, E. (2021).** Refugees of the 1923 population exchange between Turkey and Greece: Greek efforts for integration and assimilation. In The Routledge Handbook on Contemporary Turkey. Routledge, 51-62

[2] **Katifori, A., Tsitou, F., Pichou, M., Kourtis, V., Papoulias, E., Ioannidis, Y., & Roussou, M. (2020a).** Exploring the potential of visually-rich animated digital storytelling for cultural heritage: the mobile experience of the Athens university history museum. Visual Computing for Cultural Heritage, 325-345.

[3] **Škola, F., Rizvić, S., Cozza, M., Barbieri, L., Bruno, F., Skarlatos, D., & Liarokapis, F. (2020).** Virtual reality with 360-video storytelling in cultural heritage: Study of presence, engagement, and immersion. Sensors, 20(20), 5851.

[4] **Argyriou, L., Economou, D., & Bouki, V. (2020).** Design methodology for 360 immersive video applications: the case study of a cultural heritage virtual tour. Personal and Ubiquitous Computing, 24, 843-859.

[5] **Rizvic, S., Okanovic, V., & Boskovic, D. (2020).** Digital storytelling. Visual computing for cultural heritage, 347-367.

[6] **Shiri, A., Howard, D., & Farnel, S. (2022).** Indigenous digital storytelling: digital interfaces supporting cultural heritage preservation and access. International Information & Library Review, 54(2), 93-114.

[7] **Okanovic, V., Ivkovic-Kihic, I., Boskovic, D., Mijatovic, B., Prazina, I., Skaljo, E., & Rizvic, S. (2022).** Interaction in extended reality applications for cultural heritage. Applied Sciences, 12(3), 1241.

[8] **Tzima, S., Styliaras, G., Bassounas, A., & Tzima, M. (2020).** Harnessing the potential of storytelling and mobile technology in intangible cultural heritage: A case study in early childhood education in sustainability. Sustainability, 12(22), 9416.

[9] **Katifori, A., Perry, S., Vayanou, M., Antoniou, A., Ioannidis, I. P., McKinney, S., Chrysanthi. A., & Ioannidis, Y. (2020b).** "Let them talk!" exploring guided group interaction in digital storytelling experiences. Journal on Computing and Cultural Heritage (JOCCH), 13(3), 1-30.

[10] **Podara, A., Giomelakis, D., Nicolaou, C., Matsiola, M., & Kotsakis, R. (2021).** Digital storytelling in cultural heritage: Audience engagement in the interactive documentary new life. Sustainability, 13(3), 1193.

[11] **Kontiza, K., Antoniou, A., Daif, A., Reboreda-Morillo, S., Bassani, M., González-Soutelo, S., Lykourentzou, I., Jones, C.E., Padfield, J., & López-Nores, M. (2020).** On how

technology-powered storytelling can contribute to cultural heritage sustainability across multiple venues—Evidence from the CrossCult H2020 project. Sustainability, 12(4), 1666.

[12] **Lykourentzou, I., & Antoniou, A. (2019).** Digital innovation for cultural heritage: Lessons from the european year of cultural heritage. SCIRES-IT-SCIentific RESearch and Information Technology, 9(1), 91-98.

[13] **Vassilakis, C., Antoniou, A., Lepouras, G., Wallace, M., Lykourentzou, I., & Naudet, Y. (2016).** Interconnecting objects, visitors, sites and (Hi) stories across cultural and historical concepts: the CrossCult project. In Digital Heritage. Progress in Cultural Heritage: Documentation, Preservation, and Protection: 6th International Conference, EuroMed 2016, Nicosia, Cyprus, October 31–November 5, 2016, Proceedings, Part I 6 (pp. 501-510). Springer International Publishing.

[14] **Lykourentzou, I., Naudet, Y., & Vandenabeele, L. (2016, October).** Reflecting on European History with the Help of Technology: The CrossCult Project. In GCH (pp. 67-70).

[15] **Hannewijk, B., Vinella, F. L., Khan, V. J., Lykourentzou, I., Papangelis, K., & Masthoff, J. (2020).** Capturing the city's heritage on-the-go: Design requirements for mobile crowdsourced cultural heritage. Sustainability, 12(6), 2429.

[16] **Stamou, G. (2021).** CrowdHeritage: crowdsourcing for improving the quality of cultural heritage metadata. Information, 12(02), 64.

[17] **Kumar, P. (2020).** Crowdsourcing to rescue cultural heritage during disasters: A case study of the 1966 Florence Flood. International Journal of Disaster Risk Reduction, 43, 101371.

[18] **Johnson, E., & Liew, C. L. (2020).** Engagement-oriented design: a study of New Zealand public cultural heritage institutions crowdsourcing platforms. Online Information Review, 44(4), 887-912.

[19] **Vinella, F. L., Lykourentzou, I., & Papangelis, K. (2020, July).** Motivational Principles and Personalisation Needs for Geo-Crowdsourced Intangible Cultural Heritage Mobile Applications. In Adjunct Publication of the 28th ACM Conference on User Modeling, Adaptation and Personalization (pp. 362-369).

[20] **Reinsone, S. (2020).** Searching for deeper meanings in cultural heritage crowdsourcing. A History of Participation in Museums and Archives. Traversing Citizen Science and Citizen Humanities, 186-207.

[21] **Dahlgren, A. N., & Hansson, K. (2022).** Crowdsourcing Cultural Heritage As Democratic Practice. In Participatory Practices in Art and Cultural Heritage: Learning Through and from Collaboration (pp. 39-48). Cham: Springer International Publishing.

[22] **Oomen, J., & Aroyo, L. (2011, June).** Crowdsourcing in the cultural heritage domain: opportunities and challenges. In Proceedings of the 5th International Conference on Communities and Technologies (pp. 138-149).

VII. ACKNOWLEDGMENTS

This research supported under Action "Research and Innovation Synergies in the Attica Region" in the framework of the Program «Attiki 2014-2020», co-funded by the European Regional Development Fund (ERDF) in the context of the project "Digital Storyteller: Attica of the refugees" (ATTP4-0352249).

VIII. AUTHORS

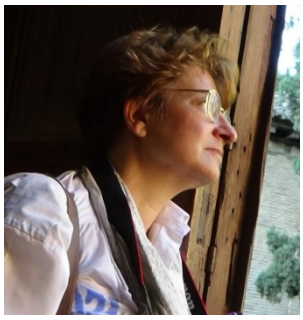
Angeliki Antoniou is an Assistant Professor in the Department of Archival, Library & Information Studies at the University of West Attica specializing in "Adaptive Educational Technologies in Cultural Information". She has many years of teaching experience (undergraduate and postgraduate level), is a course coordinator in the postgraduate program Cultural Heritage Materials and Technologies of the Department of History, Archeology and Cultural Materials Management at the University of Peloponnese and supervises doctoral dissertations at University College London, University of Peloponnese and University of West Attica. She is a collaborating researcher at the ATHENS Research Center and at the Department of Information Studies at the University College London. She has participated in many national and international research projects and has been the scientific coordinator and member of the steering committee of the European project H2020 CrossCult. She has numerous publications in conferences and international journals, but also organizes scientific conferences and publication of proceedings. She holds a degree in Preschool Education from the National and Kapodistrian University of Athens, a degree (BSc) in Clinical with Social Psychology (University of Kent at Canterbury, UK), a postgraduate degree (MSc) in Human Interaction with Ergonomics (University College London, UK), a music degree, a Piano Diploma, as well as a PhD in Educational Technologies from the University of Peloponnese, Department of Computer Science and Technology.

Christos Chrysanthopoulos works as a Special Scientific-Technical Staff at the Institute of Historical Research of the National Hellenic Research Foundation. He is an Academic Fellow on Archival Science at the Department of Archival, Library and Information Studies at the University of West Attica. He obtained his BA in History (University of Thessaly Department of History, Archaeology and Social Anthropology), and he continued with a fast-track graduate entry for a second BA in Archival, Library and Information Studies (University of West Attica). He received a Master's Degree (M.Sc.) in Modern and Contemporary History (the Panteion University of Social and Political Sciences Department of Political Science and History) and a Master of Education (M.Ed.) in Adult Education (Hellenic Open University-School of Humanities). He is a PhD candidate at the University of Patras (GR), Department of History and Archaeology.

Foteini Efthymiou works as a Special Technical Laboratory Staff at the University of West Attica, School of Administrative, Economics and Social Sciences, Department of Archival, Library & Information Studies. She has been a PhD Candidate in the aforementioned Department since 2020. Also, she is a member of the Information Management Laboratory in the above Department. She holds a bachelor's degree in Librarianship from the School of Management and Economics of the Technological Educational Institute of Athens (1994-1998) and a Master of Arts in Librarianship from the Information School of the Faculty of Social Sciences of The University of Sheffield in the UK (2004-2005). She worked as a librarian at the NTUA Central Library from 1999 until 2019. Furthermore, she worked on the implementation of the Hellenic Academic Libraries Union Catalog, its interconnection to the Central Interlibrary Loan Software & Network "Iris" and the implementation of the HEAL-Link "Advanced Services for Open Access Digital Libraries", from 2005 until 2013. Her research interests concern Media and Information Literacy, Learning Theories, Cataloguing and Scientific Communication.

Costas Papastathis currently works as a software engineer for Red Hat. He obtained his Bachelor's Degree in Informatics and Telecommunications (University of Peloponnese) and continued with a Master's Degree in Computer Science (University of Peloponnese). He is also an active member/maintainer of the paketo buildpacks (open source) community for the Nodejs buildpacks.

Stathis Theodosis is a software engineer with a Bachelor's degree in Computer Science from the University of Peloponnese. He pursued further studies with a Master's program at the same university. He worked at LIST (Luxembourg Institute of Science and Technology) and the University of Luxembourg, contributing to the development of a crowdsourcing mobile application for the CrossCult H2020 project. This app aimed to engage the public in preserving and understanding cultural heritage sites and artifacts.



Afroditi Kamara is a Historian and Cultural Heritage Consultant. She studied History at the Department of History and Archaeology of the University of Athens. She accomplished her postgraduate studies at the Universities of Manchester and Oxford in the UK. She has worked as a research historian at the Foundation of the Hellenic World, where she became specialized in Digital Humanities and Digital Cultural Heritage. In 2003 she co-founded Time Heritage, a Greek SME aiming at designing and implementing interdisciplinary projects for the protection and enhancement of cultural heritage. She has accomplished large-scale digitization projects, such as Digital Enhancement of Pylia and Digital Delphoi, she has designed the project DIAPLASIS for establishing masterplans of sites and monuments and since 2015 she works with an international consortium on Erasmus+ and other EU-funded projects for rural sustainable development with cultural heritage as its lever. She has published four books

Ioannis D. Triantafyllou holds a PhD from the National Technical University of Athens, Department of Electrical & Computer Engineering, and is currently an Associate Professor at the Department of Archives, Library and Information Studies at the University of West Attica. He has previously worked as a research associate in many European and Greek research projects at the Institute of Language & Speech Processing (ILSP / Athena RC). Recently, he participated in the CrossCult research program (Horizon2020), as a member of the research team. He specializes in Digital Libraries, Data & Text Mining, Text Classification & Clustering, Ontologies & Metadata, Linked Data, Information Extraction, Text & Information Retrieval, Automated Summary & Text Synthesis, Translation Memories, etc.

Journal of Integrated Information Management electronic journal

Unveiling Urban Narratives: eLEONAS ppWebGIS - A Multifaceted Digital Storytelling Journey through Eleonas

Giorgos Velegrakis[1], **Theodoros Vakas**[2], **Antonis Faras**[1],
[1]Commonspace Cooperative & National and Kapodistrian University of Athens, Department of History and Philosophy of Science, Greece
[2]Geospatial Enabling Technologies (GET), Greece
gvelegrakis@phs.uoa.gr [**ORCID:** 0000-0003-3888-5484], tvakkas@getmap.gr,
antfaras@phs.uoa.gr [**ORCID:** 0000-0003-2325-599X]

Article Info
Article history:
Received: 10 April 2024
Received in revised form: 17 April 2024
Accepted: 30 April 2024

https://doi.org/10.26265/jiim.v9i1.38587

Abstract:

Purpose – *During and alongside with the implementation of* eLEONAS ppWebGIS project*, an innovative digital storytelling initiative embarked on a multifaceted exploration of the Eleonas region in Attica, unveiling its unseen dimensions and weaving a captivating narrative of urban transformation. As the area undergoes a significant urban redevelopment from its industrial past, eLEONAS ppWebGIS seeks to shed light on three essential aspects: a) the often-overlooked invisible labour that shaped the region, b) the architectural significance of its building stock, and c) the intricacies of environmental and urban planning information. The pioneering project leverages local open networks (LBSN) and cutting-edge technology (φ-gital) to engage the public in an immersive and emotionally resonant experience that deepens their understanding and appreciation of Eleonas' past, present, and future.*

Design/methodology/approach – *The current research and implementation took place under the Eleonas ppWebGIS project which mainly aimed to introduce participatory planning in the Integrated Sustainable Development Planning as a "system" that can deliver at multiple scales, while responding directly to the needs of the public. For this purpose, the participatory processes emphasized correspond to the following planning/social needs: a. prediction, b. planning and c. prioritization.*

Findings – *The tools developed through the project were tested around three pilot applications in the Eleonas area of Attica, while supporting toolkits were created to enable the implementation of a same approach in other areas in Greece with similar characteristics. In this paper, we are focusing on the social innovation character of the methodology, which was achieved through the development of tools for re-appropriation of space by the residents themselves, namely: a. digital routes and narratives on the physical space (φ-gital) and b. Location based Social Network.*

Originality/value – *Through carefully curated digital routes, eLEONAS ppWebGIS introduced users to the unseen side of Eleonas, revealing the stories of the labourers whose contributions were fundamental to the area's industrial history and present. By incorporating personal narratives, archival images, and audio recordings, the platform humanizes the forgotten or unnoticed voices, giving due recognition to their essential role in shaping the region's identity.*

Index Terms — webGIS, digital storytelling, Location-Based Social Networks, urban development, environmental planning, immersive experience, community engagement, sustainable urban planning**.**

I. INTRODUCTION

Eleonas is an area of strategic location and importance for Attica and its spatial planning **[1], [2]**. During the Eleonas ppWebGIS project, it was selected as an urban area for piloting tools related to prediction, defining planning areas, and prioritization. The pilots were designed to include participatory decision-making processes and digital technologies such as webGIS and community engagement tools.

Spanning 9,000 acres, Eleonas contains areas with diverse characteristics, land uses, and identities. As such, it is a space suitable for different types of pilot applications and inquiries. We can classify the following types of areas based on their environmental importance: a) areas of significant environmental degradation (such as the streams of Profitis Daniel and Kifissos), b) residential areas (in 17 different enclaves of various typologies, such as workers' housing), and c) areas with concentrations of productive activities of different compositions and statuses. Reflecting its highly complex physiognomy, major urban interventions are planned or already taking place **[3], [4], [5]**. Alongside widespread area redevelopment policies, the discussion about the preservation of numerous historic buildings in need of conservation is gaining momentum **[6]**.

Additionally, Eleonas has been the focus of past research projects and studies, as well as institutional forecasts and planning efforts, none of which have fully met the criteria of an integrated approach. Thus, today it faces multi-level challenges for integrated spatial planning, which can unlock potential and address multiple social, economic, and environmental issues with a spatial dimension. The ICT applications developed in this project are designed to

substantially support integrated planning for Eleonas and find wider applications in other areas with similar needs and challenges **[7], [8]**.

As the area undergoes significant urban redevelopment from its industrial past to its complex future **[9]**, the storytelling approach of eLEONAS ppWebGIS aimed to highlight three essential aspects: a) the often-overlooked invisible labour that shaped the region, b) the architectural significance of its building stock, and c) the intricacies of environmental and urban planning information. To achieve the desired outcome, the project designed urban narratives that utilized local open networks (LBSN) and cutting-edge technology (ϕ-gital) to engage the public in an immersive and emotionally resonant experience. This engagement aimed to help locals, visitors, and potential policymakers understand and appreciate Eleonas' past, present, and future.

The objective of this paper is to demonstrate the social innovation element of these approaches to raise public awareness and activate participation. Thus, we will present the development and impact of the following two tools:

- ϕ-gital storytelling tours, enabled by the installation of open local networks and a mobile app (Eleonas Tales).
- the creation of a location-based social media platform (Eleonas Social), based on the reconfiguration of the open-source software Ushahidi.

II. Methodology

To develop a framework for introducing social innovation, Stilgoe, Owen, and Macnaghten **[10]** analyse the four dimensions of responsible innovation identified in the public debate to integrate them into the innovation process. These dimensions include:

- Anticipation, which involves systematic thinking aimed at increasing resilience, revealing new opportunities for innovation, and shaping agendas for socially robust risk research.
- Reflexivity, which means rethinking prevailing perceptions of the introduction of new technologies and processes, and analysing the policies required or potential changes to adapt reflections and initiate a process of reconfiguration.
- Inclusion, which involves incorporating new voices in the governance of science and innovation as part of a search for legitimacy.
- Responsiveness, which is the capacity to change shape or direction in response to stakeholder and public values and changing circumstances.

Based on the comprehension of this social innovation framework, the eLeonas ppWebGIS team proceeded with a series of methodological activities that included but were not limited to:

a) Data collection and organization: Creating a geographical database with the necessary data sets for each pilot application (satellite, vector, field, etc.), using existing open data, interfacing with open data sources, and making project data available as open data.

b) Field Work and Pilots: Collecting data for the pilot areas, managing mapping and visualization through 360° spheres in the WebGIS environment to support expert judgment and decision-making processes.

c) Analysis of the existing situation: Achieving this goal through the use and development of spatial analysis tools, creating add-ons for QGIS (open-source GIS), and implementing different visualization scenarios. Consequently, a standardized, customizable, visualized spatial analysis model was created.

d) Participatory Processes: Introducing these processes within an Integrated Sustainable Development Planning framework to address the urban challenges of the area.

e) Awareness and engagement raising: Developing necessary inclusion actions to support participatory planning and design, included in the LBSN and the ϕ-gital route.

These activities were interconnected to produce an integrated toolkit for participatory planning. To enable awareness and engagement raising, we employed technologies that we will examine in the next chapters. Since these technologies (LBSN and ϕ-gital) can be considered relatively novel and innovative technological assemblies in the Greek context, we will present the relevant literature review and then proceed with a description of their implementation in our case.

III. LBSN Definition And Uses

A Location-Based Social Network (LBSN) can be defined as a digital platform that combines traditional social networking functions with geolocation technologies. These networks allow users to share their physical location alongside social media content, adding a spatial dimension to online interactions. LBSNs can be used to monitor human activities and patterns, particularly in urban environments, providing information on how city spaces are used and how they interact with people **[11]**.

The characteristics and applications of LBSNs are diverse. In emergencies, for example, LBSNs can be instrumental in providing real-time location data, which is crucial for effective response and management. The ability to track the location and movements of individuals can greatly assist in disaster response and crisis management scenarios. From a commercial perspective, LBSNs offer significant opportunities for commercial exploitation, notably through targeted advertising and location-based promotions. By analysing user location data, businesses can provide personalized advertisements and offers to users based on their current or frequent locations. This targeted approach benefits both businesses, which can reach their desired audience more effectively, and users, who receive more relevant and localized content.

LBSNs have been used in various urban applications, leveraging specific tools to enhance the management and planning of cities. Importantly, they have been identified and exploited in various environmental applications in an urban context.

To exemplify LBSN, we share some emblematic uses of LBSN technologies:

- Urban planning with Foursquare data: Foursquare is the most widespread LBSN with significant tourism and economic exploitation. In addition, however, data from the app has enabled urban planners in understanding city dynamics. For example, its data has been crucial for land use analysis in Shenzhen, revealing discrepancies between actual and planned urban functions **[12]**.
- Public health monitoring via Weibo: Sina's Weibo, one of the largest Chinese social media, especially during the COVID-19 pandemic, provided valuable data for public health surveillance by tracking traffic patterns for implementing health measures in urban areas **[13]**.
- Environmental monitoring and conservation: LBSNs such as iNaturalist engage users in sharing wildlife and plant observations, contributing to biodiversity monitoring and conservation efforts in urban areas **[14]**.
- Air quality monitoring: Platforms like Plume Labs use location data to collect and disseminate real-time information on air pollution levels, helping urban residents make informed decisions about outdoor activities **[15]**.
- Sustainable transport: LBSN contributes to sustainable urban transport by providing data on cycling routes, walking paths and public transport use, thus supporting environmentally friendly transport options in cities. Strava, a city-level sports tracking application, is a notable example of an LBSN used for sustainable transport. One of its features, Strava Metro, collects anonymous user data to help urban planners understand and improve cycling and pedestrian infrastructure in cities. This use of LBSN data helps to enhance sustainable transportation options **[16]**.
- Crowdsourcing data for hydrological models: Several researchers have demonstrated the use of crowdsourced web content to inform water system operations in snow-dominated catchments. By integrating social media data with hydrological models, this approach enhances the management of water resources and supports sustainable water use practices **[17]**.

The successful urban applications of these networks inspired the implementation of a model LBSN network in Eleonas Social. Although our efforts were not focused on the collection of environmental data, as such data could be sourced through sensors, geodata platforms, and other means, we focused on using LBSN as a source of crowd data related to how people interact with the spaces they live in.

Hence, our LBSN model aims to harness these potentials for enhanced urban planning and community engagement. By collecting data on urban interactions and encouraging citizen participation, the project seeks to create a more dynamic, flexible urban landscape where the community actively contributes to shaping its future. This effort is aligned with the ppWebGIS broader perception of the needed elements for participatory urban development and the ability to harness the reconfiguration of technologies to promote more sustainable, inclusive urban spaces.

IV. Φ-GITAL: A ROUTE FOR PUBLIC AWARENESS AND PARTICIPATION IN SPATIAL PLANNING

The integration of public participation in spatial planning, particularly by using low-cost digital technologies, represents a significant shift in urban and regional development practices. Public participation is crucial for creating spatial plans that are not only sustainable but also responsive to community needs and expectations. Traditional methods of public participation in spatial planning often face limitations in terms of scope and inclusiveness. The availability of low-cost, scalable digital technologies, such as Raspberry Pi microcomputers, has opened new avenues for broadening public participation in this field **[18]**.

The advent of digital participation tools, including GIS systems, social media, and mobile applications, has revolutionized how public participation in urban planning is facilitated. These technologies, especially when they are low-cost and easily accessible, allow for more inclusive and dynamic public participation. They offer a scalable and flexible approach to engaging different community members, overcoming the limitations of traditional public participation methods **[19]**.

The concept of 'smart cities', supported by these low-cost digital solutions, demonstrates how technology can be leveraged to create flexible, connected, and participatory urban environments **[20]**.

In this context, innovative and combinatory technologies are emerging to achieve these goals, such as phydigital applications. The term 'phydigital' refers to the integration of physical and digital elements in urban design and public participation. It is a portmanteau of 'physical' and 'digital', highlighting the blending of these two fields.

This concept is particularly important for the creation of interactive, digitally enhanced spaces and infrastructure in urban environments:

- Physical Aspect: This includes the tangible, real elements of urban spaces, such as Raspberry Pi microcomputers, sensors, and other hardware installed in various locations. These physical elements are necessary for collecting data, interacting with users, and providing various services in public spaces.
- Digital Aspect: This encompasses the software, data processing, and digital communication technologies used alongside the physical infrastructure. The digital component is crucial for processing and presenting information, enabling interactive experiences, and facilitating digital engagement with the public.

In "phydigital" applications like the ϕ-gital route, the physical and digital components work together to enhance public participation in spatial planning. The physical infrastructure serves as a local access point or hub, while the digital technology provides the interface and tools for participation, information dissemination, and data collection.

This combination aims to create an interactive experience for users, allowing them to participate in urban planning processes in a more meaningful and accessible manner.

Overall, the phydigital approach to spatial planning focuses on creating hybrid spaces where digital technology enhances physical environments, making them more interactive, informative, and responsive to community needs and inputs **[21], [22]**.

V. AN LBSN FOR ELEONAS

The LBSN for Eleonas was designed to facilitate asynchronous public participation in the project's progress. Users could share "stories" and points of interest by geo-tagging, encouraging the collection of valuable content and fostering a digital community around the project. Additionally, users could comment on existing stories, contributing to the development of user-generated content.

Users were empowered to create detailed profiles, enabling a personalized experience on the platform. They could accurately identify locations using mapping technology, which was crucial for associating discussions and content with specific geographic areas.

The platform was meticulously designed to respect user privacy and maintain data integrity. As such, mechanisms for dynamic content posting and interactive participation were implemented. Furthermore, Eleonas Social included features for real-time discussions, news sharing, and community forums to enhance user engagement and collaboration.

There was also a content categorization and filtering tools, allowing both the public and researchers to access relevant and personalized content efficiently. Through the platform's design and its different layers, we developed a User Experience (UX) design oriented toward active community participation in content creation and data collection, harnessing the power of crowdsourcing for enriched urban development knowledge. Additionally, the UX offered a seamless and consistent user experience across devices, particularly optimized for mobile use.

Our LBSN model, Eleonas Social, was built on a robust three-tier architecture—a development framework that separates an application into three interconnected layers: presentation, application logic, and data storage. This architecture enhances scalability, performance, and maintainability.

Initially, we considered using Mastodon software due to its compatibility with the intended functionalities **[23]**. However, upon delving into customization requirements and technical complexities, we realized that Mastodon did not meet our expectations. Its limitations prompted us to explore alternatives, ultimately leading us to adopt Ushahidi as the preferred software for the Eleonas Forum LBSN prototype.

Ushahidi's flexibility and scalability aligned best with our goals, allowing us to create a highly customized and efficient spatial social network. At the presentation layer, React.js and Redux form the backbone of our application's front-end, providing dynamic and interactive interfaces. These technologies enable users to engage with the platform effortlessly, ensuring a smooth and enjoyable user journey.

Moving to the application and data logic layer, Ruby on Rails drives the core functionality of our LBSN. It powers the REST API and other web pages, handling user registration, content posting, profiles, hashtags, and reports. Simultaneously, Node.js, a flexible and high-performance runtime, supports the streaming API, facilitating real-time interactions and ensuring users stay updated on the latest content and activities. The data tier is built on PostgreSQL 9.5+ for robust and efficient data management. This relational database system ensures data integrity and supports complex queries critical to the diverse operations of an LBSN. Additionally, Redis 4+ enhances data access speed through caching, optimizing overall platform performance. Together, these technologies establish a solid foundation for the application. The app's API plays a pivotal role, enabling users to publish content, access real-time updates, and actively participate in discussions.

VI. "ELEONAS SOCIAL" – THE PLATFORM

The Eleonas Social platform **[Fig. 1]** was designed to facilitate community engagement and information sharing through a structured and user-friendly interface. It supports various categories of posts, encouraging diverse types of user interaction and information sharing. General posts are fundamental units of content sharing, while Reports indicate active user engagement with critical information. Community Discussions promote interaction and dialogue among members. Help and Support posts address user queries, and Events and Announcements keep the community informed about upcoming activities. Resource Sharing enables the exchange of valuable information or materials within the community.

Fig. 1: *The logo of Eleonas Social*

To enhance user experience and facilitate content discovery, Eleonas Social offers several filter options. Users can save their settings for quick access and apply filters

based on post status, categories, timeframe, and geographical location. Resetting filters to default allows users to start afresh.

Eleonas Social includes specialized views such as the Map View **[Fig. 2]**, featuring an interactive map interface with geolocated points of interest, user location indicators, and data filters. This view facilitates the visualization of data distribution and density with features like color-coding and clustering.

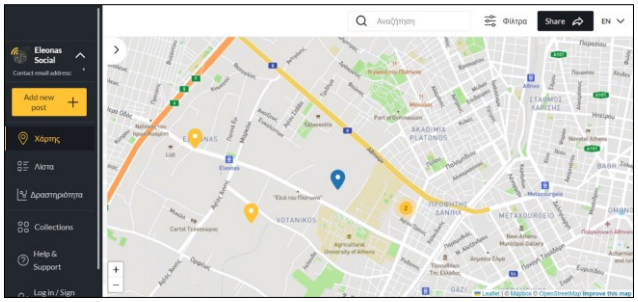


Fig. 2: *Map view in Eleonas Social*

The Data View presents geolocated content in a list or grid format **[Fig. 3]**, offering sorting and filtering options for a personalized user experience. Users can manage their content through View Collections, allowing organized content storage with drag-and-drop functionality **[Fig. 4]**.

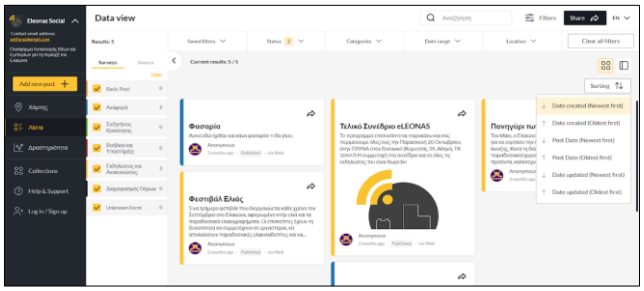


Fig. 3: *List view in Eleonas Social*

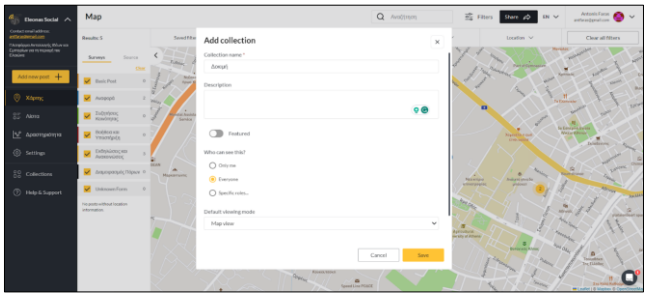


Fig. 4: *Collection view in Eleonas Social*

Interaction with entries is intuitive, with modal windows displaying entry details and a simplified posting process that includes media uploads, categorization, and optional additional information.

User rights and moderation on Eleonas Social are structured to provide varying levels of control based on user roles. Administrators have full moderation control, manage user roles, and configure system settings. Coordinators oversee content review, edit submissions for clarity or compliance, and moderate comments. Contributors have limited editing capabilities for their own posts and can flag inappropriate content. Public users can flag content for review by moderators.

In summary, Eleonas Social enhances community engagement through advanced filter options, specialized views, and clear user roles, ensuring an interactive and efficient user experience

VII. "ELEONAS TALES" – THE APPLICATION

The Eleonas Tales app **[Fig. 5]**, was developed to support the digital route of Eleonas and enhance the experience of exploring the area through interactive storytelling and rich multimedia content. Available on Android (PlayStore) and web devices, the app provides a comprehensive and user-friendly interface for both residents and visitors, ensuring cross-platform accessibility. Developed using NativeScript, the app's key features aim to create an immersive and engaging experience for users.

Fig. 5: *The logo of Eleonas Tales*

One of the core features of Eleonas Tales is its real-time, location-based information accessed through GPS technology, enhancing the user experience by guiding them to nearby points of interest within Eleonas.

Content is organized into thematic pathways, each reflecting unique storytelling efforts. Users select routes based on cultural, historical, or architectural interests, personalizing their exploration.

QR code scanning unlocks digital content at physical points of interest, integrating the app seamlessly with on-site experiences, enhancing engagement.

The interactive map view displays routes and points of interest, aiding navigation and offering detailed location information, facilitating intuitive exploration.

Eleonas Tales supports diverse content types—text, images, audio—appealing to various user preferences, providing a rich, multi-sensory experience.

Powered by Strapi CMS, the app ensures flexible content management and immediate updates, maintaining relevance and incorporating new stories.

Physical content installation across routes, such as the Landscape Reserve pilot, showcases architectural significance and community stories, enriching understanding of Eleonas.

The People's Route focuses on personal narratives but isn't

digitally mapped due to spatial challenges in commercial areas, highlighting community life and events.

The draft Urban Growth Route explores Eleonas' urban history and development, incorporating historical data, urban planning documents, and narratives, offering insights into its evolution.

Eleonas Tales, embodies phygital routes-a novel approach to urban exploration and public participation. These routes blend physical spaces with digital accessibility, enhancing city tours for residents, organized groups, and visitors, regardless of internet connectivity.

Phygital routes integrate physical locations with digital narratives, marked by visible signs guiding users to specific points of interest. This transforms urban spaces into interactive hubs where physical and digital worlds converge. Users equipped with smartphones access a repository of digital content linked to these locations, akin to navigating an augmented reality experience **[Fig. 6, 7]**.

Fig. 6: *List of viewpoints in Eleonas Tales*

Fig. 7: *Internal page of a point of interests in Eleonas Tales*

These routes support diverse digital content types—photos, videos, 3D models, text, audio, and interactive questionnaires—ensuring a comprehensive user experience. For instance, users can view archival videos or listen to audio stories about historical landmarks, catering to various preferences and learning styles **[Fig. 8]**.

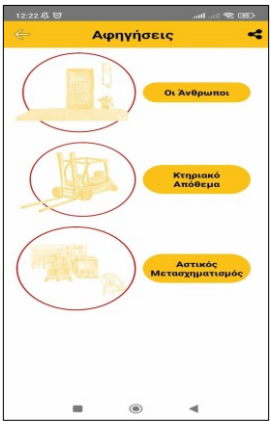


Fig. 8: *Narratives viewing page in Eleonas Tales*

Central to digital routes are local information hubs linked to physical signage throughout the city. These hubs, facilitated by signs or QR codes, connect users' physical locations to digital nodes via the dedicated mobile app. This system enriches environmental understanding and encourages interactive city exploration **[Fig. 9]**.

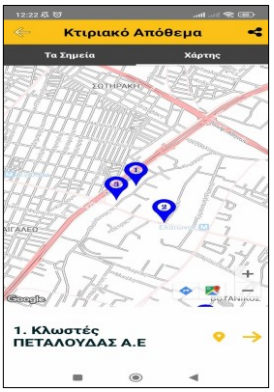


Fig. 9: *Map of points in Eleonas Tales*

In conclusion, digital routes redefine urban exploration by integrating accessible digital layers with physical city journeys. They enhance exploration experiences and serve as educational and participatory tools, fostering deeper connections between individuals and their urban environment.

VIII. CONCLUSIONS

To conclude our presentation of the multifaceted digital storytelling journey crafted by the eLeonas ppWebGIS team, we critically analyse our chosen methodology. We integrated anticipation, reflexivity, inclusion, and responsiveness deeply into the fabric of the eLEONAS ppWebGIS project's methodologies and tools.

Anticipation in our context went beyond mere prediction; it embedded systematic thinking into our toolkit. This foresight enabled us to design and deploy digital tools resilient in the face of urban challenges and capable of uncovering new opportunities for innovation within Eleonas. Each tool was evaluated for its potential to proactively shape

urban agendas, ensuring our research is future-ready and aligned with emergent urban dynamics.

Reflexivity added a critical dimension, prompting continuous evaluation and reassessment of our assumptions and practices. This was evident in developing participatory platforms where we challenged prevailing notions, ensuring ethical grounding and adaptability to new insights and perspectives.

Inclusion was realized through our commitment to diversifying voices in science and innovation governance. Our tools democratized planning, engaging traditionally marginalized stakeholders. This enriched our understanding of urban complexities and ensured interventions were rooted in community needs and aspirations.

Responsiveness was central, adapting to Eleonas' dynamic environment and stakeholder needs. Our tools and methodologies were flexible, swiftly responding to changes and feedback, maintaining relevance and impact.

In summary, integrating anticipation, reflexivity, inclusion, and responsiveness represents a comprehensive approach to urban redevelopment. This strategy advances urban narratives and highlights digital storytelling's potential in sustainable, inclusive, and responsive urban transformation. Our project lays groundwork for future urban planning, emphasizing these dimensions to create resilient and vibrant urban spaces.

IX. References

[1] **Vassenhoven, L. (1993).** 'Urban regeneration in a modern metropolis: the case of Eleonas', in Georgoulis, D. [ed.], Texts in the theory and application of urban and spatial planning, pp 51-81, Papazisis, Athens.

[2] **Agriantoni, Ch. (2010 [1986]).** The beginnings of industrialization in Greece in the 19th century, Katarty, Athens.

[3] **Ropaitou - Tsapareli, Z. (2006).** O Elaiononas tis Athens, Filippoti, Athens, Greece.

[4] **DIPLI ANAPLASI S.A. (2006)**. Double Redevelopment Intervention in Botanikos and Alexandra Avenue – Zoning Environmental report, Athens, Greece.

[5] **NTUA, AUTH, BEA, BEP (1996).** Proceedings of the Conference 'Small and Medium-Sized Manufacturing Enterprises in the Urban Fabric', NTUA, Athens.

[6] Tsadari S (2019) Urban transformations in the era of crisis, on the changes in activities and urban policies in Elaionas, Athens. PhD Thesis. National Technical University of Athens (NTUA). Department of Urban and Spatial Planning. Available at: http://hdl.handle.net/10442/hedi/45498.

[7] **Institute of Economic and Industrial Research -IOVE (2005).** Investigation of development prospects of the area of Eleonas, Phase A: The developmental physiognomy of Eleonas, Institute for Regional Development, Athens.

[8] **Institute of Economic and Industrial Research - IOBE (2013).** Update of the study "Investigation of development prospects of the area of Eleonas" and its cartographic mapping, Athens, Greece.

[9] **NTUA (1995).** Implementation of Industrial Zone Regeneration Programmes within Cities and Relocation of Economic Activities / Case Study: Athens' Eleonas, Research Project Report (Scientific Officer: L. Vassenhoven), Laboratory of Spatial Planning and Urban Development, NTUA and ORSA.

[10] **Stilgoe, J., Owen, R., & Macnaghten, P. (2013).** Developing a framework for responsible innovation. Research Policy, 42(9), 1568-1580.

[11] **Stepan, T., Morawski, J. M., Dick S. and Miller, J. (2016)**. "Incorporating Spatial, Temporal, and Social Context in Recommendations for Location-Based Social Networks," in IEEE Transactions on Computational Social Systems, vol. 3, no. 4, pp. 164-175, Doi: 10.1109/TCSS.2016.2631473.

[12] **Martí, P., García-Mayor, C., Nolasco-Cirugeda, A., & Serrano-Estrada, L. (2020).** Green infrastructure planning: Unveiling meaningful spaces through Foursquare users' preferences. Land use policy, 97, 104641.

[13] **An, L., Yu, C., Lin, X., Du, T., Zhou, L., & Li, G. (2018).** Topical evolution patterns and temporal trends of microblogs on public health emergencies: an exploratory study of Ebola on Twitter and Weibo. Online information review, 42(6), 821-846.

[14] **Edwards, T. J. (2022).** Augmenting official citizen science data collections with social media data related to wildlife observations (Doctoral dissertation, Cardiff University).

[15] **Silva, J., Lucas, P., Araújo, F., Silva, C., Gil, P., Cardoso, A., & Nogueira, V. (2019, June).** An online platform for real-time air quality monitoring. In 2019 5th Experiment International Conference (exp. at'19) (pp. 320-325). IEEE.

[16] **Salazar-Cabrera, R., de la Cruz, Á. P., & Molina, J. M. M. (2020).** Sustainable transit vehicle tracking service, using intelligent transportation system services and emerging communication technologies: A review. Journal of Traffic and Transportation Engineering (English Edition), 7(6), 729-747.

[17] **Mazzoleni, M., Verlaan, M., Alfonso, L., Monego, M., Norbiato, D., Ferri, M., & Solomatine, D. P. (2017).** Can assimilation of crowdsourced data in hydrological modelling improve flood prediction? Hydrology and Earth System Sciences, 21(2), 839-861.

[18] **Johnston, Steven & Cox, Simon. (2017).** The Raspberry Pi: A Technology Disrupter, and the Enabler of Dreams. Electronics. https://doi.org/10.3390/electronics6030051

[19] **Nabatchi, T., & Leighninger, M. (2018).** Public participation for 21st century democracy. John Wiley & Sons.

[20] **Kitchin, R. (2016).** The ethics of smart cities and urban science. Philosophical Transactions of the Royal Society A: Mathematical, Physical and Engineering Sciences, 375(2095), 20170215. https://doi.org/10.1098/rsta.2016.0115

[21] **Afzalan, N., & Muller, B. (2018).** Online Participatory Technologies: Opportunities and Challenges for Enriching Participatory Planning, Journal of the American Planning Association, 84(2), 162-177.

[22] **Innes, J.E., & Booher, D.E. (2010).** Planning with Complexity: An Introduction to Collaborative Rationality for Public Policy. Routledge, London.

[23] **Burnett, C. M. (Ed.) (2023)**. Evaluating Participatory Mapping Software. Springer International Publishing.

X. Acknowledgments

The research and implementation took place under the RTDI State Aid Action "Research-Create-Innovate", co-funded by the European Union and the Hellenic Republic through the Operational Programme Competitiveness-

Entrepreneurship-Innovation (EPAnEK) (official project identification code: T2ΕΔΚ-01288) eLEONAS ppWebGIS (2020-2023).

XI. AUTHORS

Giorgos Velegrakis, MEng in Electrical and Computer Engineering (Electrical and Computer Engineering School, National Technical University of Athens, 2007), MSc in Environmental Policies and Development (Rural and Surveying Engineering, National Technical University of Athens, 2009), and PhD in Geography and Political Ecology (Geography Department, Harokopio University Athens, 2018) is an adjunct faculty at the Philosophy and History of Science Department, National and Kapodistrian University of Athens. He is member of research initiative and workers' cooperative commonspace.

Thodoris Vakkas is head of the GET (Geospatial Enabling Technologies) application development and project implementation team. With his 10 years of experience combined with his deep expertise in the field of Geoinformatics, he supports GET's actions to design innovative high quality solutions. He holds a Diploma in Surveying Engineering (NTUA) with an MSc in Geoinformatics (NTUA).

Antonis Faras is a PhD candidate at the National and Kapodistrian University of Athens, focusing on the practices of technological maintenance. His PhD thesis entitled: "Technological maintenance and economic alternatives: Historical and Methodological Dimensions for the Circular Economy and Sustainable Development" highlights the centrality of technological infrastructure maintenance for policies addressing critical issues of the period. A graduate of the Department of Business Administration and Management from the Athens University of Economics and Business, he completed his Master's degree in the Interdepartmental Postgraduate Program in "Science, Technology, Society-Science and Technology Studies", where he graduated with distinction. In addition to his academic achievements, he has worked at the Sociality Co-op, where he has been actively involved in various research and technology projects.

Journal of Integrated Information Management electronic journal

Showcasing sepulchral heritage through cultural routes and activities: The views and opinions of the "audience" of the Anastasis Cemetery in Piraeus

Georgios Dermitzoglou
Harokopio University of Athens, Department of Economics and Sustainable Development, Greece
gdermitzoglou@hua.gr [**ORCID**: 0009-0003-6231-1445]

Article Info

Article history:
Received: 10 April 2024
Received in revised form: 30 April 2024
Accepted: 15 May 2024

https://doi.org/10.26265/jiim.v9i1.38588

Abstract:

Purpose *- Cemeteries, intrinsically linked to the history of people and communities, are places of historical remembrance and significant witnesses to local history. However, their abundant written and artistic testimonies often remain obscure, primarily due to the association of these sites with death and decay. The Anastasis Cemetery ("Cemetery of Resurrection") in the Evgenia Drapetsona area of Piraeus is a noteworthy case. Numerous funerary monuments attest to the presence of prominent families from Piraeus, who have contributed to the historical development and shaping of the city's identity. The purpose of this article is twofold: first, to highlight the "voices" of the cemetery audience regarding the sepulchral heritage of Piraeus, focusing on its preservation, enhancement, and utilisation; and second, to suggest ways for the transformation and cultural revitalisation of the burial site, primarily through cultural routes and various activities.*

Design/methodology/approach *- To study the attitudes and opinions of the audience at the Anastasis Cemetery, an online survey was conducted over approximately one year. This digital approach proved effective, resulting in a considerable number of completed questionnaires. Participants from municipalities in Attica were invited to engage, provided they had prior familiarity with the Cemetery and had visited it at least once. In total, the survey engaged 104 participants.*

Findings *- The research highlighted the participants' attitudes and opinions on issues related to the use of the burial site, as well as its educational and cultural utilisation through activities, art exhibitions, lectures, tours, and workshops, while always considering its primary function and users. Additionally, it identifies ways in which the audience could contribute to the management of the burial site.*

Originality/value *- This research introduces, for the first time, the issue of showcasing and utilizing Greek funerary heritage, examining the "voices" of the cemetery audience, which constitutes the users of the space.*

Index Terms *—* Online audience research, The Anastasis Cemetery ("Cemetery of Resurrection") of Piraeus, Funerary cultural heritage, Management of cultural heritage, Cultural routes, Cultural tourism.

I. Introduction – Historical Context

Cemeteries are spaces inextricably linked with local history and, as such, they serve as agents of memory and witnesses to historical continuity, carrying multifaceted information about the deceased and their era. Despite this, very few cemeteries in Greece receive attention commensurate with their cultural value. The vast wealth of historical testimonies found in cemeteries– whether on inscriptions or in representations such as busts– often languishes in obscurity due to the peculiar nature of these spaces.

For local residents, cemeteries are loci of the morbid and the macabre, or spaces to be generally avoided due to their association with death and decay. This attitude is demonstrated by the fact that cemeteries across Greece today are strictly delimited and contained within tall walls.

This article is a case study of the Anastasis Cemetery (Cemetery of Resurrection) in Piraeus **[1]**, **[2, pp. 121, 152, 252, 299]**, **[3]**, **[4]**, **[5]**, which was the city's new cemetery at the beginning of the 20th century, when the old cemetery and the graves were transferred from the churchyard of Saint Dionysios church. The Cemetery is situated in the area now known as Evgeneia in Drapetsona. In addition to their historical and aesthetic significance, the cemetery's sepulchral monuments offer valuable insights into the family histories of notable figures who lived and worked in Piraeus during the latter half of the 19th century and the early 20th century. By examining these personal stories, we can delve deeper into the city's local history **[6, pp. 1266-1270]** and analyse the transformations of its character over time.

Inspired by the sepulchral heritage of Piraeus, this article outlines proposals for cultural routes and actions, as well as the participation of Piraeus in relevant networks. It develops an approach to this specific category of monuments, aiming to highlight them as part of the city's cultural heritage and leverage them to attract urban tourism. These proposals are primarily based on

international examples, but also incorporate the perspectives of the cemetery's "audience", as reflected in a survey partially presented in the article.

Until the end of the 19th century, the official cemetery for the city of Piraeus was located in a remote area called Vourla,[1] which at the time lay outside the city limits. There was also a second cemetery to the north of the Church of the Transfiguration of Christ **[7, p. 39]**, in the area now known as Palaia Kokkinia.

In the final decades of the 19th century, Piraeus rose to prominence as Greece's leading industrial and commercial city. By the early 20th century, the number of factories in the region had increased exponentially, resulting in a dramatic rise in local employment rates and a significant increase in population density around the port area. This rapid growth led to the city's expansion and the incorporation of new areas into its zoning plan. Consequently, the cemetery of Saint Dionysios could only accommodate the church's parishioners **[8, p. 68]**, highlighting the urgent need for a new burial site.[2]

In 1889, the Municipality resolved to purchase a large plot of land in the Evgeneia area to establish a municipal cemetery **[3, p. 6]**. By 1890, tenders were solicited for the construction of a surrounding wall and a road to connect the cemetery with the city. In 1892, the main entrance was constructed, and over the following two years, an autopsy room was added. The area was then cleaned, levelled, and the outer wall was finished. The cemetery was inaugurated in March 1904. The process of relocating graves from the Saint Dionysios cemetery to the new site extended from 1904 to 1909, with the New Cemetery officially commencing its operations in 1910. The Church of Anastasis, after which the cemetery was named, was situated at the centre of the cemetery, and its murals were painted by the religious artist Pantelis Zografos **[9]**. In subsequent years, modifications and expansions were made to the original design. A section was allocated to the Russians and, in 1922, another section was given to the French Catholics **[3, p. 6]**,[3] where the graves from the old cemetery were also transferred.

Nowadays, the Anastasis Cemetery is situated within the urban fabric, but it is no longer in use, except for family graves. The Municipal Cemetery of Schisto has been operational since February 1998 to meet the burial needs of residents in the Municipalities of Piraeus and West Attica.

II. The Sepulchral Monuments of the Anastasis Cemetery in Piraeus

The Anastasis Cemetery hosts the gravesites of the most significant figures of the Piraeus society. Among the most prominent family names are Retsinas, Rallis, Dilaveris, Moutsopoulos, Afentoulis, Metaxas, John Mac Dowall, and many others. Their burial monuments testify to the existence of these individuals, who played a major role in the history of modern Piraeus, contributed to the city's evolution, and shaped its character. Moreover, the cemetery itself constitutes an open-air museum of modern Greek sculpture **[4], [5]**, as the monuments selected by each family were intended not only to honour their deceased but also to highlight their financial status and social prestige.

The burial monuments encountered in the Cemetery belong to a variety of types and styles: columns with classical elements, reliefs and sculptures in the round that symbolise mourning (depicting the spirit grieving for the loss of loved ones), obelisks, and even a few columns featuring representations of the deceased. There are grand mausoleums constructed entirely of marble, as well as two of the five monuments in Greece inspired by the Choragic Monument of Lysicrates.[4] Analyzing these monuments from both aesthetic and historical perspectives can provide valuable insights into the families and their aesthetic choices.

The examination of these monuments reveals that affluent families in Piraeus commissioned the construction of their burial monuments from renowned sculptors of the time, reflecting their high aesthetic standards. At least 37 names of sculptors and specialised marble craftsmen can be identified at the Anastasis Cemetery **[4]**. These artists were active from the late 19th century until 1940, which is considered the heyday of Greek sepulchral sculpture. Most of these impressive monuments are concentrated along the cemetery's main street, but notable examples can also be found along the smaller streets that intersect within the Cemetery.

The historical value of the memorials is primarily derived from the connection between the monuments and the lives of the individuals they commemorate. Beyond the memorials themselves, language plays a crucial role in preserving memory. The inscriptions engraved on the memorials provide invaluable information about the lives, origins, professions, family relationships, and ancestry of those interred in the Cemetery.

Therefore, the Anastasis Cemetery serves as both a site of historical memory and an open-air museum of modern Greek art, offering visitors a wealth of insights. In addition, sepulchral art forms an integral part of the history of

[1] The area was originally a swamp covered in bulrushes (known in Greek as "vourla"), which gave it its name. It encompassed the building block defined by the following streets: Ethnikis Antistaseos (formerly Agiou Dionysiou), Psaron, Doganis, and Sokratous (Evoias) **[2, p. 299]**.

[2] See the relevant records of the Piraeus Municipal Council sessions from 1881 to 1909 **[2, p. 121, note 456]**.

[3] According to Malikouti **[2, p. 122, note 459]**, documents from as early as 1889-1895 reference the division of sections of the Anastasis Cemetery for Westerners and Russians.

[4] These are monuments in the style of the ancient Lysicrates Choragic Monument (335-334π.Χ.), the first of which was built in the Anastasis Cemetery. There is another such monument in the First Cemetery of Athens **[see 10, pp. 23-24 / 55-57, fig. 42-43]** and two more in the Saint Georgios Cemetery in Syros **[11, pp. 489-506, 561-562, no. 413 and 415 respectively]**.

modern Greek sculpture, while also reflecting the ideological, economic, and social conditions prevalent in the modern Greek state.

III. THE "AUDIENCE" OF THE ANASTASIS CEMETERY

The first part of the survey of the attitudes and opinions of the Anastasis Cemetery "audience" was conducted within the framework of the Operational Programme for the "Support of researchers with emphasis on young researchers" (project code: EDBM103).[5] The objective of the survey was to examine the multifaceted nature of cemeteries by recording, exploring, and interpreting the attitudes, relationships, and wishes of the cemetery "audience" –comprising users, visitors, and workers–.[6]

It is important to note that only a few similar studies have been conducted on cemeteries at an international level. Most of these studies were carried out over the past few decades, utilizing interviews or short questionnaires, and were quite limited in both scope and sample size.[7]

Although the study was initially designed to be conducted on the site of the Cemetery, the restrictions imposed due to the COVID-19 pandemic necessitated a redesign, incorporating digital tools. Nevertheless, a preliminary trial of a pilot questionnaire was conducted on-site to evaluate the effectiveness of the questionnaire and to record participants' reactions to the research objectives. These observations proved to be extremely valuable in the process of formulating our final conclusions.

The questionnaires were emailed to the participants in two phases: The first one lasted for about three and a half months from 18 November 2020 to 13 March 2021, during the COVID-19 quarantine, while the second lasted from summer 2022 until February 2023. Overall, the questionnaire link remained active for approximately one year.

The digital questionnaire was distributed via email to cemetery administration staff, as well as to families and individuals who are either familiar with the Cemetery, have a connection to it, or have visited it at least once in the past. The email accounts were sourced from both interactions with participants during the research and from a tour conducted on September 30, 2022, which aimed to introduce the "audience" to the Cemetery itself. Moreover, the questionnaire was shared on social media pages related to the Piraeus area and the Cemetery. The responses were completed anonymously, and all the necessary principles of research ethics for anonymity and confidentiality were adhered to throughout the study's implementation.

At this point, it is important to clarify the concept of "audience" in the context of this study. This term refers here to the following three categories of people: a) all cemetery users, namely the bereaved who maintain the plots, graves, ossuaries or other memorials to their loved ones, b) visitors or tourists; individuals who are not normatively connected to the current circumscription of the space, but appear in it as external presences **[20]**, and c) professionals, namely the people who provide administrative or other services associated with the Cemetery, including cemetery staff as well as researchers studying such spaces.

During the digital dissemination of the questionnaire, several important issues emerged. On the one hand, the Internet provides opportunities to broaden the sampling pool and collect more comprehensive data. On the other hand, it may lead to the conflation of the phenomena under observation. The physical distance from the Cemetery translates into a distance from the conditions present at the site, potentially resulting in a somewhat idealised depiction, which is a significant drawback of digital data collection. Additionally, although a digital questionnaire can theoretically be shared across various digital platforms, in practice, due to the prominence of certain social media platforms like *Facebook*, other, more specialised platforms receive limited traffic **[29, p. 4198]**. Moreover, the tone and purpose of each platform, as well as its targeted audience are important factors that, by definition, impede access to a truly diverse sample. Finally, although the remote dissemination of a questionnaire offers convenience, the medium is still not entirely democratic **[29, p. 4199]**, as it excludes individuals who lack Internet access or are not sufficiently tech-savvy to participate in a scientific study. Nevertheless, we managed to gather a significant number of responses, which enabled us to draw certain conclusions and gain an overview of the opinions held by the "audience" of the specific cemetery.

In particular, 104 individuals participated in the survey, a satisfactory number considering the size of the Cemetery and the corresponding number of people and municipalities it serves or used to serve. In relation to the profile of the sample, most participants are residents of Piraeus and the greater area (Drapetsona, Keratsini, Agios Ioannis Rentis, Korydallos, Nikaia, Moschato and Paleo Faliro), but there is a number of respondents who live in

[5] This part of the research is co-financed by Greece and the European Union (European Social Fund - ESF) through the Operational Programme "Human Resources Development, Education and Lifelong Learning 2014-2020" in the context of the project "The cemetery audience. The highlighting of elements of material and intangible culture of the burial sites through the 'voices' of their visitors: The cases of the Anastasis Cemetery of Piraeus and the Third cemetery of Athens" (MIS 5049029).

[6] For an initial approach to the results, see: **[12]**.

[7] Indicatively, see the study conducted by Bradbury **[13]**, which managed to shed light on the distinctly different perspectives of deathwork professionals and grieving relatives; the study by Francis, Kellaher and Neophytou **[14], [15]** on the "audience" of the London cemeteries; the study by Woodthorpe **[16], [17]** on East London Cemetery; the study by Nielsen and Groes **[18]** on the cemeteries of Copenhagen; the study by Jolly **[19]** on the management of historical cemeteries by leagues of friends; Pécsek's **[20]** case study on the National Graveyard of Budapest; Paraskevopoulou's **[21], [22]** study on the preservation and management of historical English cemeteries by leagues of friends; the study by Nordh, Evensen and Skår **[23]** on the Oslo cemetery, as well as the study by Nordh και Evensen **[24]** on urban cemeteries in the capital cities of Scandinavia, specifically in Oslo, Stockholm, and Copenhagen; the research published by Lai, Scott and Sun **[25]** on the re-use of two historical urban cemeteries in Edinburgh; Grabalov's **[26]** case study on Norwegian and Russian cemeteries; the study by Grabalov and Nordh **[27]** on the public's perception of cemeteries as "philosophical parks" focusing on the cemeteries of Oslo and Copenhagen; and the study by Jedan *et al.* **[28]** on a memorial cemetery in Maastricht.

various municipalities across Athens (13 more municipalities of Attica) and are connected with the Cemetery in some way. The overwhelming majority of the participants (72) are women, while men constitute only 32. The age range of the participants extends from 31 to 83. Most respondents are between the ages of 33 and 41 (37 participants), while 20 participants are between 50 and 53.

Regarding religious beliefs, the overwhelming majority of participants identify as Christian or Christian Orthodox, with no mentions of other Christian denominations. One participant identifies as a skeptic, two as agnostics, four as atheists, four as non-religious, and one participant did not respond to this question.

Based on the participants' responses, most have visited the Cemetery to attend a funeral, pay their respects to the deceased, or maintain a spiritual connection with loved ones. A smaller group visits for other reasons, such as exploring the history of the site and admiring its monuments.

IV. The Voices of the Anastasis Cemetery Audience: The Results of the Survey

The views of the audience are influenced by a range of factors, including personal experiences, cultural and religious beliefs, and reasons for using the space, as most participants have a connection to the Cemetery through loved ones buried there.

The majority of the audience views these spaces as sacred, which justifies their demands for respect and maintenance of the area (**see Table I**). This perspective also explains their reluctance towards any alternative use of what is intended to be a peaceful resting place for the deceased. Indeed, some members of the audience are opposed to any re-evaluation of the burial site. This opposition can be attributed to several factors –religious beliefs, funerary and memorial traditions, and the condition of the Cemetery– that significantly shape the views of Greek society. It is also worth noting that the audience associates the neglect of the Cemetery with a lack of respect for the deceased.

In reference to the historical and aesthetic merits of the Anastasis Cemetery, the audience notes that the space has not been utilised, especially since it ceased its operations. The importance of the Cemetery to history and art is evidenced not just by the existence of majestic burial monuments, but also by the personalities which are interred there. The audience acknowledges the historical and cultural value of the Cemetery and even proposes initiatives to highlight its cultural heritage through educational programmes and guided tours. In this context, the audience suggests that special attention should be given to the organisation and management of the Cemetery. Specifically, the Municipality and the State should be mobilised to inform and raise public awareness through various actions, improve and enhance the cemetery area, and preserve and promote its historical and cultural heritage.

In an open-ended question regarding their suggestions for enhancing the area, the majority of participants recommend improving the surrounding environment and the burial monuments, as well as restoring the landscape to "create a sense of tranquillity for every visitor to the Cemetery". One participant expressed the desire for "memory to be more prominently featured in relation to death". Another participant suggests producing printed materials containing information about the monuments, while yet another proposes the inclusion of the Cemetery in the Association of Significant Cemeteries of Europe. Furthermore, there is a proposal to enhance infrastructure and pathways, as well as to expand green spaces through tree planting and the conversion of vacant areas into landscaped zones for relaxation, featuring benches. The aim is for the Cemetery to "acquire the appearance of a park and to be utilised as a historical promenade". Additionally, one participant recommends that the currently unused areas of the Cemetery be designated for alternative purposes, while another suggests these areas "be allocated to the city for other uses". There is also a proposal for the Cemetery to permanently cease functioning as a burial site (even for family plots), to establish a crematorium, and to be "organically integrated into the life of the city through cultural activities", as indicated in the questionnaire.

As for the role the audience itself is willing to play in the administration of the Cemetery, opinions vary significantly. Some participants express doubts or negative views, while others underline the importance of contributing to the various tasks aimed at maintaining and showcasing the Cemetery. Specific actions are suggested to encourage the audience's involvement, such as forming maintenance groups, gardening teams, organizing tours, and holding memorial days. It appears that the desire to preserve the memory and historical character of the space serves as an incentive for some members of the audience to engage in revitalisation efforts.

With regard to the ways in which the audience could contribute to the cemetery's administration (**Table II**), we draw the following conclusions: The majority of the respondents express considerable interest in the Cemetery, indicating that they could make significant contributions towards maintaining its cleanliness and greenery. However, opinions are more divided concerning the representation of the Cemetery in the municipal council, though a notable number of participants are still willing to get involved. There is also considerable interest in fundraising and obtaining sponsorships to enhance the cemetery's image and infrastructure, as well as in organizing cultural events at the Cemetery. Nonetheless, the audience feels that its ability to assist visitors to the cemetery is limited to a moderate extent.

Among the proposed actions for the Cemetery (**Table III**), the workshop for marble sculpting and maintenance was the most favoured, with 70% of respondents either partially or fully supporting it. A significant proportion of the

audience also supports the introduction of grief counselling services at the Cemetery, although there is also some representation of opposing views among the respondents. The proposal to organise history lectures at the Cemetery has received approval from the respondents, with over 60% of participants either partially or fully supporting it. The same level of support is evident for organizing educational programmes at the Cemetery; however, a portion of the sample also expresses disagreement with this proposal. On the other hand, the respondents are not particularly supportive of photography and painting exhibitions being held at the Cemetery, with a significant portion of the audience disagreeing with this proposal. Similarly, the suggestion for a gardening workshop received disapproval from approximately 40% of the respondents. Overall, the majority of the proposed actions receive considerable support from the cemetery's audience, with workshops and grief counselling services being the most favoured, followed closely by history lectures and tours.

Table I. *Audience perspectives on specific issues regarding space utilisation (percentage distribution of preference levels)*

	Strongly disagree	**Disagree**	**Neutral**	**Agree**	**Strongly agree**	**Participants** (in absolute numbers) **who responded: Don't know/No opinion**
The Cemetery is available for guided tours and lessons in history and art	10,6%	13,5%	21,2%	24,0%	29,8%	1
Within the Cemetery, educational tours can be conducted for high school students (ages 15 to 18)	10,6%	12,5%	18,3%	31,7%	26,0%	1
Within the Cemetery, educational tours can be conducted for students (aged 18 and older)	4,8%	11,5%	15,4%	29,8%	37,5%	1
It is essential to establish an exhibition space within the Cemetery focused on history, funerary art, and customs	5,8%	9,6%	12,5%	24,0%	47,1%	1
The utilisation of the Cemetery for cultural purposes can lead to an enhancement of its image and technical infrastructure	2,9%	8,7%	11,5%	23,0%	52,9%	1
The Cemetery is designated exclusively for burials and memorial services, and not for any other cultural activities	55,8%	18,3%	11,5%	5,8%	7,7%	1
The inclusion of the Cemetery in European cultural tourism routes may lead to a distortion of its character	39,4%	27,9%	14,4%	5,8%	11,5%	1

Table II. *Ways in which the audience could contribute to the management of the cemetery (percentage distribution of preference levels)*

	Strongly disagree	**Neutral**	**Strongly agree**	**Participants** (in absolute numbers) **who responded: Don't know/No opinion**
In the maintenance of the area's cleanliness	0,0%	20,2%	78,8%	1
Conservation of green spaces	1,0%	27,9%	68,3%	3
Representation of the Cemetery in the City Council	7,7%	40,4%	51,9%	-
Raising funds and obtaining sponsorships for the improvement of the area and monuments	16,3%	33,7%	47,1%	3
To the research of the cemetery's history	4,8%	32,7%	62,5%	-
In supporting the organisation of cultural events	13,5%	32,7%	53,8%	-
In providing service to visitors	24,0%	51,0%	24,0%	1

Table III. *Audience perspectives on the proposed actions and the degree to which they believe these could be implemented in the Cemetery (percentage distribution of preference levels)*

	Strongly disagree	**Disagree**	**Neutral**	**Agree**	**Strongly agree**	**Participants** (in absolute numbers) **who responded: Don't know/No opinion**
Guided tour	6,7%	19,2%	15,4%	27,9%	30,8%	-
History lecture	7,7%	11,5%	21,2%	25,0%	34,6%	-
Marble sculpting and conservation workshop of stone	5,8%	14,4%	10,6%	25,0%	44,2%	-
Educational programmes	7,7%	14,4%	17,3%	27,9%	31,7%	1
Musical concert (e.g. ecclesiastical music)	22,1%	20,2%	21,2%	17,3%	18,3%	1
Photography exhibition	24,0%	17,3%	21,2%	25,0%	11,5%	1
Painting exhibition	24,0%	24,0%	19,2%	20,2%	11,5%	1
Gardening workshop	26,0%	20,2%	21,2%	16,3%	15,4%	1
Bereavement counseling (e.g. psychologist)	5,8%	17,3%	19,2%	19,2%	36,5%	2

V. Reimagining Burial Sites

Nowadays, the Greek public is increasingly exposed to cemeteries abroad through travel and tourism. This exposure helps them gain a fresh perspective on burial sites, viewing them more as memorial gardens integrated into the modern city's public realm rather than as isolated spaces exclusively meant for the interment of the dead. As highlighted in other studies and in the oral interviews conducted during the trial run of this survey, some visitors use cemeteries for recreational purposes, such as taking a walk, resting, or enjoying moments of quiet reflection **[30], [31]**. In a study carried out at a cemetery in Oslo, Norway **[23]**, the visitors' descriptions suggest that the combination of nature, culture and history, as well as a sense of respect for the dead, differentiate the cemetery from other green spaces in the city. This allows the visitors not only to unwind and relax, but also to dedicate some time to contemplation.

The Anastasis Cemetery possesses all the necessary elements to be transformed into a green space and upgraded into a memorial park, akin to the romantic-rural cemeteries or memorial gardens of the 19th century, such as Père Lachaise in Paris and other cemeteries in London

and the USA.[8]

Another cemetery that could serve as a model for the rejuvenation of the Anastasis Cemetery is the Fiumei Road Cemetery in Budapest (Hungary).[9] An examination of the map of the Hungarian capital reveals that, like most modern cities, it too suffers from a lack of green spaces. However, the Cemetery is not merely a park in the traditional sense of the public green space; it is also an open-air museum featuring the sculptures and architectural monuments of historical and artistic importance. Furthermore, it serves as a space of national memory, constituting the final resting place of a national pantheon, housing the graves of significant national figures associated with the modern and contemporary history of Hungary. The mausoleums, the statues and the gravestone inscriptions narrate a story about the past. Viewed from this perspective, the cemetery becomes a widely accessible open-air "history book" **[34, pp. 4-5]**.

In Greece, a cemetery that follows the model of the rural cemetery is the British cemetery in the city of Corfu, which has been in operation since 1814, when the island came under British rule **[35, pp. 239-241]**. The Cemetery is also a garden with lush vegetation and specimens of botanical interest, where visitors can experience moments of serenity and contemplation away from the hustle and bustle of the modern city. The absence of complaints about the Cemetery among local residents is indicative of how well-integrated it is into the urban fabric.

Another notable example of cemetery renewal worth examining is the case of four cemeteries in England, which have been preserved and maintained through citizen action **[21], [22]**. These are the Highgate Cemetery in London,[10] the Arnos Vale Cemetery in Bristol,[11] the York Cemetery,[12] and the Ford Park Cemetery in Plymouth.[13] These cemeteries were established during the first half of the 19th century by limited liability companies and are still operating independently to this day. When the social and economic conditions in England deteriorated and the companies managing these cemeteries went bankrupt, there was a risk of their total abandonment. However, their operation and administration were subsequently taken over by non-profit organisations, such as "leagues of friends" and charity trusts[14]. These organisations were committed to reinforcing and promoting the value of these spaces for the public, in collaboration with dedicated volunteers who took on various duties. Essentially, the solution to the problem of the cemeteries' viability was to "open" the burial sites to a wider audience by organising cultural events and activities and creating recreational areas and facilities.

More specifically, the Arnos Vale and Ford Park cemeteries began organising tours, lectures, anniversary events, volunteer days, concerts, exhibitions, and workshops, as well as operating souvenir shops, cafeterias and visitor centres. The Arnos Vale Cemetery even hosts weddings. In York, in addition to offering tours and organizing events, the association "Friends of York Cemetery" also manages the landscaping and preserves the monuments by maintaining the graves, with the owners paying maintenance fees directly to the Cemetery. All these activities were offered to attract a wider public. They not only contributed to the cemeteries raising necessary funds but also allowed them to save on payroll costs through volunteer work. Additionally, the cemetery trusts activated capital raising mechanisms by utilising every aspect of the cemetery's cultural heritage, which also generated the revenue needed for the preservation and maintenance of the cemetery.

It becomes evident that, as old cemeteries face space shortages and are gradually decommissioned and left to decay, there remain opportunities for their reinvention and reimagining through modern management policies. Such policies can focus on utilizing the space in innovative ways, increasing revenue, preserving cultural heritage long-term, and upgrading infrastructure. This can be achieved by redefining cemeteries not only as final resting places for the deceased but also as parks, recreational areas, and spaces for culture, memory, and history. As mentioned in the guide to the Fiumei Road Cemetery, one effective way to counterbalance the negative emotions commonly associated with cemeteries is to establish new mental connections. Instead of identifying cemeteries solely with "those who are dead", it is beneficial to associate them with "those who once lived", emphasizing their lives,

[8] Some examples of "memorial gardens" are the Père Lachaise Cemetery in Paris (established in 1804. For a digital tour, visit http://www.pere-lachaise.com), which was one of the most influential models for the organisation of burial sites at the time; the Low Hill General Cemetery in Liverpool (1825), the first "rural" cemetery in Auburn Cambridge, Massachusetts in the USA (established in 1831, **[see 32]**; Also, visit: http://mountauburn.org); Kensal Green Cemetery in London (1833), Laurel Hill in Philadelphia (1836, **[see 33]**, Greenwood in Brooklyn (1838), Highgate in London (1839), the cemetery of Allegheny in Pittsburgh, Pennsylvania (1844), the Spring Grove Cemetery in Cincinnati (1845), the Hollywood Cemetery in Richmond, Virginia (1849, see http://www.hollywoodcemetery.org), the Vyšehradský Cemetery in Prague (see https://www.praha-vysehrad.cz/en/stranky/145/buildings-and-places/the-vysehrad-cemetery) and others.

[9] The cemetery is also known by its former name, Kerepesi Cemetery. See https://fiumeiutisirkert.nori.gov.hu/en/home and https://en.nori.gov.hu. See also the official guide to the cemetery: **[34]**.

[10] Highgate Cemetery (London), established in 1839: https://highgatecemetery.org.

[11] Arnos Vale Cemetery (Bristol), established in 1836: https://www.bristol.gov.uk/residents/museums-parks-sports-and-culture/parks-and-open-spaces/parks-and-estates/arnos-vale-cemetery and https://arnosvale.org.uk/discover/site-info (including information about the Cemetery, the events organised, the educational programmes offered, and the wedding facilities available).

[12] York Cemetery, established in 1837: https://www.yorkcemetery.org.uk. Digital database for grave search: https://www.findagrave.com/cemetery/2219259/york-cemetery. The Cemetery's Genealogy Department: https://www.yorkcemeterygenealogy.org.uk.

[13] Ford Park Cemetery (Plymouth), established in 1848: https://www.ford-park-cemetery.org. Digital database for grave search: https://www.findagrave.com/cemetery/1974110/ford-park-cemetery.

[14] Friends of Highgate Cemetery Trust, Arnos Vale Cemetery Trust, York Cemetery Trust, and Ford Park Cemetery Trust are organisations that functioned as "trusts". This arrangement implies that the ownership of the cemeteries was transferred to citizen-managers, contingent upon their commitment to fulfilling specific obligations for the public benefit.

deeds, and the preservation of their memory **[34, p. 4]**.

Finally, the aesthetic enhancement of the Cemetery could also contribute to improving hygienic conditions for local residents, revitalizing the surrounding area, and optimizing the use of the entire land associated with the Cemetery **[6, pp. 1270-1272]**. Furthermore, the proper maintenance of the Cemetery is a sign of respect for the deceased.

VI. Showcasing the Cultural Value of the Cemetery Through Cultural Actions and Integration in International Cemetery Networks

At the beginning of the 1980s, UNESCO recognised culture as a source of inspiration and a social regulator of the efforts towards comprehensive and sustainable local development **[36, pp. 4-6]**. Moreover, creating cultural routes is a dynamic process which lends itself to groundbreaking research and interdisciplinary innovation.

One of the objectives of cemetery rejuvenation is to attract urban tourism **[6, pp. 1272-1274]**. This can be achieved by integrating the Anastasis Cemetery into a local and national network of cemeteries with historical and cultural significance. At the European level, the Cemetery could become a member of the Association of Significant Cemeteries in Europe (ASCE),[15] a development that would aid in the promotion and visibility of the Cemetery and potentially attract funding from private entities interested in supporting the renewal efforts.

Another advantage of the Anastasis Cemetery is that, rather than being on the outskirts of the city, it is situated within the urban fabric and is directly connected to it,[16] thereby ensuring that the space is easily accessible. Repurposing the Cemetery for various uses will prevent an occupied piece of urban land from becoming another "urban void". [17] It could gradually alter the public perception of cemeteries as macabre and unapproachable spaces. Furthermore, by utilizing the sculptures within the Cemetery, the space could eventually transform from merely an urban refuge, ideal for strolling and quiet reflection, into a centre of scientific and educational activity.

Within this context, it is imperative that a topographic map of the Cemetery be produced, highlighting the most significant sepulchral monuments. It is also necessary to map out different routes through the Cemetery based on specific parameters and themes.[18] For example, one route could focus on the sculptures themselves, their aesthetic value, and the typology of the various burial monuments. Another route could illuminate the semiology of the monuments, track changes in social attitudes towards death, and interpret the symbols found on the sepulchral monuments in the Cemetery.[19] Finally, a third route could be a historical tour of the cemetery, which explores the history of the city through the personal stories of those buried on its grounds. This route would utilise the Cemetery's monuments to highlight some of the most significant moments in the history of Piraeus.

Another proposal to promote and facilitate the use of the Anastasis Cemetery for historical and cultural tours is to add signs containing local historical and environmental information. These signs could provide details about the families interred in the Cemetery's monuments, relating to the local economic and political history, as well as information about the sculptors whose work can be found in the Cemetery and how their creations reflect the broader aesthetic and artistic values of each era. Topographic maps could assist visitors in navigating the Cemetery by indicating their location. These straightforward practical interventions could transform the Cemetery into an open-air museum.

An initiative that would aid in establishing networks of cultural routes at both local and national levels could be the digital or printed publication of a leaflet, short guide, or even a book. This publication would include fundamental information about similar cemeteries across the country, references to the sculptures present in each cemetery, and an index that organises the artworks by sculptor. In this way, essential information is visualised, access to knowledge is facilitated, and a diverse network of cultural routes in the capital and across the country is leveraged. Thus, this could encourage and promote urban tourism in Greece.

The Anastasis Cemetery could also be integrated into a cultural route focused on the modern history of the Piraeus port, aligning with a new and emerging trend in tourism: the *city break*, which refers to a short holiday (2-3 days) in an urban environment **[39, pp. 282-283]**. City breaks to capitals and other cities, whether large or small, historical or industrial, coastal or inland, have been steadily growing in popularity, showcasing each city through cultural or historical perspectives. Some objectives of this emerging tourism trend include highlighting local cultural heritage,

[15] Association of Significant Cemeteries of Europe (http://www.significantcemeteries.org).

[16] Contemporary "landscape urbanism" views urban gardens as spaces that transcend the boundaries separating them from the built environment, leading to more complex forms. Gardens are transformed from mere areas of recreation and aesthetic enjoyment into "transitional spaces between urban and peri-urban, as well as natural environments" **[37]**.

[17] The urban void is a discontinuity in the fabric of the city. It is a liminal urban space oscillating between the concepts of "space" and "non-space". Particularly in the case of cemeteries, "the relationship between the cemeteries' memorial monuments and their peri-urban nature constitutes a major theme in cemetery design", emphasising the "monumentality" of nature **[38, pp. 32-33]**. However, accepting the new principles of burial site design and organisation also results in changes in the collective attitudes and meaning-making processes surrounding death. "The private grave has been transformed into the primary memorial of 'modern' death" **[38, p. 30]**.

[18] Similar tours are available at the Montjuic Cemetery in Barcelona (https://www.barcelona.de/en/barcelona-cementery-montjuic.html) and the Central Cemetery of Vienna (*Zentralfriedhof*) (https://www.friedhoefewien.at/zentralfriedhof). The latter also offers visitors an audio guide, allowing them to choose among three different routes based on the time available for their visit.

[19] Koumarianou **[35]** makes similar recommendations for the First Cemetery of Athens and the British Cemetery of Corfu.

attracting experienced travellers, supporting and enhancing lesser-known cities with untapped tourism potential, and, in the long term, upgrading local infrastructure. The notion of a city break presents a particular challenge for cities with limited tourist development, such as Piraeus.[20] As the natural harbour of Athens and a major Mediterranean port, Piraeus can contribute to a more comprehensive image of the Greek capital and can thus be utilised as a *Unique Selling Proposition* (USP) through the development and implementation of cultural routes **[39, pp. 282-283]**.

Naturally, this process of showcasing the city's cultural heritage is closely linked with the existing infrastructure, which is continually being upgraded and modernised.[21]

Disseminating information about the Cemetery's cultural value, as well as raising awareness about it among the local community, can be achieved through a variety of activities organised by the municipal government[22] and local cultural entities, including tours, lectures, and seminars.

Preserving and showcasing an area's cultural heritage can help transform the city into a tourist destination. Following the example of other major cemeteries, such as Père Lachaise in Paris,[23] it is proposed to provide digital tours for the Anastasis Cemetery, a suggestion that can be easily implemented given the relatively small size of the Cemetery.

There are also more economical digital solutions, including digital platforms providing open access databases, photographic material, and historical information, such as those developed by the Commonwealth War Graves Commission (CWGC)[24] and other British cemeteries.[25] The former even offers photographs and information from cemeteries located in Greece, such as the one in Faliro. Cataloguing the monuments and disseminating relevant information through the Internet are powerful tools not only for researchers but also for the interested public.

Finally, students could explore the history of their city in a more experiential manner through educational initiatives that focus on local history lessons,[26] informed by the information available at the Cemetery. Alternatively, these lessons could focus on modern Greek burial sculpture and its aesthetics, and could be conducted either in situ or in the classroom. The material provided by the Anastasis Cemetery could stimulate discussions and educational sessions on various topics, contributing to both standard education and lifelong learning.

The personal and family stories of those buried in the Cemetery can be interconnected with broader local and even national history when viewed through various lenses such as economy, industry, politics, culture, immigration, and professional activity. The history of Greek funerary art, the aesthetic value of burial monuments, the iconographic themes, symbols, and their allegorical meanings are additional topics that can be studied by utilising the Cemetery's sculptures.

VII. Conclusion

There is no doubt that sepulchral art should be regarded as an integral part of our cultural heritage, deserving of attention and preservation. It reflects the evolution of modern Greek sculpture and simultaneously embodies the ideological, economic, and social conditions prevailing in Greece and its cities from the country's inception to the present day. Consequently, the burial monuments at the Anastasis Cemetery of Piraeus must be utilised, not only for their artistic value but also as significant historical resources for scholars studying the modern history of the city. These sepulchral monuments and the information they provide can serve as a foundation for constructing a historical narrative that presents the local history of the port in engaging and accessible ways for the general public. In addition, numerous European examples can serve as models for the rejuvenation and transformation of the Cemetery into a memorial garden. We propose a series of steps to achieve this goal: mapping potential routes, integrating the Cemetery into European networks, introducing an open-access digital platform, soliciting further renewal proposals, suggesting local actions, and utilizing the rich repository of information available at the Cemetery for educational purposes as part of local history lessons. In conclusion, there are various ways to utilise and showcase the Anastasis Cemetery, offering multiple benefits for the local economy and society.

VIII. References

[1] **Koutelakis, Ch. (1987)**. «Πρώτη πλήρης ιστορία των δύο νεκροταφείων του Πειραιά - Αγ. Διονυσίου και Αναστάσεως», ["The first comprehensive history of the two

[20] According to the Greek Tourism Confederation (SETE), city breaks are a significant tool in the effort to enhance the country's tourist demand and revenue.

[21] This infrastructure includes the new "Agios Nikolaos" cruise terminal, the ISAP railway, which connects the city of Athens with the port, the construction of a light rail system (tram), the completed connection of the city with the Athens Metro Network, and the existing accommodation facilities extending along the city's coastal front up to the ISAP Metro station in the northwest **[39, p. 285]**.

[22] So far, the Municipality of Piraeus has organised public tours of the Anastasis Cemetery on only a few occasions: International Museum Day on May 18, 2012; European Heritage Days on September 24, 2017, and September 30, 2022; and a tour on April 20, 2024, as part of an international conference on Cemetery Studies, organised by Harokopio University of Athens and the Cemetery Research Group at the University of York, UK, with support from the Municipality of Piraeus. These tours were immensely popular with the public. Their purpose was to highlight the significance and historical value of the Cemetery and to present the history of the families and individuals who contributed to shaping modern Piraeus by showcasing a selection of burial monuments.

[23] Digital tour of the Père Lachaise Cemetery: http://www.pere-lachaise.com.

[24] Website of Commonwealth War Graves Commission (CWGC): http://www.cwgc.org.

[25] See examples of internet databases for grave searches provided by York Cemetery: https://www.findagrave.com/cemetery/2219259/york-cemetery; Ford Park Cemetery, Plymouth: https://www.findagrave.com/cemetery/1974110/ford-park-cemetery.

[26] See also the proposal for a new approach to studying history through the First World War military cemeteries located in the Macedonia region. This proposal suggests actions, routes, and the utilisation of these cemeteries for educational purposes **[40]**.

cemeteries in Piraeus - Saint Dionysios and Anastasis"]. *Ψυττάλεια*, [*Psitaleia*], *6-7*, 2-30.

[2] **Malikouti, St. (2004)**. *Πειραιάς 1834-1912. Λειτουργική συγκρότηση και πολεοδομική εξέλιξη*, [*Piraeus 1834-1912. Operational town-building and town-planning evolution*]. Athens: Piraeus Bank Group Cultural Foundation.

[3] **Mpafouni, E. (2012)**. *«Μιλάει» η σιωπή. Τεκμηριώνοντας την ιστορία του νεότερου Πειραιά μέσα από τα ταφικά μνημεία του νεκροταφείου της Ανάστασης*, *[Silence "speaks": Documenting the history of modern Piraeus through the funerary monuments of the Anastasis Cemetery*]. Piraeus: Municiplatity of Piraeus-Historic Archive.

[4] **Dermitzoglou, G. (2016)**. *Νεοελληνική γλυπτική: Τα γλυπτά του Κοιμητηρίου της Ανάστασης στον Πειραιά*, [*Modern Greek sculpture: The sculptures of Anastasis Cemetery in Piraeus*]. Master's thesis, Harokopio University, Athens.

[5] **Dermitzoglou, G. (2019)**. "Neoclassical monuments of the Anastasis Cemetery in Piraeus, Greece". In: E. Georgitsoyanni (ed.), *Ancient Greek Art and European Funerary Art*, Cambridge Scholars Publishing, Newcastle upon Tyne, pp. 213- 231.

[6] **Dermitzoglou, G. & Sdrali, D. (2020)**. «Τα ταφικά μνημεία του Πειραιά ως τεκμήρια της ιστορίας του και η αξιοποίησή τους στο πλαίσιο του αστικού τουρισμού», ["The funerary monuments of Piraeus as evidence of its history and their utilisation in the context of urban tourism"]. *Proceedings International Conference "Port cities and maritime routes in Eastern Mediterranean and Black Sea 18th - 21st centuries*, Harokopio University of Athens & University of Macedonia, 22-24 November 2018, Thessaloniki: Publications of the University of Thessaloniki, pp. 1263-1282.

[7] **Kambouroglou, P. (1883)**. *Ιστορία του Πειραιώς από του 1833 - 1882 έτους. Γενική κατάστασις - Κίνησις εμπορίου - Ναυτιλία - Βιομηχανία*, [*History of Piraeus in the years 1833 - 1882. General condition - Trade movement - Shipping - Industry*]. Athens.

[8] **Koutelakis, Ch. & Foskolou, A. (1991)**. *Πειραιάς και Συνοικισμοί. Μαρτυρίες και γεγονότα από τον 14ο αιώνα μέχρι σήμερα*, [*Piraeus and its Neighborhoods. Testimonies and history from the 14th century to the present*]. Athens: Estia.

[9] **Lydakis, St. (1997)**. «Ζωγράφος Παντελής», ("Zografos Pantelis). In: E. D. Matthiopoulos (edit.), *Λεξικό Ελλήνων Καλλιτεχνών. Ζωγράφοι, γλύπτες, χαράκτες, 16ος - 20ός αιώνας*, [*Dictionary of Greek Artists. Painters, sculptors, engravers, 16th - 20th century*], vol. A΄, Athens: Melissa, pp. 453-454.

[10] **Lydakis, St. (2017)**. *Μία πολύτιμη γλυπτοθήκη. Το Α΄ Νεκροταφείο Αθηνών / A treasured sculpture park. The First Cemetery of Athens*. Athens: The Panayotis and Effie Michelis Foundation.

[11] **Gavala, P. & Garezou, E. (1994)**. *Τα γλυπτά μνημεία του Κοιμητηρίου Αγίου Γεωργίου Ερμούπολη Σύρου (19ος - 20ος αιώνας)*, [*The sculptural monuments of the Saint George Cemetery in Ermoupolis, Syros (19th - 20th century)*]. Athens: Ministry of the Aegean - Municipality of Ermoupolis & "Gnosi" publications.

[12] **Paraskevopoulou, I., Dermitzoglou, G., Kritikos, G. & Georgitsoyanni, E. (2022)**. "Tracing otherness in online cemetery audience research: The 'Other' at the Cemetery of Anastasis of Piraeus and the Third Cemetery of Athens". *Mortality*, *29*(1), 141-158.

[13] **Bradbury, M. (1999)**. *Representations of death: A social psychological perspective*. London: Routledge.

[14] **Francis, D., Kellaher, L. & Neophytou, G. (2000)**. "Sustaining cemeteries: The user perspective". *Mortality*, *5*(1), 34-52.

[15] **Francis, D., Kellaher, L. & Neophytou, G. (2005)**. *The Secret Cemetery*. Oxford - New York: BERG.

[16] **Woodthorpe, K. (2010)**. "Buried bodies in an East London Cemetery: Revisiting Taboo". In: A. Maddrell & J. Sidaway (eds.), *Deathscapes: Spaces for Death, Dying, Mourning and Remembrance*, Ashgate Publishing Limited, pp. 57-74.

[17] **Woodthorpe, K. (2011)**. "Sustaining the contemporary cemetery: Implementing policy alongside conflicting perspective and purpose". *Mortality*, *16*(3), 259-276.

[18] **Nielsen, A. P. & Groes, L. (2014)**. "Ethnography inside the Walls: Studying the Contested Space of the Cemetery". *Conference Proceedings of Ethnographic Praxis in Industry*, American Anthropological Association, (available at: https://anthrosource.onlinelibrary.wiley.com/doi/epdf/10.1111/1559-8918.01015), pp. 108-118.

[19] **Jolly, G. (2013)**. *The management of historic cemeteries by Friends Groups: Local narratives and the sense of place*. Unpublished M.A. thesis, Department of Architecture and Civil Engineering, University of Bath.

[20] **Pécsek, B. (2015)**. "City cemeteries as cultural attractions: Towards an understanding of foreign visitors' attitude at the National Graveyard of Budapest". *Deturope - The Central Europe Journal of Regional Development and Tourism*, *7*(1), 44-61.

[21] **Paraskevopoulou, I. (2016)**. *Historic cemeteries: Saved and managed by their Friends*. Unpublished M.A. thesis, Department of History, University of York.

[22] **Paraskevopoulou, I. (2019)**. "The Cultural Heritage of Cemeteries". In: E. Georgitsoyanni (ed.), *Ancient Greek Art and European Funerary Art*, Cambridge Scholars Publishing, Newcastle upon Tyne, pp. 257-276.

[23] **Nordh, H., Evensen, K. H. & Skår, M. (2017)**. "A peaceful place in the city – A qualitative study of restorative components of the cemetery". *Landscape and Urban Planning*, *167*, 108-117.

[24] **Nordh, H. & Evensen, K. H. (2018)**. "Qualities and functions ascribed to urban cemeteries across the capital cities of Scandinavia". *Urban Forestry & Urban Greening*, *33*, 80-91.

[25] **Lai, K. Y., Scott, I. & Sun, Z. (2019)**. "Everyday Use of the City Cemetery: A Study of Environmental Qualities and Perceived Restorativeness in a Scottish Contex". *Urban Science*, *3*(3), 72.

[26] **Grabalov, P. (2019)**. "Urban cemeteries as public spaces: Comparison of the Norwegian and Russian case studies". *Association of Significant Cemeteries of Europe, Conference: "Heritage Cemeteries in the 21st century: Use, reuse and shared use"*, 3-5 October, 2019, Ghent (available at: https://www.significantcemeteries.org/2020/01/urban-cemeteries-as-public-spaces.html).

[27] **Grabalov, P. & Nordh, H. (2020)**. "'Philosophical Park': Cemeteries in the Scandinavian Urban Context". *Socialni Studia*, *17*, 33-54.

[28] **Jedan, C., Kmec, S., Kolnberger, T. & Venbrux, E. & Westendorp, M. (2020)**. "Co-Creating Ritual Spaces and Communities: An Analysis of Municipal Cemetery Tongerseweg, Maastricht, 1812-2020". *Religions*, *11*(9), 435 (1-21).

[29] **Venturini, T, Bounegru, L., Gray, J. & Rogers, R. (2018)**. "A reality check(list) for digital methods". *New Media & Society*, *20*(11), 4195-4217.

[30] **Swensen, G., Nordh, H., & Brendalsmo, J. (2016)**. "A green space between life and death – a case study of activities in Gamlebyen Cemetery in Oslo, Norway". *Norwegian Journal of Geography*, *70*(1), 41-53.

[31] **Evensen, K. H., Nordh, H. & Skaar, M. (2017)**. "Everyday use of urban cemeteries: A Norwegian case study". *Landscape and Urban Planning*, *159*, 76-84.

[32] **French, St. (1974).** "The Cemetery as Cultural Institution: The Establishment of Mount Auburn and the 'Rural Cemetery'". *American Quarterly*, *26*(1), 37-59.

[33] **McDannell, C. (1987)**. "The Religious Symbolism of Laurel Hill Cemetery". *The Pennsylvania Magazine of History and Biography*, *111*(3), 275-303.

[34] **Radnainé Fogarasi K. (2017)**. *More than a graveyard. The Fiumei Road Cemetery*. (Translation: Edimart Tolmács-És Fordítóiroda Kft.), Budapest: National Heritage Institute.

[35] **Koumarianou, M. (2006)**. «Ανθρωπολογική και πολιτιστική αξιοποίηση του ιερού χώρου. Το παράδειγμα του Α' Νεκροταφείου Αθηνών και του Βρετανικού Νεκροταφείου Κέρκυρας», ["Tourism and cultural promotion of the sacred space. Case studies of the 1st Cemetery of Athens and of the British Cemetery of Corfu, Greece]. *Πρακτικά Διεθνούς Συνεδρίου «Πολιτιστικό περιβάλλον και τουρισμός. Ο ρόλος του αρχιτέκτονα»*, [*International Conference Proceedings on "Cultural environment and tourism. The role of the Architect"*], Kavala, Greece, 20-23 September 2001, Technical Chamber of Greece, pp. 231-243.

[36] **Avgerinou - Kolonia, S. (2007)**. «Πολιτιστικές διαδρομές: Μία πρόταση για τη μελέτη και την ανάδειξη της πολύπλευρης πολιτιστικής πραγματικότητας», ["Cultural routes: A proposal for the study and promotion of a multifaceted cultural reality"]. In: M. Grafakou, M. Kardamitsi - Adami and E. Maistrou (edit.), *Τιμητικός τόμος στον καθηγητή Διονύση Ζήβα* (*Volume published in honour of Professor Dionysis Zivas*), Athens, National Technical University of Athens - School of Architecture.

[37] **Zavraka, D. (2013)**. «Τοπιακή πολεοδομία (Landscape urbanism): Πολιτισμικές αναθεωρήσεις του κήπου», ["Cultural revisions of the garden"]. *Citybranding.gr*, *http://www.citybranding.gr/2013/01/landscape-urbanism.html*, (accessed 25/04/2024).

[38] **Zavraka, D. (2012).** «Τα σύγχρονα νεκροταφεία ως πολυδιάστατα αστικά κενά. Χωρικός προσδιορισμός των χώρων ταφής σε σχέση με το αστικό περιβάλλον», ["Modern cemeteries as multidimensional urban voids: Spatial definition of burial sites in relation to the urban environment"]. *Χορογραφίες* [*Chorographies*], *3*(1), 29-36.

[39] **Dermitzoglou, G., Karametou, P. & Sdrali, D. (2018)**. «Ο τουρισμός πόλεων (*city break*) ως βιώσιμο εργαλείο αξιοποίησης πολιτισμικής κληρονομιάς: Η περίπτωση της πόλης του Πειραιά», ["City break as a sustainable tool for the promotion of cultural heritage: The case of the city of Piraeus, Greece"]. *Πρακτικά 20ου Επιστημονικού Συνεδρίου Συνδέσμου Ελλήνων Περιφερειολόγων «Η περιφέρεια σε καμπή: Μετα-ψηφιακές κοινότητες, νέος τοπικισμός και επανεθνικοποίηση - Αναπτυξιακές προεκτάσεις»*, [*Proceedings of 20th Scientific Conference of the Association of Greek Regionalists "Regions at a turning point: Post-digital communities, new regionalism and re-nationalisation - Sustainable development implications"*], Harokopio University of Athens, 4-5 June 2018, Kallithea, pp. 282-288.

[40] **Gavra, E. & Vlasidis, V. (2007)**. "Military Cemeteries of the First World War in Macedonia region: Routes of reading history in search the common cultural heritage". In: N. Avramidou (ed.), *1st Specialty International Conference on Monumental Cemeteries: Knowledge, Conservation, Restyling and Innovation*, Modena, 3-5 May 2006, vol. 1, Roma, pp. 179-189.

IX. AUTHOR

Georgios Dermitzoglou is a PhD candidate at the Department of Economics and Sustainable Development at Harokopio University of Athens, focusing on the funerary sculpture of the Anastasis Cemetery in Piraeus. He holds a degree in History and Archaeology from the University of Ioannina and has completed postgraduate studies in "Education & Culture" (M.Sc., Harokopio University) and "Archaeology of the Eastern Mediterranean: Greece, Egypt, the Near East" (M.A., University of the Aegean). His specialisation includes Special Education, the Design of Museum Exhibitions, and Educational Programmes. He has experience as an archaeologist at the Ephorates of Antiquities in Greece, as a teacher in Secondary Education and Special Education Programmes, and as an associate scientific researcher.

Journal of Integrated Information & Management

Volume 9 - Number 1 / Jan - Jun 2024
https://ejournals.epublishing.ekt.gr/index.php/jiim