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Original Research Article

An Investigation of the Adaptive Reuse Approach in Redesigning Nine Historical Castles in Europe

Zahra Bidkhouri
Kourosh Momeni*

Department of Architecture, Faculty of Architecture and Urban Planning, Jundi-Shapur University of Technology, Dezful, Iran

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ABSTRACT

Historic buildings and sites represent significant examples of architectural heritage, whose preservation and revitalization are of great value for future generations. Many of these structures have lost their original function over time and gradually become abandoned. One of the most effective approaches for their conservation and revitalization is the application of adaptive reuse, which enables both a change in the building's function and its alignment with new spatial and social needs. In this regard, the preservation and revitalization of such historic structures hold particular importance. Among these, castles scattered across Europe possess a remarkable capacity for adaptation and functional transformation. This study aims to examine the methods and strategies of the adaptive reuse approach in the redesign and revitalization of nine prominent and historically valuable European castles, each reimagined through adaptive reuse interventions. These interventions are classified into three levels: the addition of new materials, the addition of new architectural elements, and the addition of new spatial volumes. This research employs a qualitative approach with an analytical–comparative strategy. Case studies were selected based on three criteria: (a) accessibility of researchers to design documentation and analytical studies; (b) redesign carried out after 2000; and (c) prominence of contemporary interventions and additions while maintaining the historical structure of the castle. Findings indicate that, in the redesign of European historic castles, the addition of new architectural elements and modern materials shows the highest frequency in restoration and reconstruction projects, followed by the addition of new spatial volumes. Overall, the results reveal that adaptive reuse, beyond being a mere conservation approach, functions as a design strategy that, through carefully considered interventions at the levels of space, element, and material, facilitates the coexistence of past and present and transforms historic buildings into dynamic frameworks for contemporary cultural and social experience.

* Corresponding author: **Phone:** +989122275515, **E-mail:** K_Momeni@jsu.ac.ir

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Introduction

Historic buildings have long been recognized as symbols of the cultural, political, and architectural identity of past civilizations. Over time, and with changing societal needs, many of these structures have lost their original function, becoming vulnerable to decay or neglect, thereby necessitating preservation. The conservation of historic heritage began in Europe and gradually spread to other regions, including the Americas. In the early stages, the primary focus was on structural durability and economic efficiency in building maintenance; however, from the nineteenth century onwards, aesthetic and artistic considerations were increasingly incorporated. By the 1960s, adaptive reuse emerged as a novel approach linking heritage conservation with contemporary architecture, establishing itself as a creative strategy for the sustainable revitalization of historic buildings (Baiz & Atakara, 2025, 2). Within this context, adaptive reuse has been proposed as a sustainable strategy that preserves historical and architectural values while assigning new functions to old buildings. Each successful adaptation, while respecting the historical context, should reinforce the building's identity through the addition of contemporary layers (Ejlali Diz & Delshad Siahkali, 2024, 11). This approach not only prevents the destruction of cultural heritage but also imbues these spaces with contemporary relevance by integrating past and present. In recent decades, the application of adaptive reuse and the adaptation of buildings to new functions has become increasingly widespread. This process, while maintaining most of the building's structural system, exterior envelope, and interior materials, ensures continued use and extends the building's lifespan. The significance of adaptive reuse is not limited to historic buildings; it can also enhance the efficiency and flexibility of contemporary architecture (Mustafa, 2023, 4). Broadly, this approach encompasses a range of interventions from renovation and reconstruction to structural reinforcement and is not necessarily restricted to functional change (Gravagnuolo et al, 2024, 108). Any architectural intervention aimed at modifying a building's capacity, function, or performance for reuse should minimize impact on heritage and structural values while simultaneously adding contemporary layers that safeguard cultural significance for future generations (Hanachi et al, 2019). From this perspective, adaptive reuse not only preserves the material and symbolic authenticity of historic buildings but also enables their sustainable use through new functions. The success of adaptive reuse depends on respecting the historic fabric and integrating contemporary layers that enhance the building's character and align it with present-day needs (Basha & Sağdıç, 2025, 752).

Europe hosts numerous prominent castles, several of which have been revitalized and redesigned through adaptive reuse in recent years. This study aims to provide an architectural analysis of these castles, examining interventions at three levels: addition of new materials, addition of new architectural elements, and addition of new spatial volumes.

The main research question is:

How are interventions in redesigned historic European castles carried out based on the adaptive reuse approach?

Research Background

There have been numerous studies on the application of adaptive reuse in historic buildings, including historic castles, including: Lillian Wang, in her book "Adaptive Reuse in Architecture: A Typological Index," examined 50 historic building redesign projects under the adaptive reuse approach, in which she provided an identity for each building, including its history, location, and old and new use (Wong, 2023). In her book "New Architecture in Historic Buildings," researchers examined 60 heritage buildings that have been subjected to the adaptive reuse approach. Among them, the castles of Astley, Metrera, Doria, Pembal, Castello, Corkra, Frotza, and Lichtenberg were also analyzed. The findings of this book have shown that adaptive reuse has been able to preserve the historical identity of the buildings while adding new cultural and social uses to them, thereby enhancing the sustainability, tourist attraction, and cultural value of these buildings (Moazzen & S berenji, 2023). Among these projects, four prominent castles have been examined: the Danish Maritime Museum at Kronberg Castle, the Civic Museum of Castelocchio, the Moritzburg Museum, and the Pombal Castle. These examples have shown how adaptive reuse has preserved the historical identity of the building while creating new cultural and social uses in it. Baiz and Atakara (2025b), in their article entitled "Towards a Conceptual Model for the Practice of Adaptive Reuse in Sustainability: A Case Study of Historical Military Buildings in Northern Iraq", have provided a comprehensive understanding of the way in which historical castles have been reused in northern Iraq. In another study, Sommer et al. (2025) demonstrated a new method for adaptive reuse of the Birkenfels Castle in France using Blender, a flexible and dynamic toolkit. To answer the research question, Iida and Fukushige (2025) evaluated the changes in land prices in the Himeji Castle neighborhood and concluded that the adaptive reuse project of this historical monument accelerated the upward trend in land prices. In an article, Surugiu et al (2025) concluded that tourists expressed positive opinions about the service spaces added to historical castles in the adaptive reuse approach. Haval &and Mishra (2025) also showed in a study that adaptive reuse of historical buildings in developing countries is a key strategy for sustainable urban renewal that has brought economic, social, and environmental benefits at the same time. In a study, Parrinello and Pettineo (2025) addressed the issue of preserving the remaining historical structures of Montorio Castle in Italy and Almonecir Castle in Spain by redesigning these two buildings in the software Ruite using the adaptive reuse method (Parrinello and Pettineo, 2025). Also, Maha Shree et al. (2024), in an article titled "Adaptive Reuse of Cultural Heritage," by combining theoretical frameworks with practical insights, emphasized the

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necessity of adaptive reuse as a dynamic tool for preserving cultural heritage for future generations. Milio (2024), in a study, considered that the sustainable development of Himara Castle in Albania requires a comprehensive understanding of the Adaptive Reuse approach to heritage. In another article, Takva et al. (2023), titled "Evaluation of a Sustainable Adaptive Reuse Approach for Cultural Heritage Buildings", showed how contemporary additions that can meet the needs of the reuse of historical monuments have been implemented. Hussen et al. (2023) also used the Neutrosophic Multinomial Logistic Regression (NMLR) method to optimize adaptive reuse in the historic Aleppo Castle and concluded that this method provided decision-makers with a more accurate and reliable tool for making rational decisions about the reuse of functional spaces. Gurnick and Lah (2019), in an article titled "Sustainable Conservation of Architectural Heritage: Case Study: Njegovac Castle in Slovenia," proposed the application of an adaptive reuse approach to the historic Njegovac Castle, which resulted in its architectural integrity and greater conservation. It can be said that so far, a comprehensive study of interventions in historic castles with an adaptive reuse approach has not been conducted in a structured manner. The above research aims to investigate the methods of the adaptive reuse approach in nine landmark and historically valuable castles in Europe, each of which has been redesigned and restored with an adaptive reuse approach. These interventions have been carried out at three levels: the addition of new materials, the addition of new architectural elements, and the addition of new spaces.

Research Method

The approach of this research is qualitative, and its strategy is analytical-adaptive. The research community included all historical castles located in Europe that had been redesigned with the Adaptive Reuse approach since 2000. Given the vastness of the European castle community and the limited access to complete data, the purposive sampling method was used to select significant, documented, and analyzable samples. In the first step, an initial list of related projects was collected through architectural databases and specialized architectural magazines. The research data was collected in the form of documents and using secondary sources, including architectural plans, images, design documents, analytical reports, and specialized articles. The castles were then systematically screened by the researchers using the following three criteria: A) The researchers' ability to access design documents, including plans, castle images, technical documents, and castle analytical reports; B) The time for the castle's redesign is after the year 2000 AD, and C) The importance of new interventions and additions while preserving the castle's historical structure.

Theoretical foundations of the research

Historical and heritage buildings, as collective memory and symbols of the cultural identity of societies, have a special place in the continuity of history and the transmission of material and spiritual values to future generations. Protecting this heritage not only means safeguarding the past, but also a means of creating a link between history, culture, and contemporary life. The importance of this issue has led to the formation of various approaches and theories in the field of conservation, restoration, and adaptive reuse over the past decades. In the meantime, numerous key theories and international documents have emerged, each of which has addressed heritage values and methods of protection from a specific angle. Among them, we can mention Article 12 of the Venice Charter of 1964, which emphasizes that replacement parts in historical monuments should be implemented in a way that is harmonious and integrated with the whole of the building, but at the same time remains recognizable from the original parts (Hooshyari et al., 2022, 343) or in the Burra Charter, which was developed in 1979 by ICOMOS Australia, is one of the most important international documents in the field of cultural heritage protection and emphasizes the centrality of "cultural value" in the protection process. This charter proposes principles such as minimum intervention, respect for the authenticity and identity of the place, documentation of actions, participation of the local community, and the possibility of adaptive reuse of buildings without damaging their values. As a practical guide, the Bora Charter provides a comprehensive framework for the restoration, conservation, and sustainable management of historic sites and is now used in many countries as a basis for policy-making and the implementation of conservation projects (Khadamzade and Khorami, 2024, 4). The final Bora Charter between 1999-2002 recommends that, before any intervention, the values of the site should be identified and assessed, and that any action should have the least negative impact on the site and be reversible as far as possible. Also, maintaining the authenticity and integrity of the site, clarity in distinguishing new interventions from the original structure, continuous maintenance, and participation of the local community in decision-making are key principles of this charter. Instead of focusing solely on reconstruction or restoration, the Bora Charter proposes continuous conservation and management as a comprehensive and sustainable process (Nejad Ebrahimi et al., 2022, 97). The American Institute for Conservation (AIC), which has been operating in the United States since 1972, is considered one of the most important international authorities in the field of cultural heritage conservation and restoration. This institute defines cultural heritage conservation as a form of ethical supervision and, along with many similar institutions in developed countries, has developed a set of guidelines, regulations, and treaties related to the preservation and maintenance of cultural property, emphasizing ethical principles. However, conservation experts are always faced with unforeseen circumstances and broader ethical concerns, and inevitably, in some

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cases, are unable to fully implement these standards (Alimirzaei and Samanian, 2024, 9). John Ruskin can be considered one of the most prominent thinkers who influenced the formation of conservation and restoration ideas in the nineteenth century. He was more aware of the value of historical buildings and objects than anyone before him, and is therefore considered one of the founders of modern approaches to conservation. Instead of restoration, Ruskin emphasized the preservation and care of the monument and did not consider it permissible to return the building to its original condition. To emphasize his point of view, he even stated in an exaggerated tone that "it is better for a historical monument to be destroyed than to be retouched or restored" (Nezaratizadeh and Vatandoust, 2023, 240). Another important figure in this field, Alois Riegel, was one of the first to attempt to classify heritage values and distinguish between historical and contemporary values in the early years of the 20th century. He distinguished different types of values from each other and categorized them as historical values (including age value, historical value, and memorial value) versus contemporary values (including use value, artistic value, and new value). In fact, Riegel defined two opposing values of historical values and contemporary values as consequences in dealing with heritage sites (Zabihzadeh et al., 2024, 63). Assessing the values inherent in a heritage building is very important for the adaptive reuse process and can only be done when a deep and comprehensive analysis of the building and its context has been carried out. One of the first publications in this field is the study conducted by Riegel (Arfa et al., 2022, 153). The theories of heritage conservation, developed by prominent thinkers such as Ruskin and Riegel, need to be carefully considered in the adaptive reuse approach, highlighting the importance of the concepts of authenticity and integrity, which are the basis for the real transmission of values (Gravagnuolo et al., 2024, 226). It is also necessary to pay attention to the charters; the Bora Charter, known as the "ICOMOS Charter for Sites of Cultural Value", pays special attention to the issue of the use and reuse of historical monuments. In Article 1 of this Charter, the two concepts of "adaptation" and "compatible use" are defined: adaptation means the alteration of a place to suit an existing or proposed use, while compatible use is an exploitation that does not distort the cultural value of the place while preserving it. Article 7 also emphasizes that if the function of a place is an integral part of its cultural value, it must be preserved, and at the same time, the place requires an adaptive use. In addition, Article 14 addresses conservation processes such as "preservation" or "redefinition of use," and Article 21 states that adaptation is only acceptable when it has the least impact on the cultural value of the place and requires the least change in its valuable structure (Tahmasebi and Nasekhian, 2020, 215). DOCOMOMO International was founded in 1988 in Eindhoven, the Netherlands. This international organization focuses its mission on documenting, preserving, and raising awareness of the architectural and urban heritage of the 20th-century modern movement, and its national branches are now active in dozens of countries. In its charter, DOCOMOMO sees the preservation of the authenticity of modern architecture alongside the possibility of adaptive reuse; This means that changes and interventions should be minimal and the spatial, structural, and aesthetic values of the building should be preserved. From the perspective of this committee, reuse is acceptable when it allows the building to continue its life without compromising its cultural validity and the fundamental characteristics of modern architecture. Similarly, DOCOMO considers adaptive reuse as a means of coexistence between conservation and contemporary exploitation (Naziri & Fadaei Nezhad Bahramjerdi, 2022, 25).

To better understand the Adaptive Reuse approach, it is first necessary to examine and explain the basic and related terms, namely "Adaptation", "Reuse", "Adapt", "Conversion", "Renovation", and "Transformation", to clarify the conceptual position of "adaptive reuse" among these terms. Adaptive reuse is based on the words "Adaptation" and "Reuse". This term explicitly refers to changes that include both functional and physical components and refers to the process in which an existing building is used to respond to a new use by making functional and physical changes. This approach pursues both the preservation of historical values and reuse and can be said to be the most comprehensive concept that can include adaptation, conversion, renovation, and even transformation; but its focus is on the preservation of heritage values along with new use. Adaptation is a process that involves changing, adding, or removing elements of a building to meet new needs. Any intervention beyond mere maintenance that changes the capacity or function of the building is considered a type of adaptation and is actually a smaller step than adaptive reuse and does not necessarily result in a change of use; it may only improve the existing function. Also, conversion of a building is an adaptation strategy for abandoned and dilapidated buildings that do not satisfy their users or are no longer used by changing their function. Unlike adaptation, conversion does not necessarily consider the preservation of historical values and may cause drastic changes. Conversion can also be said to be a subset of adaptive reuse. In addition, renovation means improving and repairing an old building to achieve desirable and usable conditions. This process may also include some conversion measures, but its main goal is to improve the existing situation. Renovation is usually carried out without changing the use and aims to improve the existing situation, and is more physical than functional. Transformation is a comprehensive process of adaptive reuse in which an underused or unused building is converted into a building with a new and dynamic use. This concept emphasizes the reuse of structures, materials, spaces, and cultural memories and seeks to create continuity in the context of time and space through transformative interventions. Transformation is the most radical of all

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and can completely change the identity of the building; unlike renovation or adaptation, which preserve some of the existing features (Vafaie et al, 2023, 2).

A review of studies conducted in the field of "adaptive reuse of historical buildings" shows that researchers have addressed the issue of recreating heritage structures from various perspectives. A group of studies focusing on environmental aspects emphasize the use of new materials that have low latent energy, low carbon, and high environmental compatibility to cause minimal damage to the historical fabric and the surrounding environment (Suteja & Mudra, 2024, 2; Gayantha, 2025, 90; Yazdani Mehr, 2019, 928; Valdiviezo, 2025, 145; Diwaan & Diwaan, 2024, 617). Another group of studies has focused on the restoration, reconstruction, and reinterpretation of existing architectural elements, including walls, floors, ceilings, and openings. These studies aim to create a dialogue between the past and the present, in such a way that by combining traditional and modern components, the perceptual and aesthetic quality of the building is enhanced and its appeal to visitors is increased (Özmen, 2025, 12; Devina et al., 2025, 59; Patel & Patel, 2025, 11; Sulaiman Goriel et al., 2024, 68; Shaded, 2025, 82). In addition, some studies have paid attention to spatial and functional dimensions and have shown that in order to respond to contemporary needs, the addition of new spaces such as galleries, exhibition halls, educational workshops, or new service spaces is inevitable. This type of intervention is particularly important in projects where historical buildings are often converted into museums, cultural or educational centers, as the design of complementary spaces can ensure the continuity of the social and identity life of these buildings (Hoursan & Mofidi, 2024, 3; Angrisano et al., 2025, 16; Vardopoulos et al., 2023, 14; Özmen, 2025, 6; Swai, 2025, 88; Davies, 2023, 28; Vafaie et al., 2025, 13). Accordingly, it can be said that the extensions with an adaptive reuse approach in historical buildings can be classified into three categories: new spaces, new architectural elements, and new materials. (Fi. 1).

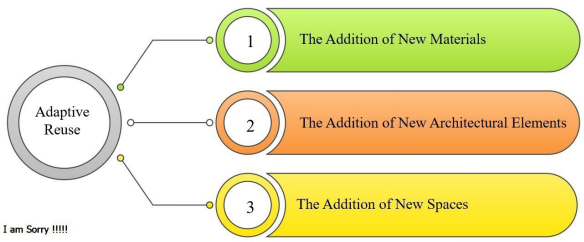


Fig. 1. Interventions and additions with an adaptive reuse approach in historical monuments. Source: Authors.

Also, recent studies in the field of adaptive reuse emphasize that the selection and application of new materials should be carried out in line with the historical fabric of the building; in such a way that the new materials are compatible with the original materials in terms of color, texture and scale, but at the same time do not damage the historical authenticity of the work. This view has its roots in international charters for architectural conservation. For example, the Athens Charter (1931) and later the Venice Charter (1964) have emphasized the need to distinguish new materials from the original materials of the historic building to preserve the legibility of the historical layers in the building. As stated in the second principle of the Venice Charter, "new materials must be identifiable so that the originality of the work is not confused" (Valdiviezo, 2025, 147; Yan et al, 2024, 21; Maha et al, 2024, 90; Abdulhalim, 2025, 13; Sanchaniya et al. 2025, 6; Marouf et al, 2024, 327; Dotel, 2024, 152; Alcântara & Santos, 2025, 14; Khalil & Üzümcüoğlu, 2025, 9;).

Introduction to the studied castles in Europe

According to the World Population Review website, there are more than 150,000 castles scattered throughout Europe, which is a large statistical population. However, according to the studies conducted by the researchers in the form of libraries, only the documents of 19 castles that were redesigned using the adaptive reuse approach were obtained, among which European castles, and were finally screened by applying the following three criteria: a- The researchers' ability to access the design documents, including maps, castle images, technical documents, and castle analytical reports; b- The time of the castle redesign is after 2000 AD; c- The importance of new interventions and additions while preserving the historic structure of the castle; and nine castles were selected. Comprehensive information is provided in Table 1 of the nine historical castles studied in Europe.

Analysis and Discussion

The interventions carried out in the process of redesigning castles can be categorized into three levels based on the adaptive reuse approach:

• Addition of new spaces

This level includes the creation of new spaces and services to enhance the visitor experience and interaction with the building. Examples of these interventions include: ticket booths, pre-entrances, cafes and restaurants, and other welfare and support spaces. The addition of new spaces transforms the castle from a purely historical place into a dynamic and multidimensional space for cultural and social communication, and enables continuous and attractive use for visitors. By preserving the historical identity of the building, these interventions play an effective role in increasing its attractiveness, usability, and sustainability (Table 2).

• Incorporation of new architectural elements

This level includes the addition or replacement of architectural elements that improve the functionality and accessibility of the building. Examples of this category include the installation of doors and windows, redesigning floors and ceilings, and constructing or reconstructing stairs and walls. The goal of incorporating new architectural elements is to restore the usability and stability of the building in harmony with the historical structure so that users can easily utilize the spaces. These actions are considered the basis for creating service spaces and visitor interactions (Table 3).

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• Incorporation of new materials

This level involves the use of new and modern materials to improve the performance and sustainability of the building, without fundamentally changing its original structure and historical identity. Materials such as iron, plaster, aluminum, glass, and other resistant and lightweight materials fall into this category. The purpose of incorporating new materials is to strengthen and stabilize damaged components of the building, improve safety and resistance to environmental factors, and provide a suitable infrastructure for reuse. The variety of new materials related to this level of intervention is reviewed in Table 4 for each of the castles.

The study of the levels of interventions showed that at least two levels of addition were used in each of the castles; in such a way that each castle is placed in one of the levels of addition of new materials, new architectural elements, or new spaces, according to the type and extent of the intervention.

• Intensity of interventions with an adaptive reuse approach in the castles under study

To examine the intensity of interventions in the castles under study, all documents, such as maps and images, were examined by the researchers, and the castles were given a score from zero to ten according to Table 5. The intensity of interventions in the three levels of addition of "new materials", "new architectural elements", and "new spaces" varies among the castles under study. At the first level, i.e., the addition of new materials, the highest level of intervention is related to the castles of Moritzburg and the Fortress of Fortezza. In contrast, the castles of El Real De La Jara and Kazimierz Dolny had the lowest level of use of new materials. At the level of incorporation of new architectural elements, the Haapsalu Episcopal, Moritzburg, Castella, Baena, and Garcimuñoz bishoprics are ranked highest, followed by El Real De La Jara, Fortress of Fortezza, and Casimires Dolny castles in second place, and Pombal castles in third place. At the level of incorporation of new spaces, the two Haapsalu and Moritzburg bishoprics have new space designs, followed by Pombal, Fortress of Fortezza, and Kazimierz Dolny castles in second place, and the other castles have no intervention at this level. Overall, by calculating the final score of the three levels, Haapsalu Episcopal and Moritzburg bishoprics are both ranked first. Castalla, Pombal, and Baena castles are ranked second, and Kazimierz Dolny castles and El Real De La Jara are ranked third.

Fig. 2 shows the frequency of three types of new additions in nine historic European castles with an adaptive reuse approach, showing that in most of the castles studied, the addition of new architectural elements and new materials was the most frequent; in contrast, the addition of new spaces was generally less frequent than the other two types and was mainly observed in the castles of "Haapsalu Episcopal", "Moritzburg" and "Fortress of Fortezz". Overall, this chart shows that for the successful redesign of castles with an adaptive reuse approach, focusing on new architectural elements and new materials is the most

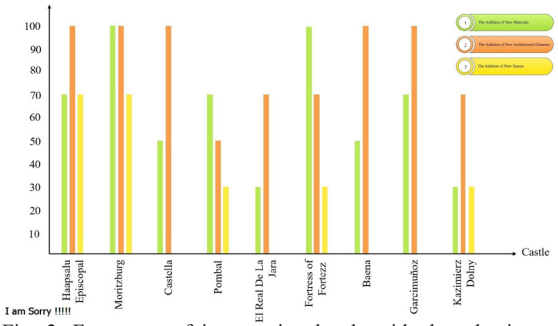


Fig. 2. Frequency of intervention levels with the adaptive reuse approach in the studied castles. Source: Authors.

frequent in restoration and reconstruction projects, and the addition of new spaces is in the next order. Of course, adaptive reuse is considered successful when it can establish a proper balance between the three levels of addition of materials, architectural elements, and new spaces. Interventions at only one level, such as focusing entirely on materials or elements without considering new spaces, can disrupt the functional and visual integrity of the building. Conversely, ignoring any of these levels will also prevent the full realization of the goals of adaptive reuse.

Conclusion

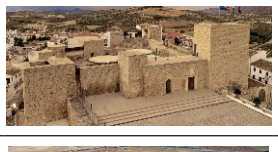
The adaptive reuse approach, as one of the methods of revitalizing historical monuments, has been able to establish a smart balance between preserving the physical authenticity of the historical monument and responding to contemporary needs. The study and analysis of the iconic European castles that have been redesigned with the adaptive reuse approach showed that architectural interventions have been carried out at three levels: the addition of new spaces, the addition of new architectural elements, and the addition of new materials in a diverse manner and in accordance with the historical and functional conditions of each castle. At the first level, the Haapsalu Episcopal and Moritzburg Episcopal Castles, with the most addition of new spaces, are considered examples of successful spatial recreation that have maintained their structural continuity while strengthening cultural spaces (such as the entrance volume, ticket booth, and cafe-restaurant). At the second level, interventions in the castles of Moritzburg, Castella, Baena, and Garcimuñoz, focusing on modern architectural elements, have demonstrated a creative fusion of the past and the present, improving the perceptual quality and spatial experience of visitors. At the third level, greater use of modern materials has been made in castles such as Moritzburg and Fortress of Fortezza, with a distinction between new and old materials, while the castles of Kazimierz Dolny and El Real De La Jara have emphasized historical authenticity with minimal changes to the materials.

In general, from the study of historic castles in Europe, it can be said that for the successful redesign of castles with an adaptive reuse approach, the focus on modern architectural elements and new materials is most frequent in restoration and reconstruction projects, and

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Table 1. Introduction to the studied European castles. Source: Authors.

Row	Name	Overall Image	Country	Redesign	User	Age	Introduction
1	Haapsalu Episcopal		Estonia	2019	14th century	Museum	Haapsalu Bishopric Castle is a stone structure with watchtowers and extensive ramparts that once served as a religious and defensive center for the region. Its strategic location near the Baltic Sea makes it a prominent example of medieval castle architecture in Northern Europe (Alem, 2021, 57).
2	Moritzburg		Germany	2008	15th century	Museum	Moritzburg Castle, with its Gothic architecture, consists of fortified towers and ramparts, which, after being partially destroyed in the wars of the 17th century, still retain its distinctive architectural features. In modern times, the castle has been converted into a museum of modern art through an adaptive reuse approach (Moazzen & Sabrenji, 2023, 174).
3	Castella		Spain	21st Century	13th century	Exhibition	Kastalla Castle, with its Arabic roots and medieval structure, is located on a hill overlooking the town of Kastalla. The castle includes a feudal palace (14th-15th century), a Torre Grossa (16th century), and an Arab cistern (12th-13th century). Its restoration began in the 1980s and continued with an integrated approach in the 21st century (Mira Rico, 2024, 79).
4	Pombal		Portugal	2014	16th century	Exhibition	The Pombal Castle is located on a hill overlooking the Arunca River and, with a history spanning from the Roman period to the 16th century, is today one of the region's tourist attractions. The castle is a valuable example of multi-layered military and defensive architecture (Wong, 2023, 206).
5	El Real De La Jara		Spain	2014	14th century	Exhibition	The El Real de la Jara Castle was built in the strategic area of Banda Gallega. With its stone structure and perimeter fortifications, this castle is an outstanding example of medieval military architecture and the defense of Spain's southern borders against Portuguese invasions (Taylankucukali, 2022, 139).
6	Fortress of Fortezza		Italy	2009	16th century	Museum	The Forza Castle was built by the Habsburgs to strengthen the defenses of the Austro-Italian border. With its solid granite structure, underground spaces, and watchtowers, it is a prominent example of 19th-century European military architecture (Drygiannakis et al, 2021, 2).
7	Baena		Spain	2015	12th century	Exhibition	The Baena Castle, with its towers and fortified stone walls, is a prominent example of the defensive architecture of southern Spain. It was built in the past to protect and control the area (Bermúdez, 2017, 84).
8	Garcimuñoz		Spain	2013	15th century	Exhibition	The Garcimónios Castle is located on a hill overlooking the plains. With its fortified architecture and strategic location, the castle is an example of defensive fortresses from the Middle Ages (Mubarakalgharib, 2024, 123).
9	Kazimierz Dolny		Poland	2013	13th century	Exhibition	The Casimir Dolny Castle was built as a defensive fortress and customs house on the Vistula River and has experienced administrative, military, and residential functions over the centuries. This castle has now been turned into a museum and tourist attraction, while preserving its architectural authenticity (Brykowska, 2019, 35).

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Table 2. Incorporation of new spaces based on the adaptive reuse approach in the studied castles. Source: Authors.

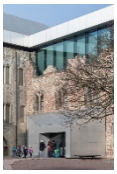
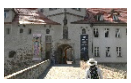
Row	Name	New Spaces					
		Cafe–Restaurant		Ticket Booth		Entrance Volume	
1	Haapsalu Episcopal	✓		✓		×	-
2	Moritzburg	✓		×	-	✓	
3	Castella	×	-	×	-	×	-
4	Pombal	×	-	✓		×	-
5	El Real De La Jara	×	-	×	-	×	-
6	Fortress of Fortezz	✓		×	-	×	-
7	Baena	×	-	×	-	×	-
8	Garcimuñoz	×	-	×	-	×	-
9	Kazimierz Dolny	×	-	✓		×	-

Table 3. Incorporation of New architectural elements based on the adaptive reuse approach in the studied castles. Source: Authors

Row	Name	Elements of New Architecture									
		Stairs		Roof/Floor/Wall		Railing		Window		Door	
1	Haapsalu Episcopal	✓		✓		✓		✓		✓	
2	Moritzburg	✓		✓		✓		✓		✓	
3	Castella	✓		✓		✓		✓		✓	
4	Pombal	✓		×	_	✓		✓		×	_

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Rest of Table 3.

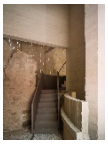
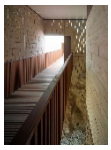
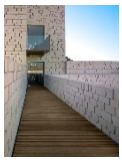
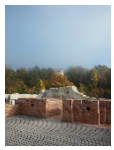
Row	Name	Elements of New Architecture									
		Stairs		Roof/Floor/Wall		Railing		Window		Door	
5	El Real De La Jara	✓		✓		✓		×	_	✓	
6	Fortress of Fortezz	✓		✓		×	_	✓		✓	
7	Baena	✓		✓		✓		✓		✓	
8	Garcimuñoz	✓		✓		✓		✓		✓	
9	Kazimierz Dolny	✓		✓		✓		×	_	✓	

Table 4. New materials based on the adaptive reuse approach in the studied castles. Source: Authors.

Row	Name	New materials									
		Ceramic	Aluminum	Plaster	Concrete	Brick	Stone	Plastic	Metal	Glass	Wood
1	Haapsalu Episcopal	×	×	✓	×	×	✓	×	✓	✓	✓
2	Moritzburg	✓	✓	✓	×	×	✓	✓	✓	✓	×
3	Castella	×	×	×	×	×	✓	×	✓	✓	✓
4	Pombal	×	×	×	×	×	✓	✓	✓	✓	✓
5	El Real De La Jara	×	×	×	×	×	✓	×	✓	×	✓
6	Fortress of Fortezz	×	×	✓	✓	×	✓	✓	✓	✓	×
7	Baena	×	×	✓	✓	×	×	×	×	✓	✓
8	Garcimuñoz	×	✓	×	✓	×	×	✓	✓	✓	×
9	Kazimierz Dolny	×	×	×	×	✓	×	×	✓	×	✓

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Table 5. Intensity of complementary interventions with an adaptive reuse approach in the studied castles. Source: Authors

Row	Name	Addition of New Spaces	Addition of New Architectural Elements	Addition of New Materials	Total Score	Ranking
1	Haapsalu Episcopal	7	10	7	24	1
2	Moritzburg	7	10	10	24	1
3	Castella	0	10	5	15	2
4	Pombal	3	5	7	15	2
5	El Real De La Jara	0	7	3	10	3
6	Fortress of Fortezz	3	7	10	20	1
7	Baena	0	10	5	15	2
8	Garcimuñoz	0	10	7	17	2
9	Kazimierz Dolny	3	7	3	13	3

the incorporation of new spaces is at a later stage. This can be considered as a decision-making criterion in the redesign of historic castles.

Overall, the findings indicate that adaptive reuse, beyond a mere conservation approach, is a design strategy that can, through deliberate interventions at the three levels of space, element, and material, enable the coexistence of past and present times and transform historical monuments into dynamic platforms for cultural and social experience in contemporary times.

Conflict of Interest

The authors declare that there was no conflict for them in conducting this research.

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