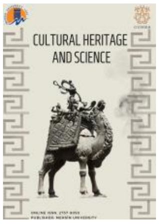
Volume 4 Issue 2
DECEMBER 2023

CUHES

CULTURAL HERITAGE AND SCIENCE

ONLINE ISSN: 2757-9050
PUBLISHER: MERSİN UNIVERSITY



Cultural Heritage and Science (CUHES) is an interdisciplinary academic, refereed journal for scholars and practitioners with a common interest in heritage.

Aims and scope

Provide a multidisciplinary scientific overview of existing resources and modern technologies useful for the study and repair of cultural heritage and other structures. The journal will include information on history, methodology, materials, survey, inspection, non-destructive testing, analysis, diagnosis, remedial measures, and strengthening techniques.

Preservation of the architectural heritage is considered a fundamental issue in the life of modern societies. In addition to their historical interest, cultural heritage buildings are valuable because they contribute significantly to the economy by providing key attractions in a context where tourism and leisure are major industries in the 3rd millennium. The need for preserving historical constructions is thus not only a cultural requirement, but also an economic and developmental demand.

Therefore, Cultural Heritage and Science (CUHES) cover the main aspects related to the study and repair of an existing historical artifact, including:

- ✓ Issues on the history of construction and architectural technology
- ✓ General criteria and methodology for study and intervention
- ✓ Historical and traditional building techniques
- ✓ Survey techniques
- ✓ Non-destructive testing, inspection, and monitoring
- ✓ Experimental results and laboratory testing
- ✓ Analytical and numerical approaches
- ✓ Innovative and traditional materials for repair and restoration
- ✓ Innovative strategies and techniques for repair and restoration
- ✓ General remedial measures
- ✓ Repair and strengthening of structures
- ✓ Seismic behavior and retrofitting
- ✓ Detailed and state-of-the-art case studies, including truly novel developments
- ✓ Cultural Heritage and Tourism
- ✓ Close-range photogrammetry applications for cultural heritage,
- ✓ Laser scanning applications for cultural heritage,
- ✓ 3D modeling applications for cultural heritage,
- ✓ UAV photogrammetry applications for cultural heritage
- ✓ Underwater photogrammetry applications for cultural heritage
- ✓ Virtual Reality and Augmented Reality applications for cultural heritage
- ✓ Remote Sensing applications for cultural heritage
- ✓ Archeologic studies
- ✓ Architecture studies
- ✓ History of Art studies
- ✓ Description of novel technologies that can assist in the understanding of cultural heritage.
- ✓ Development and application of statistical methods and algorithms for data analysis to further understanding of culturally significant objects.
- ✓ Computer sciences in cultural heritage

The main objective is to provide an overview of existing resources useful for the rigorous and scientifically based study of the state of ancient structures and to present state-of-the-art novel research in the field. The journal will publish review papers, research papers, and detailed case studies. Interdisciplinary contributions will be highly appreciated.

Cultural Heritage and Science (CUHES)

Volume *4*
Issue *2* *December, 2023*

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Articles

Cultural Heritage and Science – 2023, 4(2), 49-54

Cultural Heritage and Science

https://dergipark.org.tr/en/pub/cuhes

e-ISSN 2757-9050

Research on the change of Ankara Ulus City Center identified with its historical texture

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Keywords
Conservation
Ulus Historic City Center
Change

Research Article
DOI: 10.58598/cuhes.1202166

Received:10.11.2022
Revised: 24.08.2023
Accepted:28.09.2023
Published:27.10.2023

Abstract

When we look at the history of the city centers, it is seen that these centers were formed around an important religious structure, a special structure or an administrative structure. City centers are cultural spaces that mirror the culture of that city and build bridges between the past and the future. At the same time, these centers are an important place of the city and contribute to the identity of the city. These centers, which form the core of the establishment of cities, have changed over time and have altered. Changes and transformations in these centers, which give the city an identity, continue regardless of the historical value of the place. As a protection issue in this article; the problems brought by the reorganization of historical city centers are discussed. In the article, the changes in the square in the Ulus Historical City Center, the Temple of Augustus, which is a Roman monument, and the Hacı Bayram Mosque, which is an Ottoman Period monument are examined.

1. Introduction

There is spatial definition in historical city center settlements. The historical urban texture, which includes the social and cultural meaning here, is important for the definition of cities. Historical city centers with cultural heritage are the elements that make up the historical environment. It is important to protect these areas.

ICOMOS an important international conservation organization states that historical city centers are in danger of losing their structural or visual authenticity and integrity. In this context, it is recommended to protect historical environments with the convention adopted by UNESCO in 2011 [1]. The origin of the preservation of cities dates back to the 18th century. The understanding of protecting the monument with its surroundings, which started to develop at the beginning of the 20th century, begins with the 11-item Restoration Card (Carta Del Restaura) created by the High Council of Antiquities and Fine Arts in Italy in 1931 [1]. The Venice Charter adopted in 1964 is expanded with the scale of urban protection in the province of Rome. This statute forms the basis of today's conservation understanding [2]. UNESCO adopted the "Convention Concerning the Protection of the World Cultural and Natural Heritage" in 1972. It is aimed to protect cultural and natural heritage values as the heritage of all humanity and has played an important role in the development of conservation thought in the world [3]. If the protection of archaeological sites is the first contract; The "European Convention on the Protection of the Archaeological Heritage" was accepted in 1969 and revised and expanded in 1992 [4]. The Convention leaves the protection of the archaeological heritage to the responsibility of states. It also holds the state responsible for the preservation of the archaeological heritage in situ. The Convention adopts that archaeological research should be carried out with the financial support of the relevant public institutions and that the entire cost of the archaeological site centers required in large-scale public and private sector investments shall be covered from the relevant public and private sector funds. In addition, the Convention provides for educational activities and exhibitions of sites in appropriate conditions in order to awaken and develop public conscience about the value of cultural heritage, and holds the relevant state responsible for the regulation of these issues [1].

Ankara is a city containing ancient structures and historical sites. It remained under the rule of the Roman

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Cite this article (APA);

Ateş, N., Birlik, S. (2023). Research on the change of Ankara Ulus City Center identified with its historical texture. Cultural Heritage and Science, 4(2), 49-54

Empire for about 1500 years. Before that, Galatians and Phrygians lived here. It is known that there are temples dedicated to the Cybele and Men Gods and Phrygian Gods in this area [5]. The Temple of Augustus and the Hacı Bayram Mosque are in this city centre called “Ulus” since republican. It has a symbolic dimension.

“The city has a symbolic dimension. Monuments, squares, spaces, wide streets symbolize the universe, the world, society or simply the state.” [6]. Ankara Ulus city center contributes to the identity of Ankara with its unique elements. It characterizes the city with its historical texture.

Hacıbayram and the around of Augustus Temple, Galatians, which was formed around a temple in the past, was used as a part of the Agora during the Roman period. It is an area where it is a center of commercial administrative and social activities were experienced, especially during the Roman period. The city center, which was a part of the Turkish principalities after the Roman and Byzantine domination, continued to exist as a city center because the areas that provided the opportunity to gather in Islamic cities were formed around religious structures, palaces, city walls and similar places in Ankara. In the 13-14th centuries, Atpazarı, Samanpazarı and Koyunpazarı traditional bazaars, Mahmud Pasha Bedesten and Hanlar started the first commercial center development here. Later, Tahtakale and Karaoğlan bazaars developed through Uzunçarşı road towards Sulu Han [7].

With the construction of the Hacı Bayram-ı Veli Mosque in the Ottoman period, the area gained even more importance as a place of holy. After the proclamation of the Republic of Turkey, Ulus continues to be an area where political, administrative, commercial, financial and entertainment activities are carried out as a city center.

Figure 1. Registered buildings in Ankara Historical Ulus Square and its surroundings.

2. Method

In this study, it is aimed to examine the changes in Ulus Square and the structures around it in the Historical Ulus City Center. Again, the ruins of Roman Ancyra in the Ancient City Center and the changes around of the Hacı Bayram mosque are discussed. The research areas were compared in the context of old and new photographs, and their changes were examined.

2.1. Cultural heritage and changes in Ulus Historical City Center

The City Center has lived through the pre-Roman, Roman Period, Byzantine Period, Seljuk Period, Ottoman Period and Republic Periods. Some of them partially survived and some of them survived to the present day.

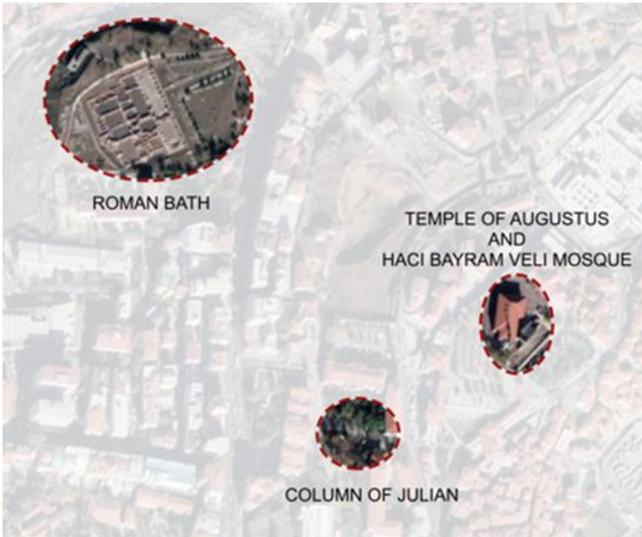

Figure 2. The Roman Ruins in Ulus City Center

2.1.1. Ankara Roman Ruins

The Temple of Augustus

The Temple of Augustus is one of the most valuable monuments of Ankara. It is known as the Ankara Monument. It is the work that the World Monuments Foundation has included in the 100 monuments that need to be protected in the world in 2002. The Temple of Augustus has been listed Unesco World Heritage with Hacıbayram in 2016. The Temple of Augustus (also known as the Monumental Ancyranum) was built between 25-20 BC on the ruins of an earlier site of a sanctuary belonging to the Phrygian God Men [8]. This is one of the most important historical, cultural and religious heritage points in the world [4].

Figure 3. Reconstruction drawing of the temple [9]

Figure 4. The Temple today

Original status: The marble temple has a pseudodipteral plan rising on a 2 meter platform over an area of 36mx54.82m. It is located in the south-west-northeast direction. It is decorated with 8 ionic columns on the short sides and 15 on the long sides, forming its peristyle. The interior complex (naos) consisted of three parts: 'pronaos' (inner area of the portico), 'cella' (central room) and 'opithodomos' (back porch). Between the extensions of the side walls, there were four Corinthian columns in the pronaos and two in the opisthodomos. The entrance to the cella is through the main door with an ornate lintel located at the rear end of the pronaos. The cella was the sanctuary of the temple, where only priests were allowed [10].

Change: The monument has undergone various changes in its architecture in later periods. It was converted into a Christian church during the Byzantine Period in the 6th century. Originally an enclosed space designed to exclude sunlight, the Cella is fitted with three large windows on the southwest wall. The raised floor was leveled to the height of the platform, the wall between the cella and the opistodomos was removed, and the apse wall and crypt were built in its place. It was used as a church until 806. Ancient Wall is currently protected by structural aids from collapsing which was oriented around Fountain [5].

Hacı Bayram Mosque

Original status: Hacı Bayram Mosque is located next to the Temple of Augustus. It built in 1427. Hacı Bayram Mosque is one of the important religious buildings of the Ottoman period. It has a rectangular plan and the northern and western sections were added later. On the southeast wall of the tomb, there is a square planned, stone pedestal, cylindrical brick walled minaret with two balconies. The main interior is covered with a wooden ceiling. The lower windows of the mosque are rectangular. It is bordered externally by pointed arched niches. The upper windows have pointed arches, plaster gratings and stained glass, and are bordered by carved plant motifs [11].

Change: Two inscriptions on the south wall indicate that the mosque was restored in 1714. In 1940 and 1947, it was restored by the General Directorate of Foundations and added to the mosque, and the originality of the work was not preserved. With its current layout, it bears the characteristics of late 17^{th} century or 18^{th} century mosques. It is thought that the religious and historical mosque has lost its original value [12].

Figure 5. Hacı Bayram Mosque [13]

Figure 6. Hacı Bayram Mosque today

2.1.2. Ulus Squares and their changes in Ulus Historical City Center

Ulus Square

Ulus (Taşhan) Square was built in 1876, after the declaration of the Constitutional Monarchy, by the Governor of Ankara, Dr. It was opened by Reşit Bey. The surrounding buildings reflect the changes.

Change: The square, whose name changed from Taşhan Square to Hâkimiyet-i Milliye Square, was changed to Ulus Square in the 1930s [14]. The first assembly was built in Ulus Square. Then, due to in adequancy of the first assembly, the second assembly was built. In addition to these, Ankara Palace was built to host state elders and foreign leaders.

The Municipal City Garden was located around the square in 1927. However, today Ulus 100th Anniversary Commercial Center (Çarşı) has been built in this area. The square has turned into a congested closed intersection square with the increasing vehicle traffic by the construction of the open areas around it.

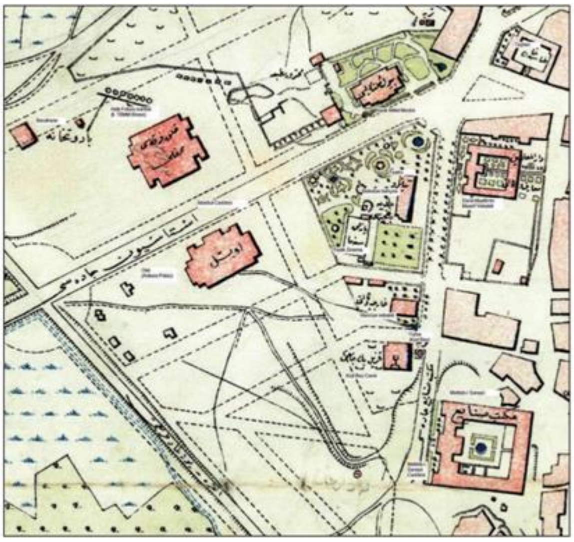

Figure 7. Ulus Square in 1924 Map Source: [15]

Figure 8. Ulus Square today

Figure 9. Ulus Square non-existent Millet Garden

Figure 10. Photograph from the Millet Garden, which does not exist today

Figure 11. Ulus Square 1931 Source: Inv. No:1687 [16]

Change of structures around Ulus Square

Darülmuallimin Building (Ulus Office Building)

The building, which was built as an art school in the late Ottoman period, first served as The Darülmuallimin Building /Teacher School and then as the Ministry of Education. After the fire, it was demolished in 1954 and replaced with Ulus İşhanı complex.

Figure 12. Ulus Darülmuallimin Building, 1925 Source: Inv.No: ACF0367_01 [16]

Change: The building, which was built as a school building in 1914, was demolished in 1934. The building, which was completely destroyed, was replaced by the Ulus İşhanı block in 1955.

Taşhan Building

The building, which was built in the last years of the Ottoman Empire, gave its name to the square. The building, built of cut stone, served as a hotel for a long time. The Sümerbank Building was built in place of the building, which was later demolished (1933). The building of Sümerbank in Ulus Square, whose name was given by Atatürk, was built by German Architect Martin Elsaesser.

Figure 13. Tashan Building Source: Inv. No: 0975 [16]

Figure 14. Sümerbank, which was built on the place of Taşhan Building Source: Inv. No: 1792 (VEKAM) [16]

Change: The Taşhan building, which was built as a guest house in 1880, was demolished and the Sümerbank Building was built in 1937-38. The building was used as a store in 1988 and transferred to the university in 2013. Today it is used as a university building by Ankara Social Sciences University.

Nation Victory Monument

It is located in Ankara Ulus Square. It was built in the first years of the Republic. He took part in printed publications and commemorative works as a symbolic work. For a long time, it served as a memorial ceremony area in official organizations on important national days.

Change: It was built in 1927 by the Austrian Sculptor Heinrich Krippel. In 1960, the location of the Monument was changed due to road widening works.

Figure 15. Schematic drawing of the first place of the Monument

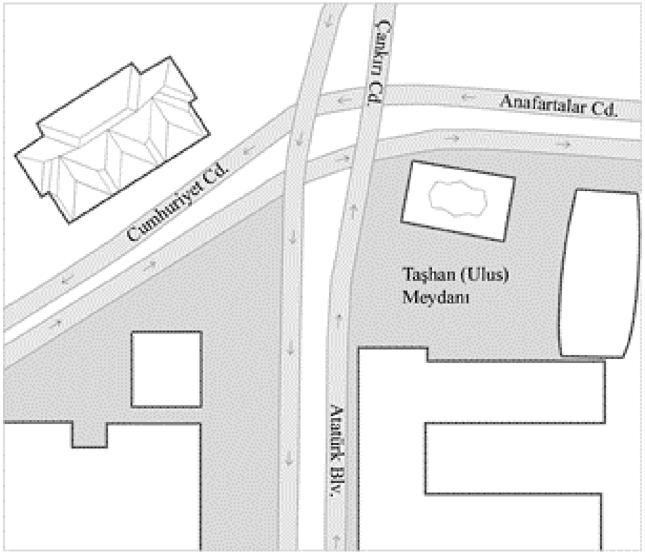

Figure 16. New location of the Monument due to road widening

3. Results

Findings in the research:

• In the 1st degree archaeological site where the Roman ruins and Hacı Bayram Mosque are located, concreting was carried out under the heading of renovation.

• Additions-enlargements were made without preserving the originality of the Hacı Bayram Mosque. For example, during the foundation excavation of Ulus City Bazaar, some historical artifacts were unearthed. Later, the remains of a late Roman road were found when the official archaeological studies conducted here in 1995 were examined. In 2006, the continuation of this Roman road was found during construction of the parking lot by the Ankara Governor's Office (URL-4).

• Ulus Square is surrounded by commercial centers, the existing green area is not protected, new buildings with no identity are built around the square.

• Ulus Square is not saved from vehicle traffic, but used as a nodal point.

• It has been observed that the Government Square has ceased to be a public space and has become a university inner garden.

Changes in identity structures and loss of identity are:

• Taşhan Building was demolished and Sümerbank Building was built in its place.

• The traditional texture of the square and its surroundings has been destroyed.

• The 100th Anniversary Bazaar was built in place of the Millet Garden.

• Ulus City Bazaar was built.

• In the fire that broke out in 1950, today's Ulus Office Building was built instead of the Ministry of Education building.

4. Discussion

Ulus Historical City Center has been changing and disappearing as a result of years of neglect and mistakes. Sensational and profit-oriented projects are implemented under the guise of "Renovation Area". It has caused destruction and irreversible destruction in the 1st Degree Archaeological Site, which contains Roman ruins. The surroundings of Ulus and Hacı Bayram containing Roman ruins; It has been declared as an urban transformation and renewal area. It is planned to create commercial areas that are thought to generate income through renovations. These mistakes damage the Ulus City Center, which both contains the archaeological site and has witnessed various periods.

5. Conclusion

The historical texture of Ulus and its surroundings has been destroyed by the changes mentioned above. The shopping malls, which were built for profit, caused the destruction of ancient artifacts. The Roman Road between the ancient Roman bath and the Roman Palace could not be preserved. Again, the historical Ankara houses around Ulus Square could not be preserved. Some existing structures were demolished and turned into structures that are far from their functions.

Acknowledgement

I would like to thank Prof. Dr. Murat YAKAR and Research Assistant Aydın ALPTEKİN, who showed interest and support in the corrections, execution and formation of my article, whose knowledge and experience I benefited from, and who shaped my article with their guidance and information.

Author contributions

Necmi Ateş: Methodology, Field study, writing original draft preparation **Süheyla Birlik:** Writing-Reviewing and Editing, validation

Conflicts of interest

There is no conflict of interest between the authors.

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Cultural Heritage and Science – 2023, 4(2), 55-61

Cultural Heritage and Science

https://dergipark.org.tr/en/pub/cuhes

e-ISSN 2757-9050

Architectural sustainability with cultural heritage values

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Keywords
Sustainability
Sustainable Development
Cultural Heritage
Cultural Heritage Management

Research Article
DOI: 10.58598/cuhes.1282179

Received:12.04.2023
Revised: 25.05.2023
Accepted:01.06.2023
Published:27.10.2023

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Abstract

Sustainability and cultural heritage are two interconnected and interdependent issues that are essential for achieving sustainable development. Cultural heritage plays a critical role in society as it is an integral part of the social and cultural fabric. This article focuses on the relationship between sustainability and cultural heritage, specifically the integration of cultural heritage into urban and environmentally sustainable development. To achieve this, the study used Tabriz Bazaar as a case study to explore how cultural heritage can be preserved while balancing economic expansion and sustainable development. The research question is how cultural heritage can be integrated into urban and environmentally sustainable development using Tabriz Bazaar as a case study. The hypothesis is that the preservation and protection of cultural heritage values are crucial for achieving sustainable development, and an interdisciplinary approach is necessary to balance economic expansion with cultural heritage preservation. Using a case study approach, the research collected data through a literature review and interviews with experts in the fields of cultural heritage preservation, urban and environmental sustainability, and economics. The research analyzes the challenges of balancing economic development with cultural heritage preservation and proposes an interdisciplinary approach to address these challenges. To make the area more sustainable and preserve its cultural heritage values, specific measures such as promoting cycling in Tabriz Bazaar were recommended. Moreover, education and awareness-raising programs are also necessary to promote the importance of cultural heritage and its contribution to sustainable development. Overall, the research highlights the interdependence between sustainability and cultural heritage and emphasizes the importance of preserving cultural heritage to achieve sustainable development. Policymakers, urban planners, and cultural heritage conservationists can benefit from the findings of this study to develop strategies that promote sustainable development while preserving cultural heritage values.

1. Introduction

Sustainable development encompasses not just ecological but also economic, social, and cultural dimensions. Many research has shown that preserving cultural heritage enhances ecological, social, cultural, and economic sustainability. Cultural legacy may benefit communities' well-being and quality of life, assist in alleviating the consequences of cultural globalization, and serve as an incentive for long-term economic growth. Cultural heritage preservation is frequently viewed as a barrier to economic development, despite the fact that cultural heritage and its preservation can generate a variety of economic benefits, including income and job creation, professional training and the preservation of craft skills, revitalization of city centers, heritage tourism, increased real estate values, small business improvement, and so on. Repurposing abandoned or underutilized historic structures is critical to regenerating communities and enhancing quality of life. It is critical to acknowledge cultural heritage as a significant resource and development incentive in order to adopt sustainable development methods and improve quality of life. The paper discusses the impact of immovable cultural heritage on the implementation of sustainable development strategies, the role of cultural heritage in the context of globalization as a fundamental means of avoiding the trend of cultural globalization, the formation of sustainable communities, and the potential impact of cultural heritage resources on economic development and resource productivity. It is important

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Cite this article (APA);

Elyasi, S., & Yamaçlı, R. (2023). Architectural sustainability with cultural heritage values. Cultural Heritage and Science, 4(2), 55-61

for cultural heritage cities and urban heritage cities to recognize heritage preservation as a necessary goal for sustainable planning in urban planning. Our past experience shows to date that monument preservation planning makes a positive contribution to sustainable planning research. This is only possible by protecting and enhancing key elements of the natural and cultural heritage through planning [1]. Cultural heritage connects us to the past, serves as the basis of our identity and is a source of knowledge.

2. Methods

2.1. Sustainable development

Sustainable development aims to improve living standards, preserve ecosystems, and secure basic needs while creating a safer and happier future. It involves designing economic, financial, trade, energy, agricultural, and industrial policies that promote sustainability. This includes investing in education, health, population, and energy to avoid social debt for future generations. Sustainable development is a comprehensive concept that impacts all aspects of human life, requiring significant changes in national and international policies. Ultimately, it is an approach to economic growth that seeks to meet the needs of the present without compromising the ability of future generations to meet their own needs [2].

The breadth of work in the name of sustainability, the diversity of existing concepts, the importance of ordering between principles, and the vast regional differences are some of the first to compel the designer to find the truth. The common purpose of sustainability studies is to examine from an architectural perspective how natural energy resources can be protected and conserved by assessing sustainability in relation to the natural environment [3]. This includes reducing carbon emissions, protecting natural resources, promoting social equity, and ensuring economic growth that is both environmentally responsible and socially inclusive.

Sustainable development is a broad concept that recognizes the interconnectedness of economic, social, and environmental factors, and it has direct implications for planning, housing, and urban development policies worldwide. Urban planning is an effective tool for steering sustainable development, but it alone is insufficient to ensure sustainability. The United Nations' Sustainable Development Goals (SDGs), particularly Goal 11, emphasize the need to create inclusive, safe, resilient, and sustainable cities and communities. The New Urban Agenda, adopted at the United Nations Conference on Housing and Sustainable Urban Development, also underscores the importance of participatory urban planning and partnerships among stakeholders to achieve sustainable development.

2.2. Cultural heritage

The term cultural heritage is used to refers to the “physical and intangible manifestations of a group’s identity” [4]. This includes such elements as art, architecture, stories, rituals, and so on. It has important economic and social roles as well, including as a tourist attraction, source of employment, and source of revenue [5]. It is also used to denote a cultural landscape that is particular to a region or area. Cultural heritage and the field of architectural science mutually constitute interrelated components that exhibit a synergistic relationship. A fresh outlook on cultural heritage has materialized, evident in the consequential provisions of the Faro Convention. Notably, the Convention's second clause distinctly delineates cultural heritage as an assemblage of historical resources, which individuals perceive as an unattributed manifestation and mirror of their continuously evolving principles, convictions, erudition, and customs [6]. Cultural heritage is a dynamic and evolving field, with new elements constantly being added. Cultural heritage has a variety of roles and functions that are related to the local community and to the global community. Many of these roles are the same as those of other sectors, such as tourism, arts, education, and health [7]. However, these are sometimes overlooked or undervalued. They have a vital role to play in society and are essential to maintaining cultural identities and improving quality of life in the community [8]. Key roles and functions of cultural heritage include education and knowledge creation, economic development, tourism, and aesthetic enjoyment. While these are valuable contributions, they have not always been considered in the same way that other sectors of society have been treated. Some of the key challenges facing the field of cultural heritage include globalization and the loss of identity, changes in behavior and attitudes.

2.3. Cultural heritage and architectural sustainable development

Short-term interests promote speculative developments, which pose substantial dangers to cultural assets and the historical landscape. Cultural assets and historic surroundings are important not just to individuals who own or reside in historic buildings. Cultural legacy may also contribute to a community's well-being and quality of life by preventing cultural globalization, preserving cultural variety, and positively impacting economic growth. According to D. Rypkema, in a larger perspective, the importance of heritage in the quest of sustainable development is unmistakable: the protection of cultural heritage offers environmental, cultural, and economic sustainability [9]. Cultural heritage plays a marginal role in the 2030 Agenda for Sustainable Development. It is only explicitly mentioned once in Goal 11, which relates to cities, specifically the need to make cities and human settlements inclusive, safe, resilient and sustainable through inclusive and sustainable urbanization, planning and management (Goal 11.3). and increased efforts to protect and preserve the world's cultural and natural heritage (target 11.4).

2.3.1. Cultural heritage values in Tabriz

According to the trend of comprehensive developments in today's cities of the world, the cities of Iran and Azerbaijan in general and the city of Tabriz in particular have undergone many changes in the architecture with historical value and the way of distributing activities in recent decades. The role of the city administration and planning in preserving historical and unique architectures and creating a healthy environment, economic, social, touristic city, etc. has helped to make the urban system healthy and balanced. The historical city of Tabriz has experienced various administrations and plans over the last few decades that have left their impact on the development of the city and the nature of the texture and environmental issues that have caused the destruction of the old architecture and the unequal distribution of the city services that these Problems in different eras and time management were different.

Figure 1. The relationship between culture, society, environment and economy with sustainability.

Tabriz, located in northwestern Iran, has a rich cultural heritage that reflects its historical importance as a commercial center and cultural center. Some of the main heritage values in Tabriz are shown in Table 1.

Cities are caught between the desire to be a member of the global network and the need to maintain their individuality and cultural origins. As new progress symbols have shattered conventional contexts, new meanings of community have developed [10].

The value of cultural heritage has always been an important factor in the development of any country. In fact, it has played an important role in the development of nations. In addition, it has played an important role in the development of the economies of these countries [11]. In this sense, it has become a valuable resource for both individual and social development. Accordingly, it is important to develop a system for the protection and management of these values. Therefore, developing a system for the conservation of cultural heritage values is a priority in Iran. To do this, it is necessary to identify these values and then put measures in place to protect them from harm. The successful execution of a comprehensive conservation program, involving scientific surveys, analyses, and evaluations, entails the diligent coordination of proficient technical experts, careful selection of suitable methodologies for the project, and the seamless transmission of precise information across different stages of scientific research. Additionally, it is imperative to establish a comprehensive management and monitoring program that encompasses the pre-implementation, implementation, and post-implementation phases of conservation efforts [12]. In this regard, it is important to draw up a plan for the protection of cultural heritage values and then monitor its implementation to ensure that it is carried out correctly. In Iran, there is not a proper system for the management and protection of cultural heritage. Thus, the contribution of this project is to develop a comprehensive plan for the conservation of cultural heritage in the country. In order to do this, it is necessary to conduct a comprehensive assessment of cultural values and identify their needs for protection and preservation. This assessment will be based on the available data and information. It will also be carried out with the help of experts and authorities who have relevant experience in the field. As a result, the project will develop a model for the conservation and protection of cultural heritage in Iran that can be used to ensure the preservation of this valuable resource for future generations. The work that is being done under this project is expected to help Iran to make a valuable contribution to the global community by ensuring the conservation and preservation of its unique cultural heritage. This will ultimately enable Iran to contribute to the development of the global economy and enhance its reputation as a developing country in the global community. As a result, the success of the project will help to enhance the country's economy and improve the overall quality of life for all citizens in Iran.

The sustainability of historical bazaars is only significant if it accurately reflects the everyday busyness of the community through their physical structures. It is crucial to consider how the renewal process affects the daily life of the community. Unfortunately, urban planners often make spatial changes in an effort to enhance functionality, resulting in changes or elimination of current behavioral regulations. When the workplaces of the sellers are significantly altered or removed, the working methods, physical presence, and sensory experiences they produce within the bazaar also change, all of which are integral to the bazaar environment and contribute to its individual memories and collective identity [13]. Therefore, the sustainability of historical bazaars can only be achieved if it accurately portrays the hustle and bustle of daily life through their physical structures, and if any renewal process considers the impact on the community's daily life and preserves the bazaar's unique character and identity.

Rebuilding Tabriz market with sustainable development in mind would involve considering economic, social, and environmental aspects of the project. Here are some steps that can be taken to achieve this (Table 1).

Table 1. Heritage values of Tabriz.

Items	Heritage values	y	z
1	Historic Architecture	Tabriz has numerous historic buildings, such as the Tabriz Historic Bazaar Complex, the Blue Mosque and the Arg of Tabriz, which reflect the city's architectural and cultural heritage.	
2	Traditional Crafts	Tabriz has a long history of producing high-quality handicrafts such as carpets, copperware and pottery, which are highly valued both locally and internationally.	
3	Culinary Traditions	Tabriz is known for its unique and delicious cuisine, including dishes such as Kofte Tabrizi, a type of meatball and Ash Reshteh, a type of soup.	
4	Festivals and Celebrations	Tabriz hosts a number of annual festivals and cultural celebrations including the Tabriz International Carpet Fair, the Tabriz Traditional Music Festival and the Tabriz Pistachio Festival.	
5	Cultural Diversity	Tabriz has a diverse population that includes different ethnic and religious groups that have contributed to the city's cultural heritage over time.	

Figure 2. Iran's Map.

Figure 3. Tabriz's Map.

Figure 4. Tabriz Bazaar Map (cyling road).

Develop a sustainability plan: The first step is to create a comprehensive plan that outlines the sustainable goals and objectives of the rebuilding project. This plan should consider factors such as reducing energy consumption, waste management, and promoting sustainable economic growth.

Use sustainable materials: In the rebuilding process, it's essential to use sustainable materials that have minimal environmental impacts. For example, materials that are locally sourced, recycled or have a low carbon footprint.

Incorporate renewable energy sources: Renewable energy sources like solar or wind power can be integrated into the design to reduce energy consumption and promote clean energy use.

Promote local economy: To ensure the long-term sustainability of the market, it's essential to promote the local economy by supporting local businesses and suppliers. This will create jobs and stimulate economic growth in the region.

Encourage public transportation: The new design of the market should encourage public transportation to reduce the use of private cars, which contribute to air pollution and traffic congestion. For example, bike lanes, bus stops, or public transportation stations can be incorporated into the design.

Implement waste management strategies: The market should have a comprehensive waste management plan that includes recycling and composting to minimize waste production and promote sustainability.

Consider social aspects: In addition to economic and environmental factors, social aspects such as inclusivity, accessibility, and safety should be considered in the rebuilding process. For example, the market should be designed to be accessible to people with disabilities and provide safe spaces for everyone.

3. Conclusion

In summary, rebuilding Tabriz market with sustainable development in mind requires a comprehensive approach that considers economic, social, and environmental factors. By implementing the steps above, it's possible to create a sustainable market that promotes economic growth, environmental protection, and social well-being.

Making the Tabriz bazaar more sustainable can have a positive impact on cultural heritage in several ways. Here are some examples:

Preservation of historical architecture: The Tabriz bazaar is a unique cultural heritage site with a rich history and unique architecture. By promoting sustainable practices in the bazaar, such as using sustainable materials and reducing waste production, the historical architecture of the bazaar can be preserved and maintained for future generations.

Promotion of local culture and heritage: Supporting local businesses and promoting sustainable tourism practices in the Tabriz bazaar can help to promote the local culture and heritage of the region. This can include showcasing traditional crafts and products, preserving local customs and traditions, and celebrating local festivals and events.

Increased awareness and education: By promoting sustainable practices in the Tabriz bazaar, people can become more aware of the importance of preserving cultural heritage and the role that sustainability can play in achieving this. This can lead to increased education and awareness of cultural heritage among visitors and residents of the bazaar.

Collaboration with local communities: Making the Tabriz bazaar more sustainable can involve working closely with local communities to ensure that their cultural heritage is respected and preserved. This can involve collaborating with local artisans and craftspeople, supporting local festivals and events, and providing opportunities for community engagement and participation in sustainable practices.

Sustainable tourism: Sustainable tourism practices can help to promote cultural heritage in the Tabriz bazaar, such as supporting local businesses, providing opportunities for cultural exchange and learning, and minimizing negative impacts on the environment and local communities.

In summary, making the Tabriz bazaar more sustainable can have a positive impact on cultural heritage by preserving historical architecture, promoting local culture and heritage, increasing awareness and education, collaborating with local communities, and promoting sustainable tourism practices.

To encourage public transportation like bike lanes in the bazaar of Tabriz, the following steps can be taken:

1. Conduct a feasibility study: Before implementing any bike lanes or other infrastructure, it's important to conduct a feasibility study to determine if it's possible and practical to create bike lanes in the bazaar. This study should consider factors like the size of the bazaar, the number of visitors, and the availability of alternative transportation options.
2. Design safe and accessible bike lanes: The bike lanes should be designed to ensure the safety of cyclists and pedestrians, and to provide easy access to the bazaar. This includes separating the bike lane from vehicle traffic, providing clear signage, and ensuring that the bike lanes are well-maintained.
3. Educate the public: Educating the public about the benefits of cycling and the availability of bike lanes in the bazaar is essential to encourage more people to use them. This can be done through outreach programs, signage, and other forms of communication.
4. Provide bike parking facilities: Providing secure and accessible bike parking facilities near the bazaar will encourage people to cycle to the bazaar. This could include bike racks, bike lockers, or even bike-sharing programs.
5. Work with local businesses: Working with local businesses to promote cycling to the bazaar can be a powerful tool in encouraging people to use bike lanes. For example, businesses could offer discounts or incentives to customers who arrive by bike.
6. Collaborate with local government: Collaborating with local government to provide funding and support for bike lanes and other cycling infrastructure is critical to their success. This could include providing funding for bike lane construction and maintenance, as well as other initiatives to encourage cycling, such as public awareness campaigns and bike share programs.

By taking these steps, it's possible to encourage more people to use public transportation like bike lanes in the bazaar of Tabriz, reducing traffic congestion, improving air quality, and promoting sustainable transportation options.

Author contributions

Sahar Elyasi: Methodology, Field study, writing original draft preparation **Ruşen Yamaçlı:** Writing-Reviewing and Editing, validation

Conflicts of interest

There is no conflict of interest between the authors.

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Cultural Heritage and Science
https://dergipark.org.tr/en/pub/cuhes
e-ISSN 2757-9050

Exploring structural deterioration at historical buildings with UAV photogrammetry

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Keywords
Germus Church
UAV
Photogrammetry
3D modelling
Digital documentation

Research Article
DOI: 10.58598/cuhes.1316822

Received:19.06.2023
Revised: 24.08.2023
Accepted:30.08.2023
Published:27.10.2023

Abstract
The preservation and transmission of cultural heritage to future generations are crucial in today's rapidly advancing world. This study focuses on the application of Unmanned Aerial Vehicle (UAV) technology and photogrammetric techniques in the modeling and documentation of Germus Church, a significant cultural heritage site. The research aims to create a high-fidelity 3D model of the church, capturing its architectural intricacies and deformations caused by time and damage. The fieldwork involved capturing aerial photographs using a DJI Mavic 2 Pro UAV system, followed by image processing with Structure-from-Motion (S*f*M) software. The generated 3D model revealed extensive deformations, including cracks, collapses, and loss of religious figures and decorations. The findings emphasize the importance of preserving and restoring Germus Church for tourism promotion. The study showcases the effectiveness of UAV technology in documenting cultural heritage and highlights its potential for future applications. The 3D model serves as a valuable resource for researchers, historians, and the public, fostering a deeper understanding and appreciation of our rich cultural heritage.

1. Introduction

In today's rapidly advancing world, the preservation and transmission of historical artifacts and cultural heritage to future generations have become not only possible but also necessary. The documentation of these invaluable treasures plays a vital role in ensuring their preservation and providing us with valuable insights into our history [1-3]. By capturing and recording every clue related to history, we can create a comprehensive repository of knowledge for future exploration.

Traditionally, terrestrial observation systems have been widely employed for documenting cultural heritage. However, in recent decades, the advent of satellite technologies with higher spatial resolution has revolutionized the field of modeling efforts on a global scale. Furthermore, the advancements in aviation and remote sensing technologies have opened new avenues for more effective utilization of photogrammetry and Unmanned Aerial Vehicle (UAV) systems in the documentation process.

Unmanned aerial vehicles are frequently used in different areas such as agriculture, mining, construction, natural disaster monitoring, meteorology, archeology, imdustry especially cartography [4-16].

The application of photogrammetry techniques using photographs captured by cameras integrated into UAVs is commonly known as UAV photogrammetry [16,17]. This innovative approach has gained significant attention in the literature, particularly in the field of 3D modeling of cultural heritage, due to its inherent advantages in terms of time efficiency, cost-effectiveness, and data collection capabilities [17,18].

The development of unmanned aerial vehicles in various shapes, sizes, and features has significantly contributed to the advancement of 3D modeling techniques [18,19].

These technological advancements have made it easier than ever before to accurately assess the current state of historical structures and identify any deformations or changes over time. Leveraging the advantages of UAV photogrammetry, this study aims to create a high-fidelity 3D model of the Germus Church, a remarkable cultural heritage site.

By harnessing the power of UAVs and photogrammetric techniques, this research endeavors to

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Cite this article (APA);

Dörtbudak, E. B., Akça, Ş., & Polat, N. (2023). Exploring structural deterioration at historical buildings with UAV photogrammetry. Cultural Heritage and Science, 4(2), 62-68

provide a comprehensive and detailed representation of the Germus Church, capturing its architectural intricacies and preserving its historical significance. The resulting 3D model will serve as a valuable resource for researchers, historians, and the general public, fostering a deeper understanding and appreciation of our rich cultural heritage. Moreover, this study aims to showcase the immense potential of UAV photogrammetry in the documentation and preservation of cultural heritage sites, paving the way for future applications and advancements in the field.

2. Study area

The selected study area, Germuş Church, is located in the Dagetegi near at the foothills of Germus Mountain, which is situated 10 kilometers northeast of the city center of Sanliurfa. The historical church is positioned at coordinates 37°12'06.0" latitude and 38°51'04.2" longitude and is located 5 kilometers away from Göbekli Tepe, which is known as the "zero point" of history. The location information for the study area is depicted in Figure 1.

Figure 1. The study area

It is rumored that Germus Church, presumed to have been built in the 19th century, was constructed over seven years using cut stones brought from the surrounding mountains. It has been reported that within the village where the church is located, there are underground markets, tunnels, and various structures [20]. In 2011, the Ministry of Culture and Tourism of the Republic of Turkey designated the vicinity of Germuş Church as a "tourism development center." However, due to years of neglect, the structure has suffered significant deterioration over time. As part of the restoration and preservation efforts, a 3D model of the church's current condition was created using UAV technology. This has enabled the necessary preliminary preparations for restoration and conservation work.

3. Method

The production of the model consists of two stages: fieldwork and office work.

During the fieldwork stage, data acquisition takes place. This involves capturing aerial photographs or images of the Germus Church using the unmanned aerial vehicle (UAV) equipped with a camera. The UAV is flown over the site, and high-resolution images are taken from different angles and positions. The purpose of this stage is to collect visual data that will be used for the subsequent modeling process.

In this study, the DJI Mavic 2 Pro, a UAV system from the DJI brand, was used to generate a 3D model of the historical church. The DJI Mavic 2 Pro is a successful system with features such as an effective range of 8 km, a maximum flight time of 31 minutes, 4K recording with a Hasselblad camera, a 1" CMOS sensor, GPS sensor, 4-way obstacle sensing, automatic return to home, and a weight of approximately 1 kg [20]. The UAV used in the study is depicted in Figure 2.

Figure 2. DJI Mavic 2 Pro UAV system used in the study

For the photo capture a circular flight plan was prepared with *6 °.* Once the fieldwork is completed, the collected images are transferred to the office for processing. This is where the office work stage begins. In this stage, specialized software is used to process the images and create a 3D model by using Structure from Motion (SfM).

The acquired aerial images underwent processing using the Structure-from-Motion (SfM) approach, which has emerged as a revolutionary and cost-effective photogrammetric technique widely employed in recent years [22].

Unlike traditional photogrammetry, SfM introduces mathematical and statistical differences. While traditional photogrammetry aims for global consistency, model validity, accurate measurements, and compatibility through a global mathematical model, SfM is an image-based modeling technique that automatically arranges camera parameters, positions, and object 3D geometries to create a three-dimensional (3D) model. S*f*M achieves this by aligning corresponding features in images captured from different locations, ensuring an appropriate overlap rate in accordance with photogrammetric measurement processes [23].

The establishment of image relationships requires the identification of features such as corners and edges within the images. By directly aiming to reconstruct the 3D object, S*f*M generates a local solution and model through photogrammetric bundle block adjustment, utilizing all available data. Nowadays, there are numerous commercial and free software applications available that operate based on the S*f*M approach, offering versatile capabilities [22,24,25,26].

The software analyzes the images, identifies common points and features, and reconstructs the three-dimensional structure of the Germuş Church based on these data points. The acquired images from the unmanned aerial vehicle were processed using Agisoft

Photoscan, an independent software that offers significant capabilities for performing photogrammetric operations on digital images. A point cloud and a 3D model were created based on the evaluation of the images.

4. Results and Discussion

Circular flight is when an UAV (Unmanned Aerial Vehicle) flies by following a circular path around a specific target. In this study, the Germuş Church was selected as the target, and a 6-degree flight plan was prepared for the circular flight from a 25 meter height. The flight duration and efficiency were increased through circular flight. In our case the circular flight is performed in approximately 5 minutes in May 2022**.** The camera angel is automatically arranges as 75 degree from nadir. In total, 40 aerial images were obtained. The flight plan is depicted in Figure 3.

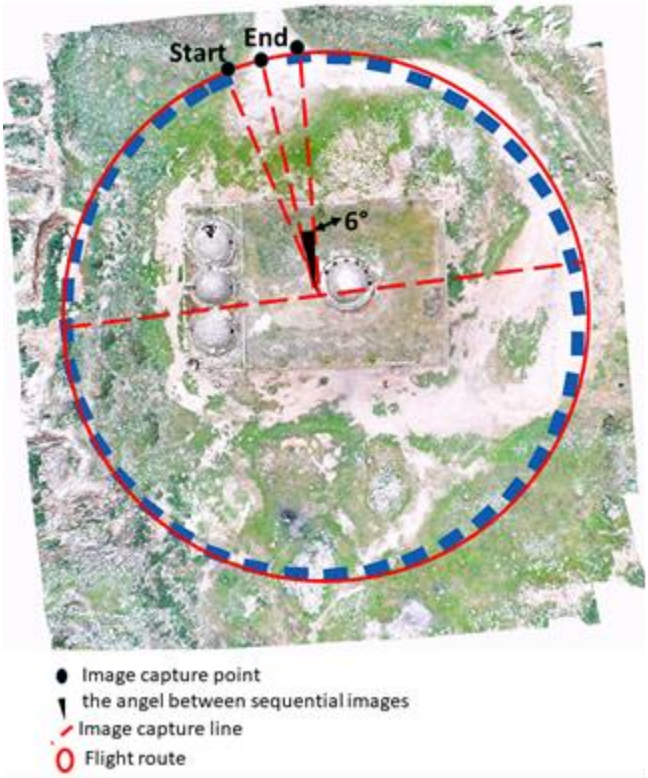

Figure 3. Photogrammetric flight plan

In this study, UAV-based 3D modeling of the historical heritage site known as Germus Church, located in the Haliliye district of Sanliurfa province, has been successfully accomplished. All photogrammetric process was performed in Agisoft software in high quality parameters.

The use of UAVs was employed to contribute to the surface investigation prior to the planned restoration of the historical church and to produce topographic products that could serve as a basis for the restoration works. The findings and processes involved in the production of the 3D model reveal that the UAV-based capture, which is overlapping, precise, and highly accurate, plays a significant role in generating the point cloud. The generated dense point cloud contains 7,800,413 points. The colorless and colored form of the generated point cloud is given Figure 4.

Figure 4. The generated point cloud

The obtained point cloud allows us to obtain both 3D position and color information from all surfaces of the structure. Using this data, it is possible to produce a 3D solid model of the structure. Within the scope of the study, the 3D solid model of the Germus church was produced both in colorless (Figure 5) and colored (Figure 6).

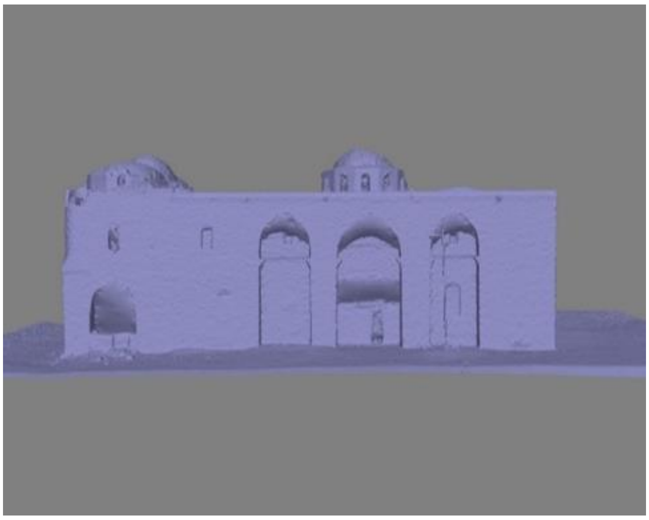

Figure 5. Colorless 3D solid model of Germus Church

When evaluating the Agisoft software used for image processing, it can be observed that photos with regular overlap rates are processed accurately, resulting in a 3D model that closely resembles reality. However, it is noted that as the number of added photos increases for the purpose of achieving greater accuracy, the processing time of the model also increases. Therefore, it is important to aim for an optimal balance between image input parameters and processing time [27].

Figure 6. Colored 3D solid model of Germus Church

When evaluating the generated 3D model and the fieldwork, it is clearly visible that the domes of the historical church have collapsed and the side facades have suffered damage. The deformed parts of the historical church are indicated on the 3D model.

The damaged domes made of knitted stone pose a high risk due to falling stones. Figure 7 shows extensive damage to the dome, completely opening it up and causing stones to fall. The unstable structure increases the danger, as each dislodged stone increases the chance of further collapse. Urgent action is needed to stabilize the remaining sections, ensure safety, and restore the domes to their former glory.

Figure 7. The deformed dome.

The building's exterior walls exhibit significant wear, a result of aging, decay, and human-induced damage. Over time, the elements have taken a toll, causing cracks and faded paint. Additionally, poorly constructed masonry walls and graffiti further mar the surfaces. Figure 8 highlights some of these damages, emphasizing the need for restoration and preservation efforts.

Figure 8. The deformed walls

The accumulation of soil and growth of grass and weed plants on the building's roof pose potential risks. The roots can compromise the structure and lead to water infiltration, while the added weight can strain the supporting elements. Proper maintenance, including regular cleaning and drainage systems, along with reinforcing the roof structure, can help mitigate these risks and preserve the building's structural integrity.

The presence of grass and weed plants on the building's roof, as shown in Figure 9 is a cause for concern alongside the structural damage. The accumulation of soil can lead to long-term structural issues. Over time, the roots of the plants can penetrate the roof's surface, compromising its integrity and creating pathways for water infiltration. The weight of the soil and vegetation can also strain the supporting elements, increasing the risk of collapse. To address these risks, regular maintenance and cleaning are necessary to remove the soil and vegetation, while implementing drainage systems and reinforcing the roof structure can help mitigate the effects of moisture and soil accumulation.

Figure 9. Soil accumulation and grass on the roof of the church

During fieldwork, it was observed that the church had been explored and excavated by artifact hunters, emphasizing the need for alternative methods of documentation. Unmanned aerial vehicles (UAVs) prove to be a suitable solution, as they can safely capture high-resolution imagery of inaccessible areas. The collected data allows for the creation of detailed 3D models, serving as a reference for future comparisons and aiding in the detection of structural changes or deformations.

UAVs offer a safer alternative to physical exploration in dangerous areas, minimizing the risk of damage to delicate structures or artifacts. The use of advanced imaging technologies enables researchers to document the church's interior and exterior without the need for human entry. The resulting imagery and 3D models provide valuable insights into the historical and architectural significance of the site.

The documentation obtained through UAVs contributes to the preservation and conservation of cultural heritage. By regularly capturing updated aerial imagery, researchers can monitor the church's condition over time and detect any deterioration or alterations promptly. This information aids in planning and implementing timely preservation efforts, ensuring the long-term protection of the site's cultural and historical value. UAVs play a vital role in documenting inaccessible areas, safeguarding artifacts, and fostering a deeper understanding of our rich heritage.

The final version of the 3D model of Germus Church is depicted in Figure 10.

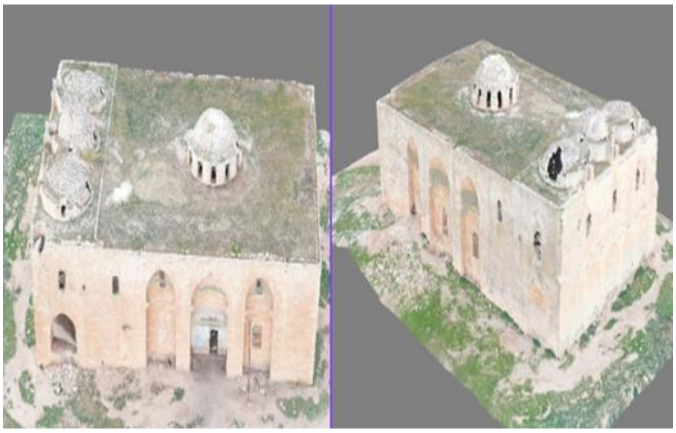

Figure 10. The 3D model of Germus Church

The 3D model generated from the site documentation serves as a valuable resource for creating architectural survey drawings. By utilizing the model, architects can accurately depict the building's main outlines and damaged sections, providing a comprehensive visual reference for analysis and preservation planning. The detailed representation of the model allows for in-depth examinations of the damage, aiding in the formulation of appropriate restoration strategies and ensuring the preservation of the building's original architectural intent.

The provided Figure 11 exemplifies the use of the 3D model for architectural survey drawings, showcasing the building's main outlines and highlighting specific damaged sections. This digital representation not only facilitates accurate documentation but also serves as an archival resource for future generations to study and appreciate the building's architectural heritage.

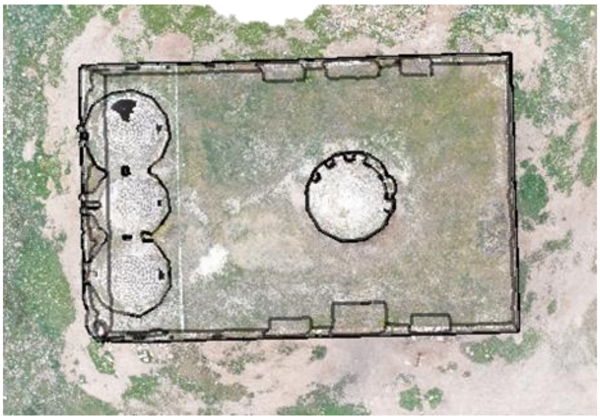

Figure 11. An example of architectural drawings over 3D model

It is possible to say that the accessibility of the 3D model enables researchers and historians to explore the structure's design elements and cultural significance, promoting a deeper understanding of its historical context.

5. Conclusion

In conclusion, this study highlights the significant contributions of unmanned aerial vehicles (UAVs) and photogrammetric techniques in the documentation and preservation of cultural heritage sites, specifically focusing on the Germus Church. The use of UAV photogrammetry has revolutionized the field of 3D modeling by offering advantages such as time efficiency, cost-effectiveness, and high-quality data collection capabilities.

The fieldwork stage involved capturing aerial photographs of the Germus Church using the DJI Mavic 2 Pro UAV system. These images were then processed using the Structure-from-Motion (SfM) approach, which automatically arranged camera parameters, positions, and object 3D geometries to create a highly accurate 3D model. The resulting model provides a comprehensive representation of the architectural intricacies and historical significance of the Germus Church.

The study area, Germus Church, located near the foothills of Germus Mountain, holds great cultural and historical value, and the generated 3D model serves as a valuable resource for researchers, historians, and the public. By documenting and preserving the current state of the church, the 3D model enables future comparisons and assessments of any deformations or changes over time.

Furthermore, the study emphasizes the suitability of UAVs and photogrammetric techniques in capturing visual data and exploring hazardous or inaccessible areas. The generated 3D model not only reveals the structural damages and deformations of the Germus Church but also aids in identifying potential preservation challenges, such as soil accumulation and vegetation growth on the roof.

This research demonstrates the immense potential of UAV photogrammetry in the field of cultural heritage documentation and preservation. The utilization of UAVs and advanced software tools offers a cost-effective and efficient means of acquiring accurate data and creating detailed 3D models. By fostering a deeper understanding and appreciation of our rich cultural heritage, these technological advancements pave the way for further applications and advancements in the field of cultural heritage preservation.

Overall, the study highlights the importance of integrating UAVs and photogrammetry in archaeological and digital documentation studies, showcasing their pivotal role in safeguarding historical artifacts and transmitting our cultural heritage to future generations.

Author contributions

Emine Beyza Dörtbudak: Field study, Data processing, Editing **Şeyma Akça:** Data processing, Methodology, Writing Original draft **Nizar Polat:** Conceptualization, Field study, Data processing.

Conflicts of interest

There is no conflict of interest between the authors.

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Cultural Heritage and Science
https://dergipark.org.tr/en/pub/cuhes
e-ISSN 2757-9050

Systematic analysis of the digital technologies used in the documentation of historical buildings

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Keywords
Digital Documentation
Digital Technology
Historical Building
Survey Methods
Photogrammetry

Research Article
DOI: 10.58598/cuhes.1344379

Received:16.08.2023
Revised:25.08.2023
Accepted:18.09.2023
Published:27.10.2023

Abstract
Cultural heritage buildings have values that provide a connection from past to present. The first stage of ensuring that these values are preserved and transferred to future generations is the documentation and diagnosis studies. The digital acquisition of the documentation data of historical buildings by digitizing, the creation of 2D drawings and 3D models with numerical data, provides an accurate analysis of the current situation of cultural heritage buildings and allows the evaluation of damage status of the building in the process after the documentation works. Although current studies in the literature mostly focus on the use of a certain method, device or software, it has been determined that there is no study that examines digital documentation methods in detail and systematically addresses the current technologies, programs and tools used in this process. Based on this gap in the literature, in this study, firstly, the documentation of cultural heritage and its importance are mentioned, the components of documentation are explained, and the methods, tools, applications and software programs that could be used in the documentation, recording and data processing of cultural heritage structures were systematically brought together. By comparing the data obtained as a result of this research study, in which the qualitative research method was used, with the documentation methods, it points out that digital documentation of cultural heritage structures allows for a more precise assessment by increasing the accuracy of data collection and analysis studies. The study also highlights the importance of the use of digital technologies, which makes it easier to store, share and manage the data at hand.

1. Introduction

Cultural heritage is a formation that reflects the unity of societies and strengthens society by keeping it together. Preserving the savings obtained from the past to the present is very important for the formation of future generations. Among the important resources we have learned about the cultural, social, religious and economic values of societies are immovable cultural heritage structures. The traces of these structures, which have been carried from the past to the present, are important memory elements that hold societies together as well as historical document values. The protection of immovable cultural heritage structures, which are important in establishing the connection between today and the past, is an important issue that requires interdisciplinary effort and work [1]. Works of cultural and historical value are damaged or even destroyed by natural disasters such as floods, fires, earthquakes, as well as environmental factors such as unconsciousness, wrong intervention and use, and climate change. As a result of the erosion and destruction of cultural heritage structures over time, the most important way to protect the structure in the most accurate way and to transfer it to future generations is restoration and conservation activities, and the first and most important step to guide these activities is documentation studies [2].

Cultural heritage constitutes the first stage of the conservation process of buildings and the stage of identification and documentation. Determination and documentation studies include determining the current status of the structure and obtaining the necessary data for other stages [1]. Expressing the current state of the structure in accordance with the drawing technique is defined as a survey. In this context, survey studies are the most important preliminary data of the documentation stage and guide other stages of the conservation process [3].

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Cite this article (APA);

Çakıcı, F. Z., & Kaçdı, R. (2023). Systematic analysis of the digital technologies used in the documentation of historical buildings. Cultural Heritage and Science, 4(2), 69-77

There are various methods used for survey taking in documentation studies. The methods to be used vary depending on the condition of the cultural heritage structure. The development of methods used in the process of documenting and diagnosing cultural and historical heritage is important both for the conservation practices to be carried out and in terms of archaeology, art history and architectural history [4]. The methods used in the documentation of cultural heritage structures and the analysis of data are gradually developing, and the traditional methods used in the diagnosis of the current state of their historical structures and in the preparation of survey projects are replaced by digital and advanced technical documentation methods with the developing technology [5-6].

Considering the degree of destruction, geometric structure and accessibility of the structure in the studies conducted with traditional documentation methods, these methods are often insufficient and the data obtained are limited to 2D drawings such as plans, sections and elevations. Digital methods allow 3D models and detailed visuals of the current state of the structure to be prepared with precise measurements [7]. Today, digital archiving of cultural heritage structures and 3D models are more preferred than traditional documentation methods. With the development of technology, many data collection tools are used in documentation studies [8]. Data collection devices such as digital aerial cameras, thermal cameras, panoramic cameras, digital cameras, satellite images, model helicopters are used instead of commonly used instruments such as tape measure, laser meter, nivo, theodolite. Today, photogrammetry (terrestrial photogrammetry and UAV photogrammetry) and the use of terrestrial laser scanning are among the digital documentation methods that have started to be used with the developing technology. The data obtained with these documentation methods enable the creation of 3D point clouds of cultural heritage structures [9]. It is seen that these methods are advantageous in terms of measurement accuracy, precision and time compared to traditional methods [10]. The tools to be used in order to make the most accurate data to be collected for the documentation studies of the historical structure should be selected correctly. In the methods to be used for documentation and diagnosis, features such as easy access to equipment, low rate/probability of making mistakes, technological data production, low cost are taken into consideration. Considering the condition and characteristics of the structure, it should be ensured that the most accurate equipment, application and the methods to be selected are compatible.

1.1. Conceptual Framework

It is very important to carry out documentation studies in the protection of cultural and historical heritage. Developing technology has brought along the digitalization of documentation methods. In this part of the study, it is aimed to evaluate the studies for the documentation of cultural heritage, the documentation methods used in the documentation of cultural heritage structures and the digital documentation methods.

Güleç Korumaz et al. [11] examined documentation, the importance of documentation, the components of documentation, the methods of documentation and digital documentation methods. Pakben [12] explained the traditional and advanced techniques used to document cultural heritage structures and applied them with examples. Letellier et al. [13] addressed the issues of documentation, recording and information management in the conservation of historical buildings. In this study, the documentation process, traditional and digital documentation methods were evaluated. Hamamcıoğlu Turan [14] discussed the architectural photogrammetry method, one of the contemporary documentation techniques, made examinations through sample photographs using film and digital cameras, scanners and image evaluation software, and discussed the advantages of the applications. Duran & Toz [7] discussed photogrammetry, one of the methods of documenting cultural heritage values, and focused on the 3Dization of the obtained data with photomodeler software and the compatibility of the obtained digital data with Autocad and 3DS max programs. In this way, he stated that the data obtained for documentation studies, which is an interdisciplinary field, is an environment that can be accessed directly or indirectly by people. Yakar et al. [6] obtained data with photogrammetry techniques by measuring with total station for the documentation of Emir Saltuk Tomb and obtained 2D and 3D drawings of the work by transferring the obtained data to the photomodeler program. Ulvi et al. [15] mentioned the methods of documentation and created the 3D model by producing the point cloud with the photogrammetric techniques of the Aksaray Red Church (using UAV). Tekinöz & Sağıroğlu [1] evaluated the use of different phone applications used for survey studies of immovable cultural heritage buildings in documentation studies. Kaya & Yiğit [16] studied to obtain a 3D model of the building from the photos obtained with digital cameras. In this context, it was emphasized in the study that digital handheld cameras were insufficient for inaccessible parts of the structure and precise detail measurements and the necessity of UAV technology. Yakar et al. [17] used Faro Scene, JRC 3D Reconstructor and Autodesk Recap software programs to 3D the data obtained in the documentation studies and made comparisons over the Obelisk sample.

Over time, developments have been made about the protection of cultural heritage structures, and in this direction, the concept of documentation has gained importance and new methods have been developed. During the literature review, it is seen that studies on the subject of digital documentation have increased in recent years and the subject remains up-to-date and important. In addition, in the studies examined in the literature, it has been determined that the documentation methods used to analyze historical buildings differ and develop with the development of technology. However, it has been determined that there is no study that examines digital documentation methods in detail and systematically addresses the current technologies, programs and tools used in this process while focusing more on the use of a certain method, device or software. Based on this gap in the literature, in this study, first of all, the documentation of cultural heritage and its importance were mentioned, the components of the documentation were mentioned, and it was aimed to systematically address the methods, tools, software and application programs that can be used in the documentation, recording and data processing of cultural heritage structures.

1.2. Cultural Heritage and Conservation

Culture is a characteristic formation that contains all the values of a society materially and spiritually. There are many studies in the literature on the definition of the concept of "culture". The concept of culture in the dictionary is defined as "all the material and spiritual values created in the historical and social development process and the whole of the tools, hars, crops used in creating them and communicating them to the next generations, showing the extent of the sovereignty of man over his natural and social environment". The concept of heritage is defined as "what a generation leaves to the next generation". When both definitions are considered, cultural heritage can be considered as all of the material and spiritual values that societies leave for the next generations and it can be stated that societies assume the role of a bridge by keeping their past values alive in the present and future.

The concept of cultural heritage is a universal issue rather than nationality. Within the scope of the legal legislation on the protection of cultural heritage and its protection in a universal context, "Venice Regulation", "Convention on the Protection of the World Natural and Cultural Heritage", "ICOMOS", "ICOM", "Convention on the Protection of the European Architectural Heritage" and "European Convention on the Protection of the Archaeological Heritage" are some of them. According to the Turkish Law No. 2863 on the Protection of Cultural and Natural Heritage, "Cultural assets are all movable and immovable assets that are related to science, culture, religion and fine arts of prehistoric and historical periods or that have been the subject of social life in prehistoric or historical periods and have original scientific and cultural value above ground, underground or under water" (2863, article 3) [18]. Within the scope of this article, the main features of the works that are accepted as cultural assets and need to be protected are stated.

Cultural heritage buildings carry various values belonging to the period they were built and ensure that the values of the society in which they occur are kept alive. These are historical, social, cultural and architectural values. Cultural heritage are important values that enable the correct establishment of the knowledge transition between the past, present and future of the experiences and cultures of the people of the past throughout their lives. In this context, cultural heritage should be protected because it plays a role in the transfer of knowledge between generations, the protection and survival of cultural values, and adds historical depth to our perspective on life and guides us. Cultural heritage buildings that are already standing should be preserved, and besides, documentation studies should be carried out by investigating the structures that have lost or will lose their chance of preservation [19].

1.3. Documentation

Documentation, which is the first stage of cultural heritage conservation studies, is the physical definition of the current state of the structure in its most general definition [11]. Documentation is the recording and archiving of data obtained from cultural heritage works by various methods in order to ensure the transfer of information between generations. It is necessary for the preservation, survival, maintenance and control of the current work [20].

The documentation process of cultural heritage structures includes collaborative work of people who have knowledge/profession in different fields/disciplines [21]. Documentation studies starting with survey taking and visual studies are followed by damage analysis of the structure, material analysis and period analysis studies within the scope of analytical survey. The survey is the expression of the current state of the structure in accordance with the drawing technique. In this context, the survey is defined as "drawing documents that are prepared to describe the current situation of the whole or part of the structure or group of structures at certain scales and do not contain any comments or evaluations" [22]. Survey studies are the most important preliminary data of the documentation process and constitute a basis for damage analysis, restitution and restoration projects [4]. Survey drawings include layout plan, floor plans, ceiling plans, sections and elevation drawings, damage analysis, material analysis and 3D model of the structure. With the analytical survey studies, the work is examined in more detail and conservation decisions are taken in this direction [23].

The documentation process consists of two stages. These are the registration process and the documentation process. The registration process, which is the first stage, is the process of investigating what is necessary for the documentation of the cultural heritage work and the known information about the work. The second stage is the documentation process, which includes studies involving the recording of the data obtained in the registration process with the documentation methods selected in accordance with the work (Figure 1).

1.3.1. Importance of Documentation

With the documentation of a cultural heritage structure;

- The current status of the structure is recorded and defined.
- The current damage status of the structure is determined.
- By documenting the current state of the structure, a new function can be defined for use.
- Documentation studies, which constitute the first stage of conservation activities, form the basis for other stages (restitution, restoration) [3].
- Documentation studies are carried out in the digital environment and the data of the structure can be used by different disciplines and it sets an example for people who want to work [25].

• It carries the message of cultural heritage and itself from the past to the future and ensures that it is transferred to future generations in a sustainable way [23].

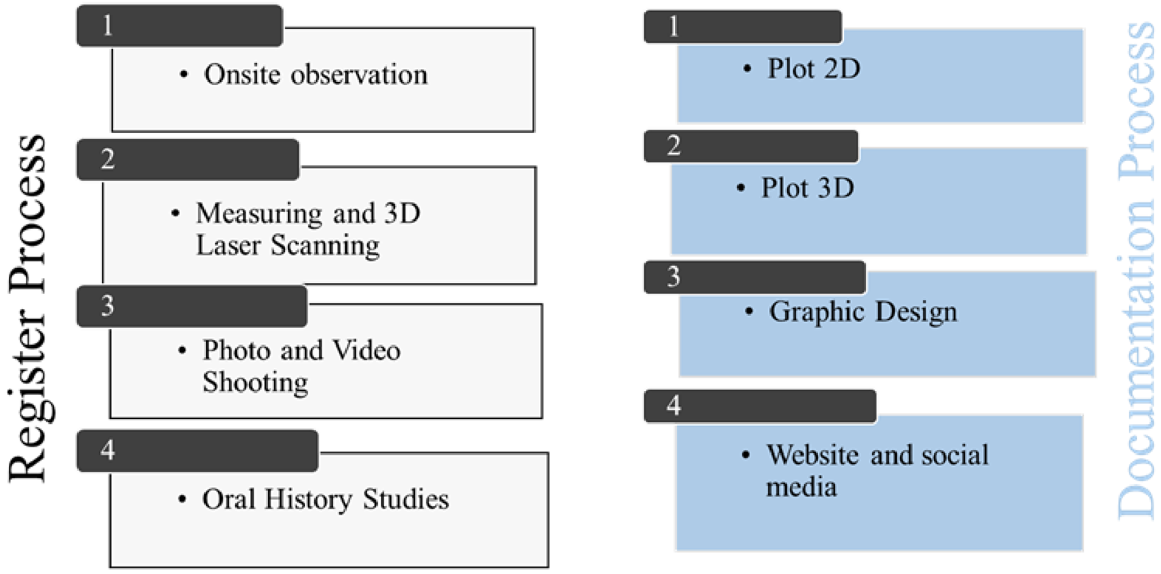

Figure 1. Registration and documentation process [24].

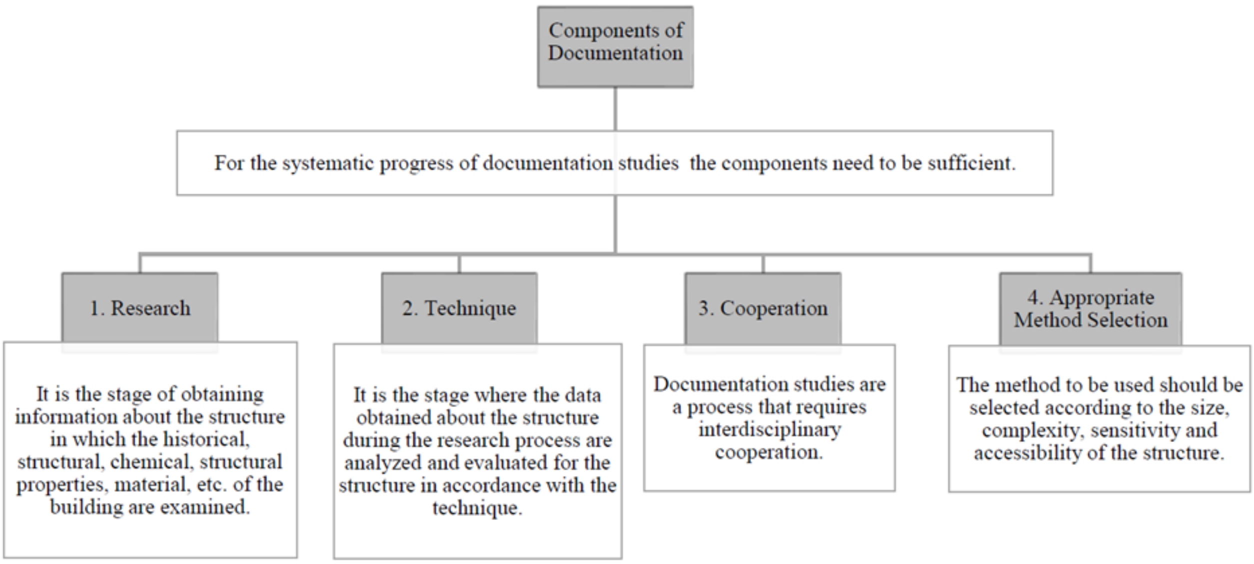

Figure 2. Components of documentation [12].

1.3.2. Components of Documentation

More than one component plays a role in the process of performing documentation studies (Figure 2). The fact that all components are complete and that studies are carried out with the right method will increase the accuracy and value of documentation studies.

2. Method

As a research method, a conceptual framework was created within the scope of the research, and a literature review was conducted on cultural heritage, documentation and documentation methods, and qualitative research method was adopted in the study. In the light of the data obtained, traditional and digital documentation methods have been evaluated and the methods, tools, software and application programs that can be used in the documentation, recording and data processing of cultural heritage structures have been systematically brought together.

3. Results

3.1. Methods used in documentation

In order to carry out documentation studies, it is necessary to obtain a large number of data and to process the obtained data. Conducting these studies requires interdisciplinary cooperation and technical work. In this context, the workflow consisting of survey, restitution and restoration stages should be planned and proceeded in the most accurate way.

There are different methods for survey studies, which form the basis of documentation and are the first stage of the process (Figure 3). Methods used for obtaining data in documentation can be classified as;

1. Oral-written documentation

2. Visual documentation
3. Documentation by measurement techniques
4. Documentation based on scanning
5. Software and application programs

Various software and application programs are also used to process the obtained data, transfer it to digital media, create 2D and 3D drawing documents and make interdisciplinary sharing.

1. ORAL -WRITTEN DOCUMENTATION METHODS	2. VISUAL DOCUMENTATION METHODS		3. DOCUMENTATION METHODS WITH MEASUREMENT TECHNIQUES		4. DOCUMENTATION METHODS BASED ON SCANNING	SOFTWARE-APPLICATION PROGRAMS
Written Documents Drawing Documents Graphic Documentation (with drawing) Information forms	Digital Handheld Cameras Cameras Smartphone Apps		Traditional Measurement Methods	Digital Measurement Methods	The global measurement coordinate system (Nivo Theodolite Total station 3D laser scanner Terrestrial laser scanning) Airborne Laser Scanning (LIDAR) Underground Radar (Geo-radar scanning) (Ground-penetrating radar (GPR)) Bathymetric (Submarine)	-Faro (Scene) -Topcon (Scan master) -Lieca (Geosystem hds cyclone) -Riegl (Riscan) -Netfab (Flexscan 3d) -Minolta (Polygon) -Surphaser (Geomagic, surph view, inventor autodesk) -Trimble (LFM ve realwork) -Z+F imager (LFM) - Stonex (Reconstructor) -Maptek (I-Site Studio Software) - Polywork -Point Cab -JRC 3D Reconstructor - Autodesk Recap -Photomodeler program -PİX4D program -Agisoft program -3D Reshaper program -HBIM (BIM for Heritage)
	Photogrammetry		Tape Measure Jalon Water balance Plumb Waterspout Measuring plug	Laser meter Smartphone Apps -Easy measure -Laser type (laser ruler) -Cam measure -Tape measure -Ruler phone - Photo ruler ABC -My measures -Magic plan		
	Aerial Photogrammetry (Balloon, Airplane, Model Airplane, Model Helicopter)	Terrestrial Photogrammetry				

Figure 3. Documentation Methods.

3.2. Technological/Digital documentation process

Recent technological developments have brought along the development of methods used in the documentation and diagnosis of cultural heritage structures. Traditional documentation methods are being replaced by digital documentation methods along with technological developments and are progressing rapidly. Digital methods have more advantages than traditional methods. It enables easier and more precise measurements to be made in determining and documenting the current state of the structure, enabling more accurate data to be obtained and is advantageous in terms of time.

In digital documentation methods, studies are carried out by choosing the most appropriate method for the current situation of the structure. The digital documentation process starts with the definition of the structure, the parametric object library of the structure is created and continued, and documentation work is carried out by creating 2D drawings and 3D models (Figure 4).

3.2.1. Registration process: Visual and/or numerical documentation methods

The first stage of the documentation process is to obtain data using visual and numerical documentation methods. In this process, interior places and exterior of the structure is visually documented with the help of smartphone cameras, digital handheld cameras and cameras as well as advanced technical methods of photogrammetry enhancing more professional ways of taking photographs of the structure (Figure 5).

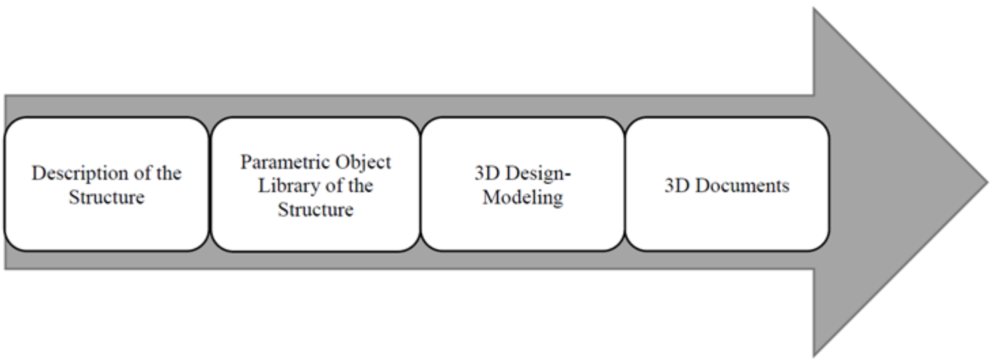

Figure 4. Digital documentation process.

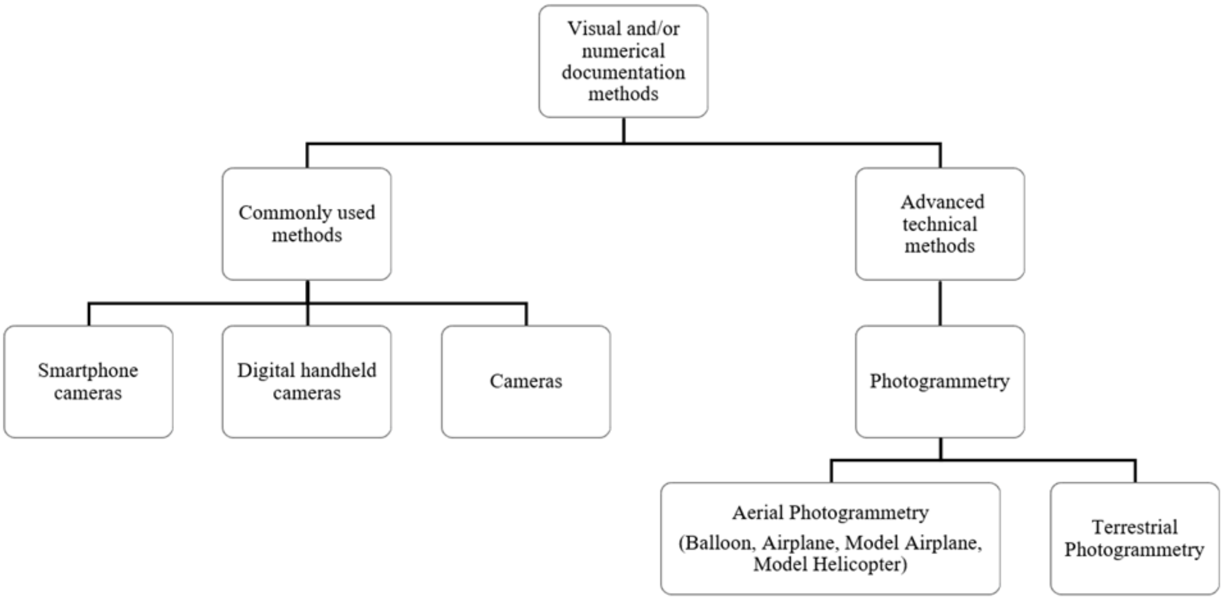

Figure 5. Visual/Numerical documentation methods.

3.2.2. Recording process: Methods of measurement

The second step of the documentation process consists of obtaining information about the structure and the data of its current status. In this context, this stage focusses on surveying process of the structure with the help of measurement studies. Traditional measurement methods include traditional instruments like tape measure, jalon, water balance, plumb, measuring plug etc. On the other hand, there are increasing number of technological/digital measurement methods ranging from laser meter and smartphone applications to the global measurement coordinate system, airborne laser scanning, underground radar, bathymetric measurement methods (Figure 6).

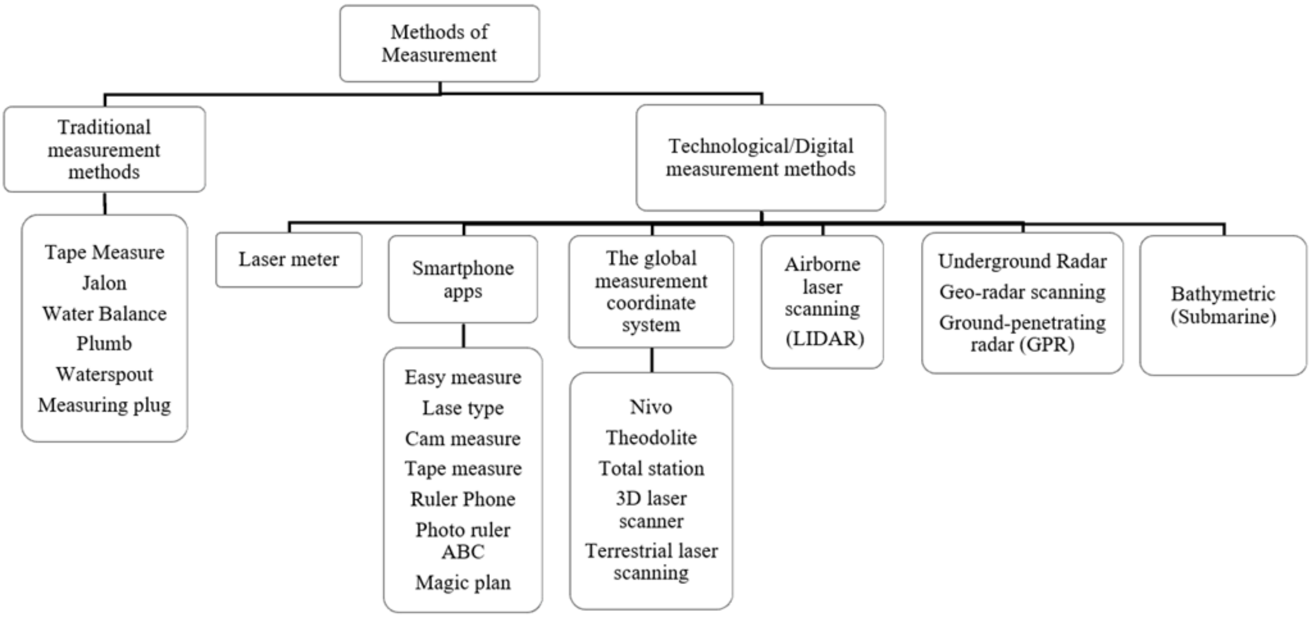

Figure 6. Methods of measurement.

3.2.3. Documentation process: Data processing methods/programs

The data processing stage in which the data obtained during the survey process is digitized constitutes the final stage of the documentation studies. Data sources may be damaged during the digitization process of the obtained data. In this context, hardware and software programs are needed for the transfer and availability of digital documents to future generations [26]. The programs used in digitization differ according to the methods used to obtain the data and the documents required for the work. Photomodels, Faro Scene, Autodesk Recap, JRC 3D Reconstructor, 3D Reshaper, HBIM are commonly used software in the processing of the obtained data. Each software works with different methods, but the working method of all of them is the processing of photogrammetric research data. Photomodels software provides 3D data and images from photos and videos, while Autodesk Recap, JRC 3D Reconstructor are photogrammetric software that create 3D models that work with laser scanners that scan photos and videos as well as 3D. In addition, the Faro Scene software has been developed for Faro Focus and 3D laser scanning devices. HBIM software covers not only the documentation of the current status of the cultural heritage structure, but also the deterioration of the structure over time and the evaluation of the interventions to be made to the structure. In this context, the data processing methods and programs actively used today are summarized in Figure 7.

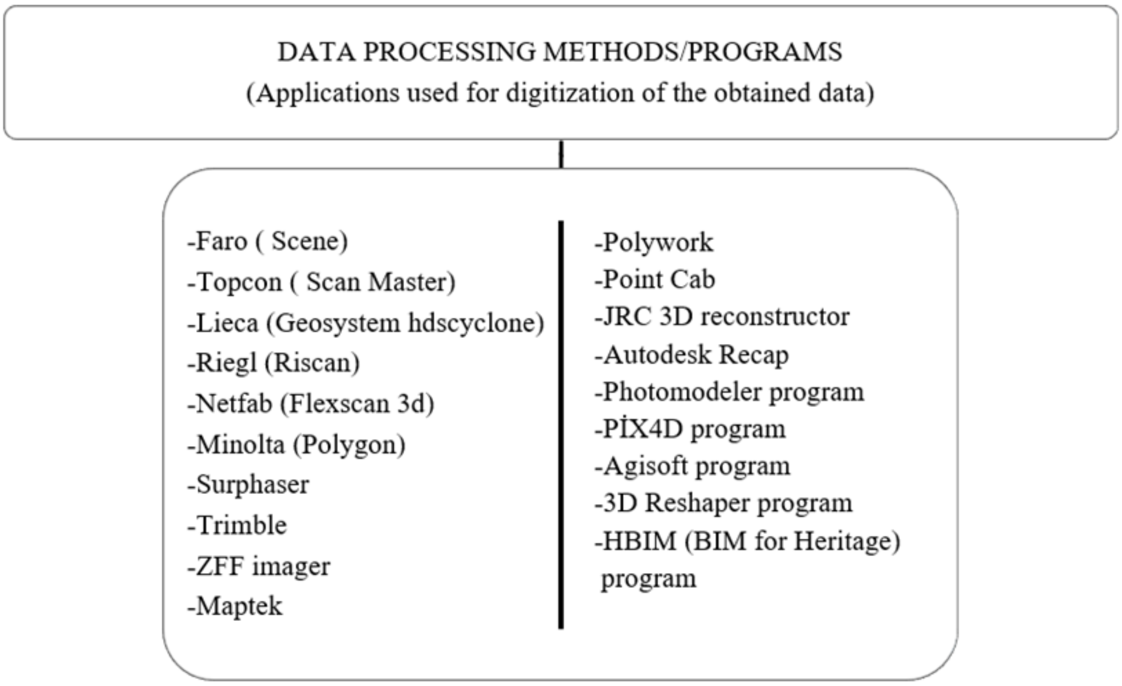

Figure 7. Data Processing Methods/Programs.

4. Discussion and Conclusion

The data obtained by using traditional methods in the documentation studies of cultural heritage structures allow the creation of more 2D documents of the structure. However, traditional methods are not always sufficient in documenting cultural heritage structures and obtaining all the data of the structure in survey measurements. Using traditional documentation methods in the documentation of large-scale cultural heritage buildings, which are difficult to reach, located on narrow streets, have a high level of destruction, and are composed of complex geometric shapes, causes problems in terms of time and workforce. Traditional methods used can make data consistency difficult, increase the error rate in the evaluation results and cause errors in the process of making decisions for restoration.

Digital documentation of cultural heritage structures allows for a more precise assessment study by increasing the accuracy of data collection and analysis studies. The use of digital technologies also makes it easier to store, share and manage the data at hand. Measurements of geometric shapes such as domes, arches, etc. encountered in the historical structure with digital documentation techniques can be made in a short time by giving more accurate measurement results in the regions that are difficult to reach in the structure and need to be measured by installing a scaffold. With digital documentation methods such as photogrammetry to be used, in a short time, the documentation data of the structure can be obtained with studies with less workforce, and by creating 3D models with software programs, the damages that occur in the structure and will occur over time can be determined and the appropriate intervention method can be selected [27]. As a result of the digital documentation process consisting of various stages, architectural model of the building in virtual reality and animation videos with virtual tour are obtained. With the use of virtual models and virtual tours, access to the information of the structures with limited access will be facilitated, interdisciplinary information exchange could be given an opportunity and the structures could be analyzed [28]. The digital documentation methods used (photogrammetry, 3D laser scanning, software programs) can work in harmony with each other and the data obtained can be easily shared by different occupational disciplines. With digital technologies such as laser scanners and UAV technology, point clouds of the structure are obtained. In this way, orthophotos and panoramic images of the structure are obtained and a connection is established between 2D and 3D data [29]. Digital methods are used not only in building scale but also in documenting complex structures and archaeological sites. Periodic analyses can be made by obtaining drawings and models of the layers of structures and archaeological areas containing different periods in 2D and 3D [30].

Accuracy is one of the most important factors in documenting the current status of the work. The accuracy of the 3D documents to be created for the artifact is important for the preservation of the historical structure to be transferred to future generations. The software used in the data processing process following the data acquisition stage, which is the first stage of documentation, should ensure the sensitive processing of the scan data. Software programs covering the creation of the 3D model, restitution and restoration works may differ according to the structure and required documents. Photomodels, Faro Scene, Autodesk Recap, JRC 3D Reconstructor, 3D Reshaper, HBIM are the most preferred software programs today.

Digital systems based on today's technology are also widely used in modern building production and every stage of the construction process can be calculated in advance. It is even seen that, thanks to digital systems, building production is done using 3D printers. In this context, it is thought that the use of digital systems will provide important usage opportunities for data collection, modeling and analysis of historical buildings in different scenarios [31].

As a result, with the development of technology, the emergence of different methods, tools, applications and software allows the use of alternative methods in documentation studies. Choosing the appropriate methods for the needs and requirements of the structure will be important in the accuracy of the resulting products. Adapting to the developing technology in the field of documentation and following the increasing number and types of digital technologies and developments are among the primary tasks of the actors involved in the process, especially architects.

Author contributions

Fatma Zehra Çakıcı: Conception of idea, introduction, methodology, analysis and discussions, conclusions, writing-reviewing and editing. **Rabia Kaçdi:** Literature review, data collection, analysis and discussions, writing-original draft preparation.

Conflicts of interest

There is no conflict of interest between the authors.

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Cultural Heritage and Science – 2023, 4(2), 78-87

Cultural Heritage and Science

https://dergipark.org.tr/en/pub/cuhes

e-ISSN 2757-9050

The divergent perspectives of civil engineers and architects in historic building restoration: A comparative analysis

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Keywords
Civil Engineering
Architecture
Conservation
Restoration
Architectural Heritage

Research Article
DOI: 10.58598/cuhes.1354966

Received:04.09.2023
Revised: 23.10.2023
Accepted:25.10.2023
Published:27.10.2023

Abstract

This article delves into the distinctive viewpoints held by civil engineers and architects during the process of restoring historic buildings. The restoration of heritage structures involves complex decisions and multidisciplinary collaboration, where professionals from varying backgrounds contribute their expertise. Notably, architects and civil engineers approach restoration with different lenses, stemming from their unique educational backgrounds, professional experiences, role expectations and many various other factors. These divergent perspectives may significantly impact the overall restoration process, influencing design choices, material selection, structural interventions, and project outcomes. To shed light on this phenomenon, this study employs a comprehensive methodology. The research incorporates a meticulous literature review to elucidate existing knowledge on the subject. Subsequently, a structured questionnaire is administered to a diverse pool of practicing civil engineers and architects, aiming to capture their distinct viewpoints and perceptions regarding historic building restoration. The survey is carefully designed to explore a spectrum of factors, including project goals, design approach, project involvement, decision-making processes, and challenges. the collected data, comparing and contrasting the responses of civil engineers and architects were also presented in this research. The analysis uncovers nuanced variations in how these professionals prioritize different aspects of restoration, from historical authenticity and aesthetic considerations to structural stability and feasibility. The implications of these divergent perspectives are critically evaluated, emphasizing how they influence project outcomes and the holistic restoration process. Furthermore, the article addresses the potential benefits of bridging these perspectives, fostering enhanced interdisciplinary communication and collaboration. This article provides a comprehensive understanding of the distinct viewpoints that civil engineers and architects bring to historic building restoration. By recognizing these disparities and their implications, the restoration field can work toward more effective integration of expertise, contributing to more informed decision-making and successful restoration projects that balance both functional and aesthetic considerations.

1. Introduction

In the realm of the built environment, the distinctions between architects and engineers have long been recognized. These two professions, integral to the design and construction of structures, bring their unique perspectives, skills, and objectives to the table.

As an illustration, Davis [1] points out some differences between engineers and architects in curriculum, standards of evaluation, and allied fields in his research. Cruise [2] discusses the contested territory between architects and engineers, exploring the challenges faced in defining their roles and the increasing need for interdisciplinary collaboration. Another study by Khan and Tunçer [3] acknowledges that while boundaries within the field of engineering are blurring, architects and engineers are still viewed as distinct groups. This indicates that their approaches to architectural heritage may differ due to their unique perspectives and expertise. Holford [4] argues that while architecture and engineering share common principles, they are often seen as separate due to the growth of technology and specialization.

The division of construction history into two main areas, namely the history of structural design and the

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Cite this article (APA);

Aktuna, M. E. (2023). The divergent perspectives of civil engineers and architects in historic building restoration: A comparative analysis. Cultural Heritage and Science, 4(2), 78-87

history of building practice, has been a subject of interest, as described by Summerson [5]. Saint [6] extends this notion by highlighting the evolution of history as it branched into art history, architectural history, and eventually engineering history, which collectively encompass a broader perspective known as construction history, a field that aims to comprehensively address the various professionals, including architects, engineers, builders, and craftsmen, involved in the complex realm of construction. Whitney [7] further expounds on this evolution by observing that the Renaissance era contributed to the separation of engineering and architecture into distinct categories, with one emphasizing structural aspects and the other focusing on aesthetics. Saint [6] states that this divide persisted through history, as exemplified by the career of Perronet, who sought to unite architecture and engineering within a social framework. Whitney [7] similarly indicates that "The development of the Ecole des Ponts et Chausses and the further need to divide and specialize the training and the labour of both the engineer and the architect, split the professions more definitively into segregated roles.". Supportingly, Argan [8] states "The one emphasizing the engineering aspect, i.e. structural analysis and calculation, and the other stressing the architectural aspect, i.e. the aesthetic appearance.". According to Straub [9], the post-enlightenment and especially the Industrial Revolution era further accentuated this division, as seen in the specialized training and distinct roles of engineers and architects. This historical context may also give rise to the differences between these two professions and the potential conflicts resulting from different approaches.

Whitney [7] thinks that "the development of the engineer created a split in the building profession"; as civil engineers bear a primary concern for the structural integrity of buildings, possessing a specialized aptitude to assess building conditions and devise interventions that ensure safety, on the other hand architects center their focus on the aesthetic and historical significance of structures, driven by a commitment to preserving architectural authenticity.

Restoration projects, operating as multidisciplinary and interdisciplinary endeavours, provide an intriguing context to explore whether such divisions and conflicts exist between architects and engineers. As suggested by Straub, this separation allows for diverse perspectives in designing structures, with one emphasizing engineering aspects and the other accentuating architectural aesthetics.

According to Whitney [7], splitting of the roles into the liberal (thinking) of a building and the mechanical (execution) of the building made the professions more definitively into segregated roles and the distance between these professions becomes a new barricade as the professions have become more expert and distinct from other aspects of building development. This barricade which may cause disparity in perspectives between civil engineers and architects may also rise to conflicts. For instance, civil engineers may advocate for structural modifications that could potentially alter a building's external appearance, while architects, recognizing the historical import of such structures, may resist these alterations to safeguard the building's inherent historical essence. Consequently, the articulation of differing viewpoints between these two professions becomes pivotal, as it influences the overall outcome of restoration projects.

Thammavijitdej and Horayangkura's [10] investigates interdisciplinary conflicts and resolutions as cultural behavior occurring between two professions, architects and engineers. In the study conducted by Genç [11], an investigation was conducted for the reasons of conflicts among architects and engineers working on construction projects. Jaffar et al. [12] in their research, considered delays in instructions from contractors, architects, or engineers as factors contributing to conflicts arising from technical issues. Furthermore, the study by Çivici [13] explored the relationship of the conflict resolution approaches architects and civil engineers involved in construction project organizations.

Marra et al. [14] states the restoration of historic buildings presents a multifaceted endeavour that necessitates the expertise of various professionals, including civil engineers and architects and it is a subject of scholarly interest whether the barricades mentioned by various scholars may be observed among architects and engineers in the field of restoration. These two separate disciplines naturally offer differing perspectives on restoration, thereby possibly contributing to a divergence in their approaches to this intricate task.

Fernandez [15] posits the conservation process is complex and not only requires a technical approach from an engineer, but may also need to address a variety of wider aspects, such as cultural and artistic qualities, or be based on a combination of scientific and humanistic values. Rabun [16] suggests that in the conservation process, engineers and architects should engage in a collaborative preliminary assessment. Di Biase and Albani [17] assert that restoration, from its inception, should function as a distinct discipline that explicitly delineates the competencies required of architects and those possessed by civil engineers. Lourenço [18] underscores that conservation engineering necessitates a unique approach and skill set distinct from those employed in the design of new constructions. While the conventional belief assigns responsibility for the restoration of historic buildings mostly to architects, D'Ayala [19] contends that structural engineers, like many participants in restoration projects, must adhere to overarching conservation guidelines.

This article undertakes a comprehensive examination of the divergent perspectives inherent in civil engineers and architects during historic building restoration. It commences by offering a concise overview of both professions and their distinct roles within the restoration domain. Subsequently, the article presents the outcomes of a survey conducted to elicit the viewpoints of practicing civil engineers and architects on a range of restoration-related issues. The analysis of survey results highlights dissimilarities in how these professionals prioritize distinct facets of restoration, including considerations of historical fidelity, aesthetic attributes, and structural robustness.

The culmination of this article involves a contemplative exploration of the implications borne by these divergent viewpoints for the restoration process. A critical contention is posited that an enhanced recognition and understanding of these disparities could pave the way for the formulation of more efficacious strategies that amalgamate the expertise of civil engineers and architects. This effort holds the potential to foster a synergy that culminates in informed decision-making, thereby engendering successful restoration projects that judiciously balance both utilitarian and aesthetic aspects.

2. Method

Initially, a literature review was undertaken to comprehensively explore the subject. This was motivated by the recognition that the restoration of architectural heritage entails intricate interactions among diverse stakeholders, a subset of which comprises architects and civil engineers.

Primary emphasis was placed on an investigation into the historical evolution of architects and engineers, with the aim of comprehending their origins and subsequent divergence. This approach was pursued to identify potential variances in their viewpoints and methodologies. Consequently, a broadening of the research scope beyond restoration literature occurred, encompassing more extensive subjects, notably the historical development of architects and engineers. Furthermore, various stages of architectural and engineering processes were explored to examine distinctions in approaches and perspectives during design and construction activities.

The inquiry was initiated to examine the emergence and subsequent differentiation of architects and engineers in order to discern disparities in their perspectives and approaches. This encompassed not only the exploration of literature related to restoration but also the examination of interconnected subjects, such as the history of architecture and history of construction. Furthermore, an investigation into divergences in the approaches and perspectives of architects and engineers during design and construction activities was conducted. Regrettably, limited resources were available on the research topic.

Following this literature review, the subsequent phase involved the execution of interviews with experts, meticulously designed to glean insights into the distinct perspectives harboured by architects and civil engineers. These consultancies were conducted with adept professionals possessing specialized knowledge in conservation, thereby ensuring an informed foundation for formulating key thematic elements for the forthcoming questionnaire.

The decision to conduct a survey aimed at probing differences in perspectives led to the initial step of formulating a survey. This approach was considered instrumental in identifying relevant queries that could effectively capture perspective distinctions. Following the articulation of the research problem, a timeline of three weeks for the questionnaire was established. The duration of the survey was selected as three months, as according to Zheng, 95% of the responses were collected at the end of the third week [20].

Afterward, three experts in restoration field, each with diverse backgrounds, including an architect 20 years in the private sector, a civil engineer in government employment, and an architect as an academic that is researching in architectural heritage restoration, were contacted. Their contributions substantially enhanced the development of the questionnaire. This collaborative effort culminated in the creation of survey items, then the survey was adapted to an online platform, and administered.

The questionnaires are widely employed methodologies in scholarly researches to procure data and glean insights into diverse subject matters. These methodological tools furnish researchers with the capacity to amass both qualitative and quantitative data, thus affording a comprehensive comprehension of the researched domain. The questionnaires adopt a structured array of queries, to which participants respond in a standardized manner. Their aptitude lies in facilitating the compilation of quantitative data from a substantial cohort of respondents [21].

The scholarly literature indicates that questionnaires have the potential to serve as dependable and valid instruments for data collection in the realm of academic research. Wong et al. [22] elucidate the process of crafting a survey questionnaire, attesting to its possession of attributes such as sensitivity, reliability, and validity. Lefever's investigation in 2007 underscored that online surveys offer access to substantial and widely dispersed populations, enabling swift data acquisition; however, the challenge of effectively reaching the intended sample remains [23]. Additionally, Roztocki's preliminary exploration in 2001 delved into the utilization of internet-based surveys as tools for academic research and underscored the necessity for future inquiries in the realm of internet-based survey methodology [24]. Collectively, these studies advocate for the credibility of online surveys as a robust avenue for data collection in academic research. Nonetheless, researchers must remain cognizant of limitations and variables that could impact response rates [25].

Consequently, an online survey was devised to encompass the opinions and viewpoints of architects and civil engineers actively engaged in the conservation of architectural heritage. The survey questionnaire, comprising multiple-choice inquiries, was structured to encapsulate essential facets of their perspectives. The provision is of significance, wherein participants were furnished with the chance to articulate their individual viewpoints through open-ended response alternatives, thereby enabling the acquisition of their insights in an unconstrained manner alongside the structured choices. This dual approach aimed to encompass both quantitative and qualitative aspects of their perspectives, thereby fostering a comprehensive understanding of the nuances within their viewpoints.

A total of ten questions were prepared during the survey creation process. The first two questions were used to discern the respondent's professional background, whether they were an architect or a civil engineer, and to gauge their level of experience. Subsequently, in the third question, respondents were asked to rank the importance of seven project goals. The fourth question aimed to ascertain the frequency of interdisciplinary collaboration. The fifth question sought to determine respondent preferences for modern or traditional materials and techniques. The sixth question was designed to gather information regarding the ease of communication and collaboration between the two professional groups. The seventh question was concerned with identifying whether respondents had experienced conflicts between architects and engineers during restoration processes. In the eighth question, respondents were asked if involving both civil engineers and architects in decision-making contributed to improved project outcomes. The ninth question aimed to identify the most significant challenges encountered when collaborating with professionals from the other discipline. The final question inquired about potential outcomes resulting from enhanced collaboration between civil engineers and architects. All questions were prepared in alignment with the literature review.

According to Lin [26], the universe of a research, encompassing all relevant sources, is referred to as the population of the study, and it is imperative to include everyone related to the problem to reach a comprehensive outcome. In this study, the universe was defined to consist of a total of 20 individuals, comprising 10 architects and 10 civil engineers, all actively working in the field of restoration, and the subsequent analyses were based on this number. The data collected through online survey were subjected to descriptive statistical and percentage analyses using Microsoft Excel software. The findings are elaborated upon in the Results section.

3. Results

The total number of participants comprised 20 individuals, evenly divided between architects and civil engineers, each accounting for 50% of the total. The architects' average experience spanned 15.6 years, with the most experienced individual holding 30 years of experience. Correspondingly, civil engineers possessed an average experience of 6.1 years, with the most experienced participant boasting 18 years of expertise.

Participants were tasked with ranking a series of project goals according to their perceived significance. This list of project goals was formulated subsequent to the analysis of semi-structured interviews conducted with experienced conservation experts. The delineated project goals encompassed "Preservation of Historical Authenticity", "Enhanced Aesthetics and Visual Appeal", "Structural Stability and Safety", "Sustainability and Environmental Impact", "Functional Adaptation", "Community Engagement and Public Use", and "Economic Viability and ROI".

In terms of the most and second most important project goals, 90% of participants, a total of 18 individuals, singled out "Preservation of Historical Authenticity". Simultaneously, 80% of participants, comprising 16 individuals, deemed "Structural Stability and Safety" as either the most or second most vital project goals.

In contrast, "Economic Viability and ROI" were regarded as either the least or the second least important project goals by 60% (12 participants), "Sustainability and Environmental Impact" held similar positions for 50% (10 participants), while "Community Engagement and Public Use" was ranked as the third least important project goal by 45% (9 participants). "Functional Adaptation" and "Enhanced Aesthetics and Visual Appeal" were ranked as the third and fourth most important project goals respectively (Table 1).

Within the context of architect perspectives, 6 participants opted for Preservation of Historical Authenticity as the most important project goal (60%), with 3 selecting it as the second most important. Conversely, 5 architect participants considered Economic Viability and ROI as the least important (Table 2). Similarly, among civil engineer perspectives, 6 participants designated Structural Stability and Safety as the most important (60%), with 3 marking it as the second most important. Additionally, 4 civil engineer participants identified Sustainability and Environmental Impact as the least significant (Table 3).

When considering experience, participants with more than 10 years of experience exhibited a notable inclination. Out of 8 such participants, 5 (62.5%) prioritized Preservation of Historical Authenticity among their project goals and 2 individuals (25%) deemed Structural Stability and Safety as their most important project goal. For participants with up to 10 years of experience, out of 12 individuals, 6 (50%) indicated Structural Stability and Safety as a top priority, with 5 (41.67%) selecting Preservation of Historical Authenticity in the first place.

Table 1. Project goals rankings according to the perceived significance.

	Σ	%	Σ	%	Σ	%	Σ	%	Σ	%	Σ	%	Σ	%
Preservation of Historical Authenticity	10x	50	7x	35	1x	5	-	-	-	-	1x	5	1x	5
Enhanced Aesthetics and Visual Appeal	-	-	1x	5	5x	25	6x	30	3x	15	2x	10	3x	15
Structural Stability and Safety	8x	40	7x	35	3x	15	1x	5	-	-	1x	5	-	-
Sustainability and Environmental Impact	-	-	-	-	1x	5	5x	25	4x	20	5x	25	5x	25
Functional Adaptation	1x	5	4x	20	8x	40	1x	5	3x	15	3x	15	-	-
Community Engagement and Public Use	1x	5	-	-	-	-	4x	20	7x	35	5x	25	3x	15
Economic Viability and ROI	-	-	1x	5	2x	10	3x	15	3x	15	3x	15	8x	40

Table 2. Project goals rankings according to the perceived significance of architects.

	Σ	%	Σ	%	Σ	%	Σ	%	Σ	%	Σ	%	Σ	%
Preservation of Historical Authenticity	7x	70	3x	30	-	-	-	-	-	-	-	-	-	-
Enhanced Aesthetics and Visual Appeal	-	-	-	-	2x	20	2x	20	3x	30	1x	10	2x	20
Structural Stability and Safety	2x	20	5x	50	2x	20	1x	10	-	-	-	-	-	-
Sustainability and Environmental Impact	-	-	-	-	-	-	4x	40	1x	10	4x	40	1x	10
Functional Adaptation	1x	10	2x	20	6x	60	-	-	1x	10	-	-	-	-
Community Engagement and Public Use	-	-	-	-	-	-	2x	20	3x	30	3x	30	2x	20
Economic Viability and ROI	-	-	-	-	-	-	1x	10	2x	20	2x	20	5x	50

Table 3. Project goals rankings according to the perceived significance of civil engineers.

	Σ	%	Σ	%	Σ	%	Σ	%	Σ	%	Σ	%	Σ	%
Preservation of Historical Authenticity	4x	40	4x	40	1x	10	-	-	-	-	1x	10	-	-
Enhanced Aesthetics and Visual Appeal	-	-	1x	10	2x	20	4x	40	1x	10	1x	10	1x	10
Structural Stability and Safety	6x	60	3x	30	1x	10	-	-	-	-	-	-	-	-
Sustainability and Environmental Impact	-	-	-	-	1x	10	1x	10	3x	30	1x	10	4x	40
Functional Adaptation	-	-	2x	20	3x	30	1x	10	1x	10	3x	30	-	-
Community Engagement and Public Use	-	-	-	-	-	-	2x	20	4x	40	2x	20	2x	20
Economic Viability and ROI	-	-	-	-	2x	20	2x	20	1x	10	2x	20	3x	30

Regarding collaboration across disciplines during project design, all participants concurred with occasional or more frequent collaborative efforts. The distribution indicates 45% (9 participants) for "Very frequently" 25% (5 participants) for "Frequently" and 30% (6 participants) for "Occasionally"(Figure 1).

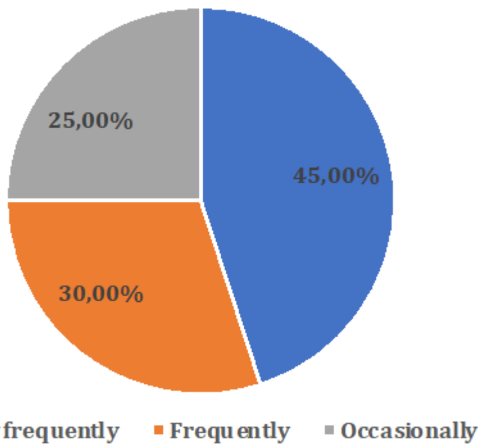

Figure 1. Distribution of frequency of collaboration with professionals from the other discipline during project design

In response to the query concerning material and technique preferences for restoration, 55% (11 participants) favoured traditional materials and/or techniques for historical accuracy, while 45% (9 participants) opted for modern materials and/or techniques for enhanced durability (Figure 2).

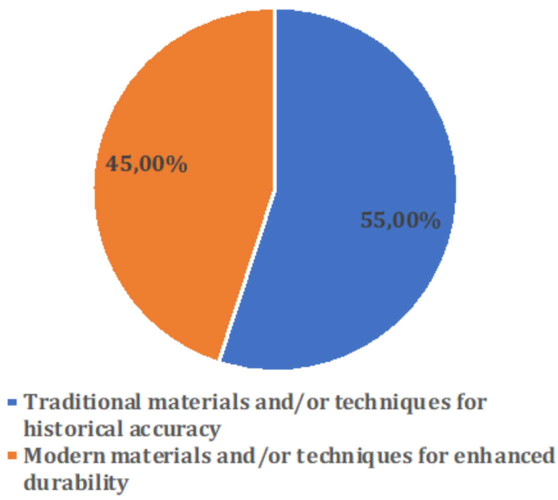

Figure 2. Distribution of prioritization of traditional materials and techniques over modern materials and techniques

This preference demonstrated a 70% inclination among architects towards traditional choices and a 60% inclination among civil engineers towards modern options.

Considering ease of communication and collaboration across disciplines, 15% (3 participants) strongly agreed, 30% (6 participants) agreed, 40% (8 participants) remained neutral, and 15% (3 participants) disagreed (Figure 3).

In relation to conflicts between architects and civil engineers arising during project execution, 10% (2 participants) strongly agreed, 45% (9 participants) agreed, 40% (8 participants) were neutral, and 5% (1 participant) disagreed (Figure 4).

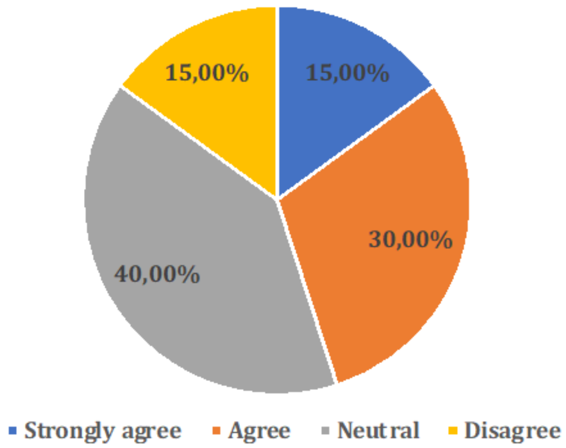

Figure 3. Distribution of collaboration ease with professionals from other disciplines

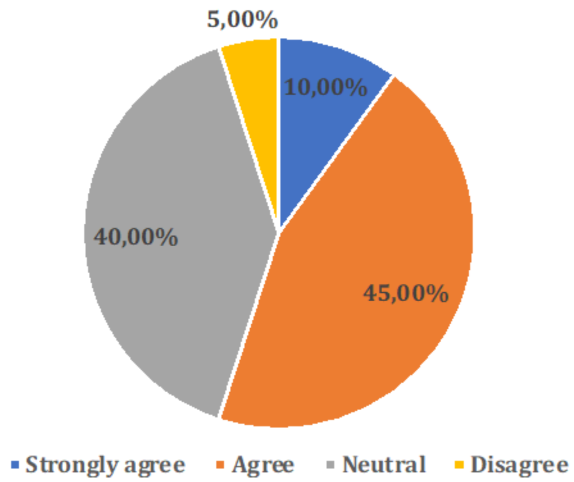

Figure 4. Distribution of frequency of conflicts between civil engineers and architects during project execution

In terms of involving both civil engineers and architects in decision-making and its impact on better project outcomes, 17 participants (85%) have generally agreed or strongly agreed on involving both parties during restoration, better project outcomes would be reached. On this matter, 50% (10 participants) strongly agreed, 35% (7 participants) agreed, 10% (2 participants) were neutral, and 5% (1 participant) disagreed (Figure 5).

Regarding challenges encountered in interdisciplinary collaboration, 35% (7 participants) cited "Differing philosophies," 25% (5 participants) mentioned "Lack of interdisciplinary understanding," 15% (3 participants) identified "Disagreements on materials and/or techniques selection," another 15% (3 participants) noted "Balancing aesthetics with functionality," 5% (1 participant) referred to "Lack of education, knowledge, perspective, or experience in historic building conservation," and a similar 5% (1 participant) highlighted the challenge specific to Türkiye, where professionals beyond architects lack education in conservation principles and apply standards designed for new structures (Figure 6).

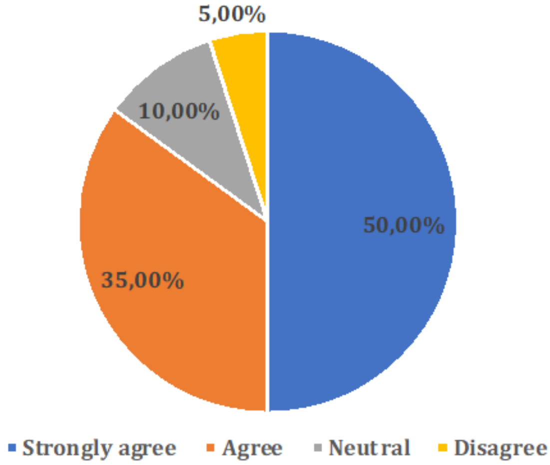

Figure 5. Distribution of perceptions of collaborative decision-making in restoration works

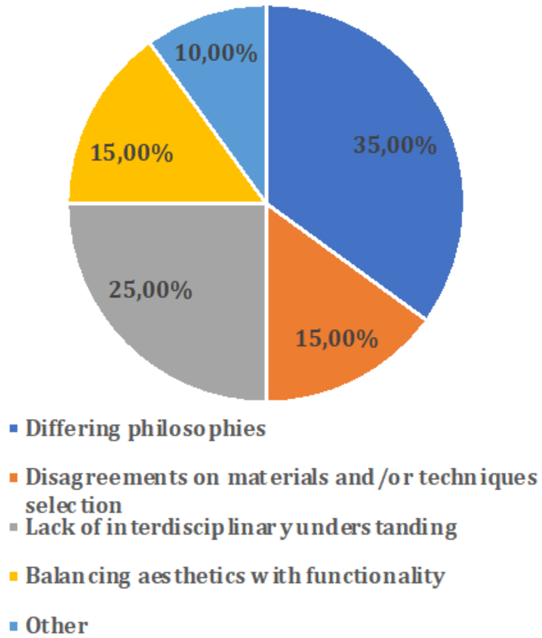

Figure 6. Distribution of challenges in collaboration with professionals from the other discipline

As for the anticipated outcomes of improved collaboration between civil engineers and architects, 50% (10 participants) opted for "Enhanced preservation of cultural heritage," 25% (5 participants) favoured "More sustainable restoration practices," 10% (2 participants) chose "Greater innovation in restoration techniques," and 5% (1 participant) each selected "Accelerated project approvals" "Increased stakeholder satisfaction" and "Consistent adherence to heritage guidelines" (Figure 7).

4. Discussion

The analysis of participants' rankings unveils distinct trends in their perceptions and preferences. The assessment of the importance of project goals in architectural heritage restoration reveals discernible patterns. The emphasis on historical authenticity and structural stability signifies the importance attributed to preserving the integrity and safety of historic structures. Conversely, the relatively lower ranking of "Economic Viability and ROI" and "Sustainability and Environmental Impact", may imply a reduced focus on immediate financial returns and environmental concerns. This could be attributed to specific contextual factors or participant priorities.

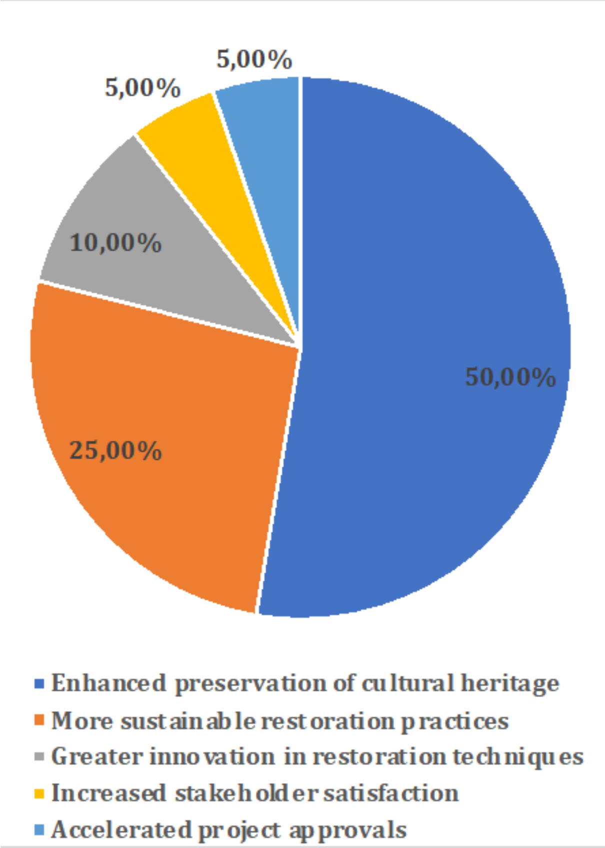

Figure 7. Distribution of anticipated outcomes of improved collaboration between civil engineers and architects

The findings underscore consistent patterns in the priorities of architects and civil engineers. Architects prioritize historical authenticity (with an average score of 1.3) and civil engineers selects structural stability (with an average score of 1.5) as the most important. This difference basically reflects the divergent perspectives of the parties. They also diverge in their perspectives on economic viability and ROI, with architects deeming it less significant (with an average score of 6.1). Sustainability and environmental impact may also hold less importance for civil engineers (with an average score of 5.6), contrasting with their counterparts' perspectives. These findings highlight architects' and civil engineers' distinct viewpoints and their divergent emphasis on the most and the least important project goals.

Upon examining the data concerning participants' experience, it is evident that those with over ten years of experience exhibit a noticeable tendency towards "Preservation of Historical Authenticity" (with an average score of 1.38). This observation implies that individuals possessing experience place significant importance on conserving historical authenticity, likely stemming from their profound grasp of the cultural and historical significance inherent to architectural heritage. Furthermore, within this subset of participants, there was also a consensus in identifying "Structural Stability and Safety" as a paramount project goal (with an average score of 2.00). This underscores the notion that seasoned professionals hold a strong commitment to ensuring the structural soundness and safety of historical structures, possibly influenced by their exposure to a spectrum of structural challenges and complexities over the course of their careers.

For participants with up to ten years of experience, the findings underscore the prioritizing Structural Stability and Safety (with an average score of 1.75). Moreover, within this same group, there was unanimous agreement in designating Preservation of Historical Authenticity as a top priority (with an average of 1.92). This suggests that while these participants may slightly favour structural stability, their devotion to upholding historical authenticity remains prominent as well.

Collaboration emerges as a prevailing theme, with unanimous agreement among all participants on their engagement in collaborative efforts to varying degrees. The data underscores the significance of interdisciplinary cooperation for successful restoration outcomes. Collaborative frequency distributions reveal extensive engagement, particularly in the "very frequent" and "frequent" categories, suggesting the prevalence of consistent interdisciplinary collaboration. A smaller yet notable portion acknowledges occasional collaboration, indicating recognition of cross-disciplinary contributions even among those who collaborate less frequently.

The data underscores different preferences between architects and civil engineers on the query concerning material and technique preferences for restoration. A strong inclination towards traditional choices among architects aligns with their emphasis on historical authenticity, while civil engineers' preference for modern options indicates a focus on structural integrity. The varying preferences underscore architects' commitment to preserving historical character and civil engineers' dedication to structural resilience.

The findings also portray a varied perspective regarding the effectiveness of communication and collaboration between architects and civil engineers during project design. This indicates that, while certain participants view collaboration as seamless and productive, others encounter hurdles or difficulties in their cross-disciplinary interactions. The outcomes also suggest that a notable portion of participants acknowledge the likelihood of conflicts arising during project execution due to disparities between civil engineers and architects. Nevertheless, the presence of neutral and dissenting responses implies that conflicts may not be universally perceived as a pervasive concern.

The findings also reveal a diverse viewpoint on the effectiveness of communication and collaboration between architects and civil engineers during project design. This indicates that while certain participants perceive collaboration as efficient and productive, others may encounter difficulties or challenges in their interdisciplinary interactions.

The outcomes also infer that a notable portion of participants acknowledge the likelihood of conflicts arising during project execution due to disparities between civil engineers and architects. However, the presence of neutral and dissenting responses also indicates that not all participants universally regard conflicts as a widespread issue.

Furthermore, the results indicate a generally positive perspective among participants regarding the advantages of collaborative decision-making involving both civil engineers and architects. The prevalent agreement suggests that the majority of participants recognize the value of interdisciplinary collaboration and its potential to enhance project outcomes.

The range of responses provided by participants concerning the most significant challenge in collaborating with professionals from different disciplines illustrates a diverse spectrum of perceived hindrances. Predominantly, cited by 35% of participants, the challenge of "Differing philosophies" underscores instances where civil engineers and architects might hold contrasting perspectives in the domain of historic building restoration. This underscores participants' recognition of the potential impediments posed by disparities in viewpoints and approaches between these two disciplines to the effectiveness of collaborative efforts. Another salient challenge that emerges is "Lack of interdisciplinary understanding," cited by 25% of participants. This pertains to difficulties stemming from the incomplete grasp of each other's roles by civil engineers and architects, leading to miscommunication or underestimation of each other's contributions. This response implies that a significant portion of participants believe that the absence of a shared understanding and comprehension across disciplines can hinder the progress of collaborative endeavours.

Moreover, "Disagreements on materials and/or techniques selection" and "Balancing aesthetics with functionality" were each identified by 15% of participants. This indicates participants' awareness of potential conflicts arising from differing preferences in materials and techniques, along with the challenge of striking a harmonious equilibrium between the aesthetic considerations and functional necessities of restoration projects.

A smaller faction, constituting 5% for each category, raised the issue of "Lack of education, knowledge, perspective, or experience in historic building conservation." Additionally, a distinctive challenge specific to Turkey was brought to light by a participant, where professionals other than architects might lack education in conservation principles and might employ standards designed for new structures. These responses emphasize the pivotal role of proper education and shared comprehension of conservation principles within interdisciplinary collaborative efforts.

In the last query, the distribution of responses unveils several distinct patterns in participants' anticipations. The foremost envisioned outcome is the "Enhanced preservation of cultural heritage," which stands out prominently, chosen by 50% of participants. Notably, upon closer examination, a majority of both architects and civil engineers also cited this outcome. This underscores a substantial belief among participants that enhanced collaboration would bolster the emphasis on safeguarding the historical and cultural importance of heritage structures. This response conveys a shared acknowledgment of the significance of upholding the authenticity and cultural value inherent in these edifices. The preference for "More sustainable restoration practices" garnered support from 25% of participants. This implies that a quarter of the participants foresee collaborative efforts between civil engineers and architects culminating in an intensified focus on sustainable and environmentally conscientious approaches to restoration. This response reflects the emphasis on environmental considerations within restoration projects. Selected by 10% of participants, greater innovation in restoration techniques signifies a subset of participants who suggest that collaborative activities have the potential to produce innovative restoration methods. This outcome could potentially lead to the inception of novel techniques and methodologies that synergize the strengths of both disciplines. Several other outcomes garnered individual mentions among participants: "Accelerated project approvals," "Increased stakeholder satisfaction," and "Consistent adherence to heritage guidelines." These responses underscore the diverse spectrum of expectations held by participants regarding enhanced collaboration. The notion of accelerated approvals hints at an anticipation of expedited project processes, while the focus on increased stakeholder satisfaction stresses the potential to meet the varied needs of stakeholders. Similarly, the aspiration for consistent adherence to heritage guidelines reiterates a desire for more cohesive and standardized practices in the restoration of architectural heritage.

5. Conclusion

This article embarked on extensive research of the distinct perspectives of civil engineers and architects in the realm of historic building restoration. It started by outlining the contrast between these two disciplines, which supports their divergent approaches to this intricate task. The study's main objective was to unravel the nuances of these contrasting viewpoints and assess their repercussions for the restoration process.

The methodology embraced a multifaceted approach, starting with a literature review, followed by the execution of a survey. The survey results and subsequent analysis shed light on discernible patterns in perceptions and preferences of participants. The prioritization of historical authenticity by the architects and of structural stability by the civil engineers evinces the different perspectives of the parties. The relatively lower ranking of Economic Viability and ROI, as well as Sustainability and Environmental Impact, is also evinces reduced emphasis on financial gains and environmental concerns. The outcomes also unveiled disparities in perspectives between architects and civil engineers, further emphasized by their varying prioritization of project goals. While architects prioritize historical authenticity, civil engineers prioritize the structural stability. This difference reflects their divergent inclinations.

Collaboration emerged as a foundational cornerstone, with unanimous agreement among participants on its importance. Collaborative frequency distributions showcased a prevalence of interdisciplinary engagement, further highlighting its significance.

Survey results also illuminated disparities in material and technique preferences, underscoring architects' dedication to historical accuracy and civil engineers' focus on structural resilience.

The data on communication and collaboration efficacy within interdisciplinary teams demonstrated a range of perspectives, with varying levels of collaboration smoothness and challenges. Similarly, participants had diverse expectations regarding potential conflicts. However, a consensus emerged regarding the benefits of collaborative decision-making.

Challenges in interdisciplinary collaboration revealed a diverse array of perceived obstacles, underscoring the importance of shared understanding and education within collaborative efforts.

Lastly, participants' anticipated outcomes of enhanced collaboration unveiled a range of expectations, highlighting the potential benefits of more integrated approaches. The widespread aspiration for enhanced preservation of cultural heritage and the emphasis on sustainability underscore the transformative potential of improved collaboration. The collaborative efforts of both architects and civil engineers are instrumental in achieving this delicate equilibrium between safety and durability, all the while preserving the building's original design and historical significance [27].

Engineering field is initially oriented towards training engineers for new construction, now emphasizes heritage preservation, strategic interventions in historical buildings, and sustainable future uses for these structures. This approach not only promotes sustainability but also enhances the field of structural engineering as a whole [28].

In conclusion, this research examined the multi-disciplinary world of historic building restoration, revealing the distinct perspectives of civil engineers and architects. The findings illuminate the complexities inherent in this collaborative process and underscore the need for effective interdisciplinary communication and collaboration. By recognizing and reconciling these differences, restoration projects can achieve a harmonious synthesis of structural integrity, and historical authenticity. The joint effort of architects and civil engineers with other restoration experts promises holistic and well-informed restoration outcomes that honours the past while shaping the future.

While this study has made progresses in understanding the perspectives of architects and civil engineers, there remain avenues for further exploration. Future studies could delve deeper into the specific mechanisms of interdisciplinary communication and cooperation that facilitate the resolution of conflicting viewpoints. Additionally, comparative analyses of restoration projects, particularly those characterized by seamless collaboration, could provide valuable insights into best practices. Such inquiries might offer a more comprehensive understanding of how these two disciplines can cohesively work together for enhanced restoration outcomes.

It is also essential to acknowledge the limitations of this study. The research scope is based on a specific sample size, and the findings may not be entirely generalizable to all contexts. Furthermore, the study's focus on the perspectives of architects and civil engineers does not encompass the entire spectrum of professionals involved in restoration projects. As with any survey-based research, there may be inherent biases in the responses collected. These limitations underscore the necessity of further research to broaden our understanding of interdisciplinary dynamics in historic building restoration.

Last of all, the author believes that this research contributes to both the academic field and vocational practice. The study's findings have significant implications for the education and training of architects and civil engineers, emphasizing the need for a more comprehensive understanding of the roles and viewpoints of their counterparts. Moreover, it may also provide a foundation for academic institutions to develop integrated programs that promote effective interdisciplinary collaboration. Ultimately, practitioners in restoration of architectural heritage may utilize these insights to inform their approach to restoration projects, fostering enhanced communication and cooperation for more successful outcomes.

Conflicts of interest

There is no conflict of interest between the authors.

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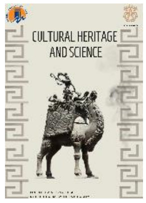
Cultural Heritage and Science
https://dergipark.org.tr/en/pub/cuhes
e-ISSN 2757-9050



Edirne New Palace excavations (2018-2021)

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Keywords
New Palace
Ottoman
Archeology
Presentation Room
Iron Door

Research Article
DOI: 10.58598/cuhes.1363290

Received:19.09.2023
Revised: 23.10.2023
Accepted:25.10.2023
Published:27.10.2023

Abstract
The palace serves as a legitimacy tool for states that operate under a monarchical system of administration and for the dynasty holding power. It is the residence and administrative location of the highest ruler of the state. Thus, the edifice has the ability to depict the period and civilization it embodies in the most elevated manner. The palace has been a crucial emblem of Ottoman society for 600 years, spanning the inception of the civilization. Although Bursa Bey Palace and Edirne Old Palace, erected in Ottoman capitals, have not withstood the passage of time, Edirne New Palace acted as a blueprint for Istanbul's Topkapı Palace, serving as an efficient residence until the final days of the Ottoman Empire. The palace now stands deserted as a result of the Ottoman-Russian war and subsequent destruction. This study focuses on excavations carried out in 2020 to uncover its heritage, which encompasses Ottoman architecture and art from the II. Murad period to the late 19th century in a diverse manner, and to reintroduce certain components into contemporary Turkish cultural life. The article presents the land applications and data gathered during the excavation period.

1. Introduction

The construction of Edirne's New Palace began during the Second World War, on an island situated between two Tunca River branches outside Edirne. It was initiated by Murad in 1450 - Sultan II. Although left unfinished for a brief period after Murad's death, the palace complex was later extended by Fatih Sultan Mehmet and named Saray-ı Cedid-i Amire. During later periods, particularly under the reigns of Suleiman the Magnificent, II. Sultan Selim, Ahmet I, IV. Mehmet II. Ahmet, III, additional expansions were carried out. With the additional structures and renovations commissioned by sultans such as Suleiman, the Edirne New Palace has achieved a grand size and a wealth of functions. The palace contains 117 rooms, 21 divanhanes, 18 baths, 8 masjids, 17 large doors, 13 wards, 4 cellars, 5 kitchens and 14 pavilions, providing insight into its impressive scale [1]. However, it is necessary to consider this size as the area encompassed by the Ottoman palace complex, consisting of numerous buildings arranged in a specific order. None of the buildings in question are monumental in terms of size compared to European palace architecture, within the context of a single structure. The scale employed is historically fitting for the architectural style of the region, enabling panoramic view and preventing the user from feeling overwhelmed. The Edirne New Palace retained its significance, even after the capital city relocated to Istanbul. Erected in the third century, it was subject to neglect following Ahmet's reign, ultimately succumbing to destruction in the 1752 earthquake [2]. Explorations were conducted to repair the palace in 1787, 1802-1803, 1807, 1811 and 1827-1828, however, no significant restoration work took place and only a few ruined sections were taken down [1]. After 1805-1806, some parts of the palace were utilized as military storehouses for weaponry and ammunition [3]. Following the Russian occupation of Edirne in 1829, their camp was stationed in the palace.

The Yeni Saray in Edirne was largely destroyed due to the Russian occupation in 1878. The Yeni Saray in Edirne was largely destroyed due to the Russian occupation in 1878. The palace had served as a storage for military equipment and ammunition since the beginning of the 19th century. On January 18, 1878, the palace was set on fire by the order of the Governor of Edirne, Cemil Pasha, and the fire lasted for three days. Badi Ahmet Efendi, a local from Edirne, provided information on Cemil Pasha

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Cite this article (APA);

Güner, Y. & Kurtişoğlu, G. A. (2023). Edirne New Palace excavations (2018-2021). Cultural Heritage and Science, 4(2), 88-95

in his book "Riyaz-ı Belde-i Edirne". "In 1294, while serving as Governor in Edirne during the Russian invasion, the Vali set fire to the ammunition stored in the palace at the specific time and day he was to depart for Istanbul, supposedly in a bid to prevent its capture by Russia. This decision endangered the city for several days and caused significant damage to the 540-year-old Palace, a memorial to Fatih Sultan Mehmet Han." [4].

After the liberation of Edirne from Russian occupation, Governor Rauf Pasha reportedly gave valuable pieces and tiles from certain unscathed parts of the palace as gifts to foreigners. It is believed that 27 chests of plundered valuables were taken this way. Although Hacı İzzet Pasha was reinstated as Governor of Edirne in 1884 and expressed a desire to restore Edirne New Palace, this wish was ultimately unfulfilled. Subsequent governors saw it fitting to acquire the required construction materials from the remains of the Edirne New Palace for the purpose of building barracks and public structures in Edirne [5]. Presently, only the remnants of Matbah-ı Amire and Kum Kasrı Bath, which underwent recent renovation, as well as the Adalet Pavilion, Bâbüssaâde and Cihannüma Pavilion, have survived from the Edirne New Palace [6] (Figure 1).

Figure 1. Buildings in the New Palace of Edirne, a. Justice Pavilion, b. Kum Kasrı Bath, c. Cihannuma Pavilion, d. Babüssade, e. Matbah-ı Amire

This constitutes Edirne New Palace, II. This cultural heritage encompasses all stages of Ottoman architecture and art from the reign of Murad until the end of the 19th century. Its purpose is to showcase this heritage in a diverse way and restore certain elements of it to bring it into contemporary Turkish cultural life. Pursuant to this overarching objective, the Edirne Museum began excavations at the Edirne New Palace in 1999.

These studies were conducted by Prof. until 2003. The excavation at Matbah-ı Amire was conducted under the scientific guidance of Gönül Cantay. From 2004 to 2007, excavations persisted in Cihannüma Pavilion and Presentation Room. From 2009 to 2015, the Edirne New Palace excavation was performed by Prof. on behalf of the Ministry of Culture and Tourism and Trakya University, authorized by the Council of Ministers. Mustafa Özer chaired the excavation. After a two-year hiatus from excavation works, our scientific consultancy restarted the excavations in 2018. By Presidential decision dated 01.06.2020 and numbered 2020/2587, the excavations were granted a 12-month status.

Before commencing fieldwork for the Edirne New Palace Excavation, which had its inaugural season already completed, the aim was to arrange accommodation, housing, work offices, and an excavation warehouse for the team. Accordingly, studies were conducted to achieve these goals. In this context, the Trakya University Sarayiçi Campus rejuvenated and transformed two former military buildings into a dig house, courtesy of the funding support of Trakya University Rectorate. Furthermore, the facility was fitted out with essential furnishings, encompassing beds, cupboards, and kitchen equipment.

2. Land Application

Excavations took place in three areas: the Presentation Room, the Akağalar Wards, and the Iron Gate. The aim was for these three locations to complement each other and aid in understanding the site map. The goal was to find out where Sur-i Sultani separates the two courtyards (Alay Square and Kum Square) of the palace, following the protocol rules of the Edirne New Palace. This research aimed to create a strong foundation for planning the palace as a whole (Figure 2). Unfortunately, this is not easy to do because the New Palace has been mostly destroyed and restoration is difficult.

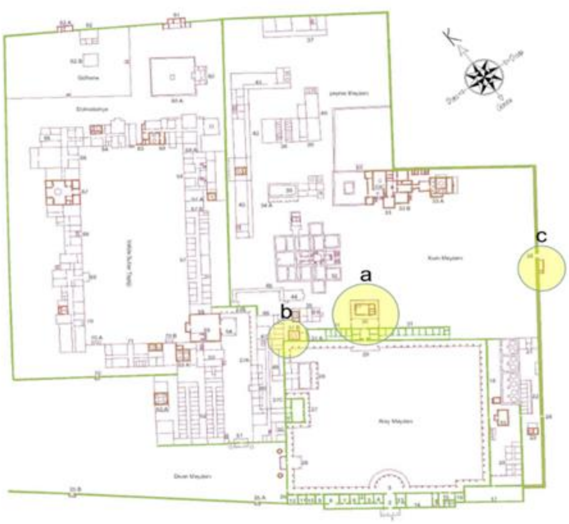

Figure 2. Areas where excavation works were carried out. a- Presentation Room b- East and north wall of the Alay Square c- Iron Gate, "Engraved from the map of the New Palace in Edirne made by Avadis Benliyan, an army journeyman"

2.1. The Presentation Room

Room is a mansion with a dominant architectural style, comprising of a single room and adjoining ablution area. The entrance to the Presentation Room Hall is through Bâbüssaâde, one of the most significant doors of the palace (Figure 3). This chamber is utilized for official visits, ambassadorial receptions, and festive occasions. As it is intended for celebratory purposes, this apartment within the palace boasts meticulously crafted interior design. The sole illustration of the interior engraving is found within C. Our sources of information regarding the building are limited to pre-fire photographs, extensive exploration journals, and documents compiled by Doctor Rıfat Osman. These photographs were taken by Edirne Governor Hurşid Pasha back in 1868 (H.1285) and presented to Kargopulo during the palace's restoration. Some of these photographs are available through various individuals and collections (Figure 4). The sole illustration of the interior engraving is found within C. The sole illustration of the interior engraving is found within C. Sayger and A. Desarnod's album [7] (Figure 5).

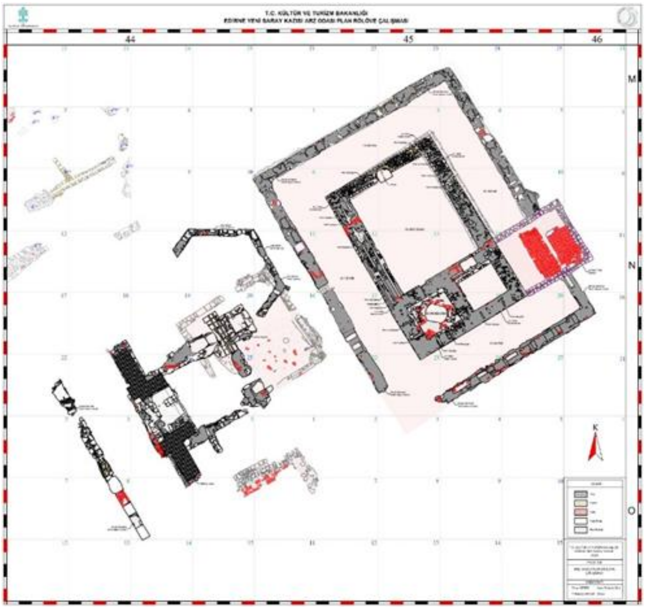

Figure 3. Presentation Room Survey Plan

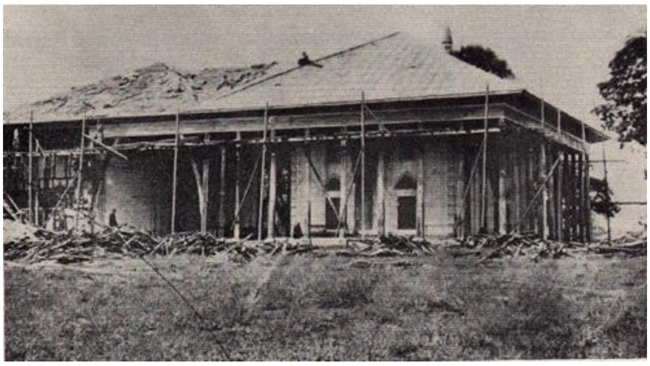

Figure 4. During the 1868 renovation, view of the Arz Chamber from the Kum Square (by Rıfat Osman)

The Bâbüssaâde complex comprises the Presentation Room, a courtyard paved with marble, and four rooms allocated to the Kapı Ağası and the duty gatekeeper. These rooms are situated on either side of a small corridor accessible through a door from the courtyard, all supported by a lead-covered roof. The portico encompassing the Presentation Room on the opposite side of the Bâbüssaâde is upheld by 35 oak columns [1]. Sedat Hakkı Eldem is unequivocal about the construction date of the building, dating back to the period of Fatih Sultan Mehmet, based on the relief arches being in the shape of a full circle [8].

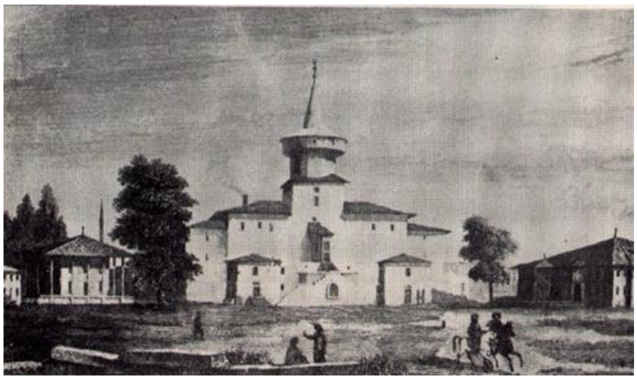

Figure 5. Cihannüma and presentation room engraving. (C. Sayger & A. Desarnod Album)

Additionally, the function of the Presentation Room implies that the building belongs to the first construction phase of the palace since it functioned as military material warehouses and ammunition depots after 1805-1806, notwithstanding any architectural data. In the final years of Sultan Abdülaziz's reign, Governor Hurşid Pasha undertook the renovation of the dilapidated roof and wooden sections. Regrettably, this intervention proved fruitless. Subsequently, after a few years, the palace, including the Alay Square, sustained partial destruction due to the explosion of the stored ammunition, resulting in the complete incineration of the wooden areas. The building's stones were removed, and debris cleared to its current state after it turned into ruins, leaving only its walls standing due to a movement.

Engravings and photos in give general insight into the building's external appearance and Presentation room. The excavation site, determined using various sources is situated in the northwest section of the disaster area extending in a northeast-southwest direction. It belongs to DSI and is located 10 metres away from the Bâbüssaâde Gate. Positioned in the northeast, it is 8 metres south of Cihannuma Pavilion. The 44-M, 44 N, 45 M, and 45 N trench systems, which have 25 trenches each measuring 5x5 metres, were analyzed.

As a result of the excavation in the area, we uncovered the walls that make up the Imperial Throne of the Presentation Room and the portico walls surrounding it. Figure 6 shows the walls uncovered during the excavation (Figure 6). The walls were discovered at the same height, leading us to believe that the land had been leveled and the building was subsequently removed, likely using machinery to shave it down. It is believed that the construction of the structure occurred during the building of the embankment on the south side, overlooking the sand square. The flood level of the Presentation Room was reached at the 37.67 elevation level, in the area descending down to 37.40 elevation level. Furthermore, during the drilling process, excavation of waste and clean water canalsthat belong to the palace, as part of a broader system were found at the 37.41 water level elevation [9] (Özer and Dündar 2019).

Figure 6. General view from the Presentation Room excavations. (by EYSK Archive)

2.1.1. Portico Walls

The wall foundation encircling the Presentation Room and supporting the portico pillars has a thickness of 95 cm. It consists of a mixture of irregular stones and mortar. The strength of the 80 cm wide wall, which rises above the foundation and was built from a combination of mortar and rubble, was enhanced with wooden beams. While carrying out this work, a well-cut stone measuring 75cm x 66cm was discovered on the southwest portico wall. Traces on the northwestern and northeastern walls of the portico exhibited similar stone widths, as the stone found on the southwest wall. This stone was identified as one of the pedestal stones supporting the portico pillars.

The façade walls of the main space, also called the Presentation Room, have a varying thickness of 110 cm to 150 cm and were constructed using uneven stonework. Chipped face stones were used on the cheeks of the wall, which was filled with masonry rubble and brick particles. The wall was then reinforced with wooden beams.

Inside the northwest wall, there is a stone structure measuring 1.19 m x 1.05 m made of old stone. The structure contains a large monolithic stone measuring 15.5 inches, which has been identified as a hearth stone based on information provided on the Presentation room drawings made by Rıfat Osman (Figure 7). To the south of the Presentation Room, remnants of a wall have been discovered which separates the chamber where the Imperial Throne is situated from the ablution and toilet areas. The investigation indicates that a significant portion of the wall is still present below the State Hydraulic Works Disaster Set. The internal wall length measures 7.58 metres. Upon examining the main walls of the Presentation Room, which were uncovered during the excavation, it is apparent that the walls above the flood level detected at an elevation of 37.67 have been levelled at 37.89, revealing that the building follows different axes than the flood level. This disparity can be attributed to the building's repairs.

The southwest, northwest, and northeast walls of the resulting Presentation Room, along with the wall unearthed in the southeast section, comprise the Taht-ı Hümayun, the room containing the sultanate throne. According to sources, the throne room has two doors that face the Bâbüssaâde Gate and the Cihannuma Pavilion. The study identified the threshold of the door overlooking the Cihannuma Pavilion on the northeastern Wall [1]. It measures 155cm. The threshold leading to Bâbüssaâde could not be located, although we anticipated it to align with this broad threshold.

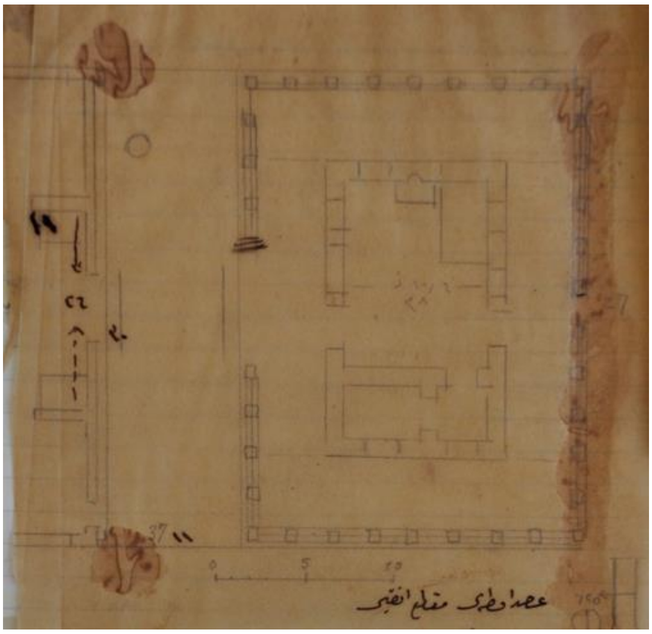

Figure 7. The plan of the Presentation Room in Rıfat Osman's book "Edirne New Palace"From the original copy in Edirne Bayezid II Complex.

2.1.2. Water Canals

During the excavations in the area; besides the remains of the walls of the Presentation Room; water canals belonging to the palace were also encountered. There are two different types of canals; waste and clean water canals (Figure 8).

Figure 8. View from the water canals. (by EYSK Archive).

2.1.2.1. Waste Water Canals

They were built of brick and stone masonry and covered with large cap stones. The canal, of which the first cover stone was encountered at level 37.30, was observed to extend in the north-south direction. The fact that the canal is inclined towards the south indicates that it flows into the Tunca River approximately 300 m in this direction. However, it was possible to follow the canal until below the DSİ disaster embankment. It was observed that it merged with another wastewater canal at 37.35 elevation level, which was identified at 37.53 elevation level and extends in southwest-northwest direction. It was observed that the canal running in southwest-northwest direction was more regular than the canal running in north-south direction. This canal was formed by covering large schist stones as a cover over the brick masonry body wall. The canal extending in southwest-northwest direction merges with the canal extending in north-south direction. This situation suggests that it was built in a later period. In general terms, it is observed that these canals have poor insulation against external factors and have a rough form. Similar ducts were encountered during the excavation and cleaning works in Matbah-ı Amire. The fact that the same sloppy structure was observed here and the remains of wastes were also encountered inside suggests that these canals were built for sewerage purposes.

2.1.2.2. Clean Water Canals

They have a more elaborate structure compared to waste water canals. The joints of terracotta drains laid on a brick floor were sealed with "lökün", a paste produced by mixing lime, olive oil, cotton and egg white. The top of the funnels was covered with a hipped roof made of bricks, and the canals, which were given a triangular form by plastering between the bricks with mortar, became more resistant to external factors. The clean water canal passes over the waste water canal. At the top of the clean water canal, where it gains height as it passes over the waste water canal, it is seen that a limestone with a hole in the centre opens out. It is probable that this hole was made to allow the water to rise to the surface, which indicates the presence of a fountain here.

It is observed that the fresh water canals in the supply room extend in three different directions; north, southeast and west. A precise understanding of the connections of the canals identified in the area requires the completion of excavations in much larger areas. Regardless of the architectural boundaries of the supply room, it is clear that the water system was in relation with the other structures of the palace. However, the careful and patient collection of the findings made so far and those to be made in the following years will provide us with more information about the infrastructure of the palace.

2.2. Alay Square (East Wall)

Alay Square is one of the oldest courtyards within the Edirne New Palace, featuring the surviving ruins of Matbah-ı Amire to the south and Bâbüssaâde to the east. Excavations have previously taken place in the structures and surrounding areas, with the goal of the 2020 studies to establish a wider perspective and continue the previous work. The primary objective was to ascertain the limits of Alay Square and the positions of its related edifices. As part of this overarching aim, the location for the upcoming developments in 2020 was identified following the remnants of the eastern wall that borders the square and referring to Avadis Benliyan's sketches (Figure 2 - b). Geophysical studies were conducted on the northern wall of Alay Mansion to assist with future planning. Technical term abbreviations were explained upon first use. The text adheres to conventional academic structure, formal register, and clear, objective language.

The sources were used as a basis for the study, which focused on the 5x5 m intersection of the eastern wall that separates Birun and Enderun from the northern wall. The study involved four trenches, each measuring 1.55 cm. During the conducted studies, archaeologists uncovered the remnants of a wall running in an east-west direction that coincides with a wall extending from Bâbüssaâde (Figure 9).

Figure 9. Alay square east wall (by EYSK Archive).

The width of the wall, constructed with rubble stone, measures 95 cm. Additionally, three rows of foundation beam gaps, measuring 10x10 cm each, were discovered. Additionally, researchers have identified one of the triangular buttresses that extends parallel to the western wall of the eight-domed dining hall at Matbah-ı Amire, which was previously unearthed. A set of schist stones, the exact characteristics of which are not completely understood, have been found at the upper levels of the wall, resting against the section overlooking Alay Square. This finding suggests that soldiers during the Balkan Wars utilized rubble to fill the soil between walls as a temporary solution. Further data in later stages of the study may shed light on the nature of this finding.

The wall technique and width of the Presentation Room are identical in this area, and the damage to the wall is consistent throughout. The available information implies that the remnants of the deserted palace and its stonework were cleared subsequent to the conflagration, which persisted for three whole days and resulted in the obliteration of the palace.

2.3. Iron Door

The third point where the works were carried out was at Demirkapı, which opens to the Fatih Bridge, which provides access from the Kum Square to the Hasbahçe (Figure 2 - c). Demirkapı is located on the wall extending from the east of the Matbah-ı Amire parallel to the Tunca River and defining the eastern border of the Sand Square. A 19th century photograph of the gate, which is on the same axis as the entrance façade of the Cihannüma Pavilion, shows that the wall above the gate makes a curve and that there is a lead-covered, three-faceted transom on the side facing the Sand Square. It is reported by Rıfat Osman that there was also a fan-shaped sayeban on the Hasbahçe side. The triangular buttresses on the eastern wall of the Alay Square can also be identified in the photograph (Figure 10).

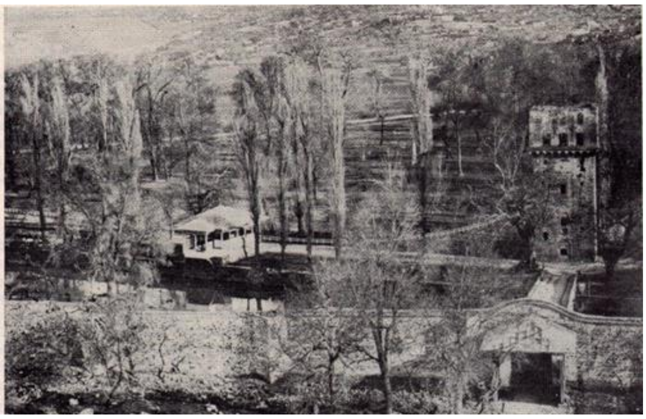

Figure 10. Iron Gate, Justice Pavilion and Iftariye Pavilion (by Rıfat Osman)

In the first days of the works, the asphalt that was built to provide the connection between the stadium where Kırkpınar wrestling was held and Yeni İmaret Neighbourhood was dismantled. Then, at a point very close to the surface, the largely destroyed traces of Demirkapı were reached. However, no reliable plan of the remains of the gate, which was exposed to vehicular traffic for many years and pressurised during the asphalting works, could be reached. On the other hand, one of the triangular buttresses, which can also be identified in the photograph, could be identified. In addition, the direction of the wall (Sur-i Sultani) on which the gate was placed, extending in the north-south direction parallel to the Tunca River and forming the eastern border of both Alay Square and Kum Square, could be identified (Figure 11).

Figure 11. General view of Demirkapi and Sur-i Sultani excavation site. (by EYSK Archive)

3. Conservation Applications

3.1. In-situ Conservation (Architectural)

In situ conservation studies were carried out on the architectural findings obtained in three different excavation areas where the excavations of Edirne Yeni Saray were carried out. The main purpose of these works is to protect the architectural findings unearthed in these areas against deterioration that may occur due to external factors such as seasonal conditions, human destruction and flooding. The applications carried out within this framework were carried out with a conservative approach and it was planned to provide temporary protection before a possible comprehensive repair activity.

Within the scope of the applications, firstly, dry cleaning was carried out with the help of soft-tipped brushes and small dental tools, and the dry deposit and soil layer were removed from the surface of the find. After the architectural finds group was documented, it was covered with geotextile. Then it was covered with a high soluble lime mortar prepared with three parts of aggregate (river sand, stone dust, marble dust and some firebrick dust) and one part of lime (calcium hydroxide). The mortar was about 10 cm thick and applied in herringbone form to prevent water retention on the surface (Figure 12).

Figure 12. In-situ conservation practices (by EYSK Archive)

3.2. Small Find Conservation

As a result of the excavations; coins, terracotta nozzles, glazed and unglazed ceramics, tiles, metal objects such as nails, horseshoes, bullets, cannonballs, hooks, door hinge parts, rifle parts, keys, clamps, empty casings, bullets, pendants, taps, bullets, terracotta funnels and tile fragments were found. These finds were cleaned in the excavation house and classified. For each find, find slips were prepared for each find, including the area worked, the type of find, its function and importance, and placed in labelled crates and protected in the excavation warehouse. The finds were divided into two groups as inventory and study artefacts. Inventory artefacts are indicated with "1" and study artefacts are indicated with "2". Inventoried artefacts are preceded by the site, year, a numerical expression indicating whether they are inventoried or studied, and an abbreviation indicating the type of artefact (e.g., Ak.20/02/PT/01). For the convenience of the excavation house storage system, a QR code system was introduced. In this system, the general information of the artefacts in the vault (find location, find type, find name, find dates) was transferred to the QR code via the computer. The barcodes were printed out and hung on the board. If these barcodes are scanned by downloading any QR Code programme from a mobile phone, the information about the type of finds in the vault will be accessed (Figure 13).

Figure 13. QR code system used in artefact storage.

During the restoration and conservation works of the metal artefacts, they were firstly documented with photographs and then mechanically cleaned. With the help of small hand tools such as soft-tipped brushes, scalpels, cotton, bamboo sticks, active and passive corrosion layers on the metal surface were removed from the metal surface and the patina was preserved. The mechanically cleaned bronze finds were kept in a 3% solution of BTA (Benzotriazole) in Ethanol for 45 minutes to stabilize them against corrosion. Then they were purified in Ethanol-Distilled water solution. The surface of the mechanically and chemically cleaned metal artefacts was coated with Paraloid B72 prepared at 3% in Acetone with the help of a brush and the conservation works were finalized and stored under appropriate conditions.

Within the scope of the conservation and repair works of the ceramic artefacts, firstly, mechanical cleaning was carried out with the help of soft-tipped brushes, small dental tools and bamboo sticks, and the dry deposit and soil layer were removed from the artefact surface. After the cleaning was completed, wet cleaning was carried out on the entire artefact surface with 50% ethanol-pure water solution and hydrophilic cotton wool. After the conservation works were completed, the artefact was stored under appropriate conditions.

4. Conclusion

The year 2020, when the Edirne New Palace excavations, which we started in 2018 under the supervision of the Museum, turned into a presidential determined excavation, mainly consisted of the preparation of the physical, technical and expert infrastructure necessary for a more systematic and efficient excavation and conservation in the coming years within the boundaries of the study. In this context, the available data regarding the boundaries of the Edirne New Palace area were evaluated and efforts were made to eliminate the deficiencies identified. The surveys of the structures of the palace, which were prepared in the previous periods of the excavation and reflected in the reports, were updated.

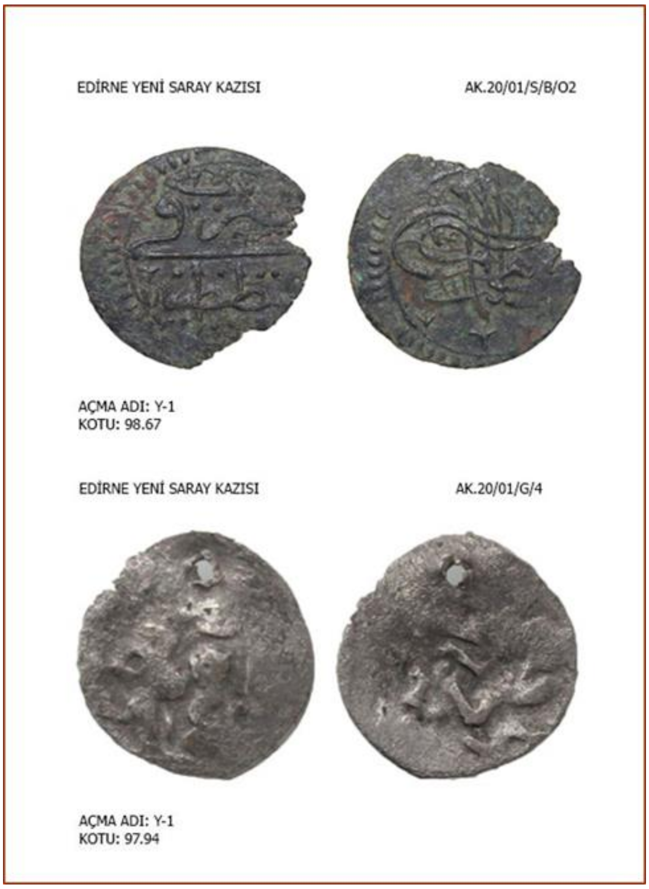

Figure 14. Examples of conserved coins (by EYSK Archive).

In this period, the excavation works were carried out in accordance with the method determined for the excavation works of the palace consisting of a series of courtyards, with the main purpose of determining the boundaries of the courtyards. In addition to archive and source research on the New Palace of Edirne, excavations were carried out on the Arz Chamber, Demirkapı and the eastern wall of the Alay Square. Architectural and small finds were unearthed during the excavations. With the architectural findings, our views on the characteristics of the buildings have started to gain clarity and the small finds have given clues about the changing functions of these buildings over time. This year's excavations have provided important information about the infrastructure (clean water, waste water system) of the New Palace of Edirne, especially thanks to the infrastructure systems (funnels, canals, etc.) uncovered. After the architectural findings were documented with drawings and photographs, temporary conservation measures were taken until major conservation and restoration works were carried out in the following years. Small finds were cleaned, sorted and recorded in the excavation house and documented with drawings and photographs.

It was observed that both the architectural and small finds identified in the studied areas have common aspects in all three areas in terms of their characteristics. The most numerous finds in all trenches are military materials. Especially cannonballs, weapon parts and empty casings are among the most prominent finds. The second most common finds in terms of density are terracotta artefacts.

Acknowledgement

We would like to thank the Ministry of Culture and Tourism, the Turkish Historical Society, Trakya University and our Rector Prof. Dr. Erhan Tabakoğlu, the Governorship of Edirne and SİSEV for their support to the Edirne New Palace Excavation.

Author contributions

Yavuz Güner: Conceptualization, Methodology, Software, Field study, Writing-Original draft preparation **Gülay Apa Kurtişoğlu** Data curation, Field study Visualization, Investigation, Writing-Reviewing and Editing.

Conflicts of interest

There is no conflict of interest between the authors.

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