
Revitalization in the Age of Artificial Intelligence, an Adaptive Architectural Conservation Strategies for Courtyard Houses in Palestine

Mumen Abuarkub¹, Jihad Awad², Afaq Hyder Chohan^{2*}, Firas Noori²

¹Faculty of Architecture, Isra University, Amman, Jordan.

²College of Architecture, Art and Design, Ajman University, Ajman, UAE.

*Corresponding Author: a.chohan@ajman.ac.ae

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ABSTRACT

This research delves into the architectural nuances of traditional Palestinian courtyard houses, unveiling their varied typologies and significant contributions to cultural identity. Research methodology involves meticulously examining their design (case studies), emphasizing strategic planning, utilization of local materials, and adherence to traditional construction methods. The core of this study centers on the assessment of heritage conservation and adaptation strategies, advocating for the modernization of these historical buildings to meet contemporary demands while safeguarding their cultural heritage. A novel aspect of the research is the application of AI-generated designs, which are utilized to ensure that modifications uphold the architectural integrity of these structures and are sensitive to both historical and modern requirements. This approach fosters a synthesis of local and global conservation practices. The research results present a detailed analysis of adaptive reuse strategies through case studies of the Al Nimr House and Ibrahim Touqan House, demonstrating their successful transformation that incorporates modern enhancements while preserving historical elements. The findings advocate for adaptive reuse as a viable strategy to revitalize historic structures, ensuring their functionality in contemporary society without compromising their historical essence. The study provides a sustainable framework for culturally sensitive urban development and sets a precedent for future conservation projects, highlighting the importance of a balanced approach to integrating modern innovations within traditional contexts.

1.0 INTRODUCTION

The courtyard, a fundamental element in architectural design, has been pivotal in shaping living spaces throughout history. Brzovski (2005) acknowledges its role in offering protection and enhancing domestic intimacy. This traditional design element, serving as the heart of both ancient and modern structures, showcases a design philosophy that transcends time.

In recent times, there has been a notable resurgence in incorporating courtyard designs into contemporary architecture, evident in both residential and public buildings. This trend signifies an increasing appreciation of the courtyard's ability to harmoniously balance communal and private spaces. It particularly addresses the modern era's focus on individuality within living arrangements.

The courtyard's importance is even more pronounced in Palestinian urban settings, where traditional homes are typically built around courtyards. As Hirschfeld (1995) observes, these structures vary in size and layout based on the owner's social and economic standing. They are distinguished by their complete enclosures, creating a distinct separation between internal living spaces and the external world. Such a design ensures effective ventilation and lighting, orienting rooms around the courtyard.

Palestinian courtyard houses often feature multifunctional spaces, where rooms are designed for multiple uses like sleeping and living. Common areas, such as kitchens and bathrooms, are accessible through shared doors, with staircases leading to upper floors. These upper floors sometimes open up to terraces, adding an elevated dimension to the courtyard concept. This architectural approach is particularly conducive to large, extended families, allowing for the division of the house into separate vertical units (Al-Jubeh & Bshara, 2002; Canaan, 1933; Awad, 1996).

Historically, as Al-Jubeh and Bshara (2002) highlight, courtyard houses were the predominant residential structure until the early 20th century. These multistory buildings had upper floors overlooking the main courtyard, fostering both privacy and communal living. When accommodating multiple families, privacy was maintained by constructing walls on upper floors to obscure views to lower levels.

Thus, the traditional courtyard house epitomizes a unique architectural style in the Middle East, it embodies a perfect balance between communal living and individual privacy. The design's adaptability for extended families, while preserving the autonomy of each unit, exemplifies a versatile and sustainable approach to residential architecture.

In contemporary architecture, the underlying principles of courtyard house design have far-reaching implications. They reflect a sustainable approach to urban planning, promoting natural light, ventilation, and a sense of community. This architectural style maintains its relevance, not only as a historical artifact but also as a template for modern housing solutions (Bougdah, 2016; El Demery, 2010; Hanif et al., 2017). This indicates the necessity for the preservation and modification of these traditional dwellings using affordable and practical design techniques. The research posits that utilizing artificial intelligence in design represents a promising approach to help local inhabitants prevent further degradation of their homes.

The conservation of courtyard houses, especially with the integration of AI-generated design, symbolizes a blend of traditional architectural principles with modern technology. This synergy offers innovative avenues for adapting these historical structures to meet contemporary requirements, ensuring the preservation of their cultural and architectural essence (Sukkar et al., 2024; Pena et al., 2021). The incorporation of AI in design processes marks a significant milestone where longstanding architectural traditions gracefully merge with the advancements of modern technology. This integration signifies more than just technological progress; it represents a thoughtful fusion of time-honored design principles with the innovative capabilities of AI (Rane, 2023). This harmonious blend of old and new opens up a realm of possibilities for refurbishing heritage buildings. It skillfully meets the needs of the present while meticulously preserving the rich cultural and architectural heritage embedded within these structures. The approach ensures that the essence of our historical legacy is maintained, even as it undergoes modernization (Panteli et al., 2020; Bruno et al., 2018).

However, the application of AI in the field of generative design for building adaptation is an emerging phenomenon, replete with opportunities for the safeguarding and transformation of heritage properties. This cutting-edge approach in architecture and design brings a new perspective to the conservation and adaptation of historical edifices, marrying past and future in an elegant symbiosis (Cogdell, 2019; Kamali, 2024). Furthermore, Rane et al. (2023) stress that the use of AI in the realm of heritage conservation and adaptation emerges as a sustainable design strategy, significantly reducing financial expenditures. It presents a myriad of design options that are not only financially viable but also attuned to cultural, social, and environmental needs. Through AI, the adaptation process becomes more resource-efficient, context-sensitive, and culturally respectful, marking a new era in architectural conservation where innovation meets tradition.

This study posits that courtyard houses, particularly within the Palestinian context, exemplify architectural ingenuity and resilience. These structures adeptly adapt to evolving social and environmental landscapes while steadfastly preserving foundational principles of protection, intimacy, and communal existence. This research underscores the importance of continued exploration into AI design and adaptation of courtyard houses, emphasizing their lasting significance in architectural discourse and practice.

This study aims at analyzing the historical and cultural significance of Palestinian courtyard houses, focusing on their architectural typologies, traditional construction techniques, and cultural roles. Additionally, it explores AI's potential in architectural conservation, evaluating technologies and methodologies for adapting heritage buildings while maintaining their historical integrity. Furthermore, the study intends to develop an AI-driven adaptive reuse strategy for courtyard houses that meets modern functional needs. Key research questions include the historical and cultural importance of these houses, the effectiveness of conservation policies, the capabilities and limitations of AI in conservation, and how AI can be applied to adapt these houses for contemporary use.

While AI integration offers innovative opportunities as mentioned in Section 1, it also raises ethical concerns and potential drawbacks. AI must be culturally sensitive to avoid compromising heritage significance, and data privacy must be safeguarded, especially in politically sensitive areas. Access to AI technologies may be uneven, leading to disparities in conservation efforts. Furthermore, AI's technical limitations, over-reliance on technology, and significant investment requirements pose challenges.

Moreover, this study also considers that adaptive reuse of courtyard houses has broader social, cultural, and economic implications. It enhances community cohesion, preserves cultural heritage, ensures the transmission of traditional practices, and boosts local economies through tourism and job creation. By integrating AI with traditional methods, the study demonstrates a balanced approach that preserves cultural heritage while embracing modern innovations, fostering a deeper connection between the past and present, and setting a precedent for future conservation efforts.

1.1. Heritage Conservation in Palestine:

The antiquity of buildings and houses in Palestine, including Jerusalem, stands as a testament to the region's rich and diverse historical tapestry. Jerusalem, in particular, is a focal point of historical architecture, with its ancient buildings reflecting a blend of various civilizations and epochs. Jerusalem's architectural heritage spans several millennia, showcasing influences from the Roman, Byzantine, Islamic, and Ottoman periods. The conservation of this mosaic of styles is evident in the Old City of Jerusalem, where ancient structures, such as the Al-Aqsa Mosque and the Church of the Holy Sepulchre, symbolize the city's historical and religious significance (Leatherbury, 2019; Swenson, 2015). Similarly, buildings like Hisham's Palace in Jericho or the Church of the Nativity in Bethlehem further exemplify the ancient architectural heritage. These structures represent architectural ingenuity and narrate the cultural and historical journey of the region. Preserving these ancient buildings is thus pivotal in maintaining the rich history and cultural identity of Palestine (Golzari & Sharif, 2011; Al Jubeh, 2009; Yahya, 2018).

Bleibleh and Awad (2020) emphasize the rich historical and cultural significance of Palestinian heritage buildings, noting that these structures are not just physical entities, but repositories of collective memory and identity, integral to maintaining the historical narrative of the Palestinian people. Complementing this perspective,

O'Neil (2018) addresses the devastating impact of conflicts on cultural heritage, highlighting how, in Palestine, such destruction exacerbates the loss of cultural identity and historical continuity, thereby elevating the importance of preserving heritage buildings.

Further examining the challenges in heritage preservation, Browne and Raff (2023) explore the role of international law in protecting cultural heritage, noting a concerning gap in the enforcement and effectiveness of these laws, especially in the context of the persistent threat to Palestinian heritage buildings. In this context, Shehadeh (2023) offers a unique angle by portraying the preservation of these buildings as an act of cultural resistance, a strategy to combat the erasure of Palestinian history amidst political conflict.

Moreover, Iwaisi and Barghouth (2024) argue for the necessity of adapting heritage buildings to contemporary needs, ensuring their relevance and functionality in modern contexts, particularly in Palestine. This need for adaptation aligns with Qanzu'a (2013) exploration of the economic benefits of preserving heritage buildings, such as tourism and job creation, which could provide significant economic impetus amidst the challenges faced in Palestine.

Delving into the social dimensions, Nahed (2020) focuses on the role of heritage buildings in social and community cohesion. In Palestinian society, these structures often serve as communal hubs, their preservation plays a key role in maintaining social cohesion and community identity. In parallel, Shehada et al. (2015) and Ijla and Broström (2015) highlight the potential of technology in the preservation and restoration of heritage buildings, a crucial consideration in Palestine where traditional methods may fall short due to extensive damage and limited resources.

Moreover, Al Tamimi et al. (2023) underscore the importance of education and cultural awareness in heritage preservation, advocating for initiatives to educate the public, particularly the younger generation, about the value of these structures. This approach is vital for the long-term preservation of heritage buildings in Palestine. Finally, De Cesari (2019) and Daher and Maffi (2014) critically examine the intricate politics surrounding heritage preservation in Palestine. The struggle over heritage buildings often mirrors broader political conflicts, adding layers of complexity to preservation efforts.

2.0 ARCHITECTURE AND CONSTRUCTION OF COURTYARD HOUSES IN PALESTINE

In this section, the unique architectural planning of Palestinian traditional houses, including courtyard layouts, access, doors and windows, surface decoration, and the integration of living spaces, are critical considerations, reflecting the adaptation of traditional Palestinian architecture to local conditions. These architectural factors have been discussed in the context of the possibility for a modern adaptation of these structures, ensuring that modifications align with the integrity of the original design while catering to contemporary needs. Furthermore, an analysis of the construction techniques and materials used in these houses will shed light on the traditional craftsmanship of Palestinian architecture. This section aims to provide an in-depth understanding of the historical, architectural, and cultural importance of Palestinian courtyard houses, contributing to discussions on heritage preservation and architectural adaptation. In this context houses in various regions of historic cities and countryside in Palestine have been reviewed, particularly houses in Nablus, Al Khalil (Hebron), Bethlehem, Gaza, and Tulkarm have been studied and their various architectural and construction factors have been evaluated.

2.1. Courtyard Houses in Urban Districts of Palestine

The study of Hamdan (1996) has outlined the urban districts of Palestine, residences of affluent families displayed distinctive urban architectural traits. These homes were adorned with intricate stonework, the craftsmanship of skilled artisans from major cities. These buildings typically featured two or three rooms, with an extensive room on the upper floor, known as the 'Illiya,' which stood as a symbol of the family's status and power. Family living (salon) is situated above an 'Iwan', a semi-open vaulted space on the ground floor, reinforcing the multi-layered design of Palestinian homes where public and private spaces are vertically integrated. In more opulent residences, a central hall referred to as 'Liwani' was a common feature, flanked by bedrooms on either side, as shown in (Figure 1).



a

b

c

Figure 1. The Iwan and Liwan in Palestinian homes.

Sources (a: Authors; b & c: Revault et al., 2002)



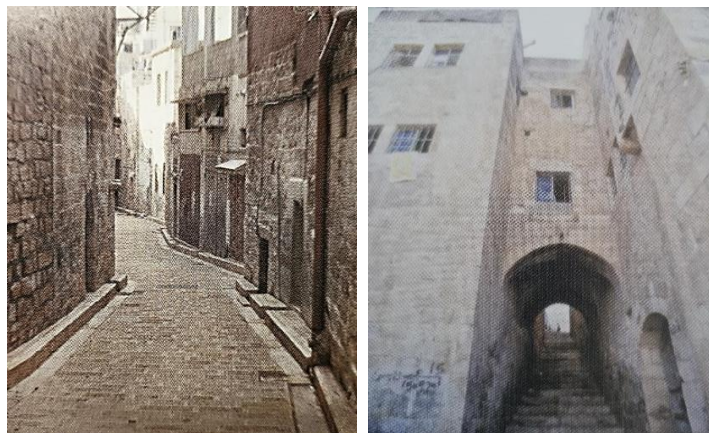
a

b

Figure 2. The balconies and terraces in Palestinian homes.

Source (Revault et al., 1997).

Unlike their rural counterparts, city houses are multi-storied supported by arcades, often featuring balconies or terraces on the first floor overlooking traditional courtyards, as shown in (Figure 2). These private open spaces, whether the ground-floor courtyards or the upper-floor terraces, played a pivotal role in the social fabric of Palestinian family life, especially in maintaining intimacy and privacy. The courtyard and terrace, in particular, served as sanctuaries, fostering a secluded environment for close family interactions and activities. Such architectural elements were not mere structural components but were integral to nurturing the private and communal dynamics of family life in urban Palestinian homes. Besides the essential planning features, design of urban houses often included a narrow curving street access, high straight flight stairs and a connected bridge of extended house over public streets, which are interesting features of the heritage architecture of Palestine, as shown in (Figure 3).



a

b

Figure 3. Narrow curved streets and connecting bridges.
Source (Revault et al., 2002).



a

b

Figure 4. Wooden doors.
Source (UNDP Focus, 2004)



a

b

Source: (Revault et al., 2002)

Source: (UNDP Focus, 2004)

Figure 5. Wooden windows.

Doors in Palestinian heritage architecture are more than mere entryways; they are vital elements that blend utility and art, especially in structures made of stone. Typically made from durable wood, these doors are nestled within elegantly horseshoe and circular stone arch, a distinctive feature of the region's architectural legacy, as shown in (Figure 4). The surrounding stonework is not merely supportive but also adorned artistically. A notable aspect of these heritage doors is the presence of stone corniced entrances. The cornice, an ornamental feature protruding above the doorway, brings a sense of majesty and intricacy to the design as shown in (Figure 4b). The embellishments on these doors are a testament to the area's cultural artistry, displaying detailed engravings of geometric shapes, elaborate calligraphy, and designs reflecting the local environment. This ornamentation goes beyond mere decoration, encapsulating the region's artistic and cultural essence.

However, windows laid in stone walls are integral to both the aesthetics and practicality of the design of Palestinian house. Typically arranged in harmonious sets of two or three, these windows are interspersed either with beautifully ornate stone embellishments or simple stone post, contributing significantly to the visual allure of the buildings, as shown in (Figure 5). Crafted traditionally from wood, these windows serve the dual purpose of moderating sunlight and facilitating ventilation. They are often adorned with external shutters of sunscreen, which not only permits light and air to flow in but also ensures privacy and aids in heat reduction. To optimize airflow, many windows in this architectural style are fitted with a ventilator at the top, as shown in (Figure 5a). Additionally, the heritage structures in Palestine commonly feature windows reinforced with iron grills. These grills provide extra strength and security to the windows, simultaneously enhancing the building's aesthetic as shown in (Figure 5a).

2.2. Houses in Rural and Suburban of Palestine

In Palestinian villages, buildings were isolated near farming areas in small clusters, separated by unpaved roads, with each cluster centering around a shared courtyard. Typically, these courtyards housed a semi-private main square with common facilities and courtyards for extended families. Families generally occupied a single room opening onto the courtyard, with the house's size reflecting the owner's wealth and the style of construction. These houses have stable or indoor space for domestic and farming animals in the subfloor and have high vaulted roof or flat roof supported with big open arches, constitute sleeping and private spaces at first floor as shown in (Figure 6). In this context it could be added that a traditional Palestine house in countryside is earlier model of open floor planning and barn house. These distinctive features of countryside houses in Palestine make them different from their counter parts of houses in urban districts of Palestine.



Figure 6. Indoor spaces of rural houses.
Source (Awad, 2012)

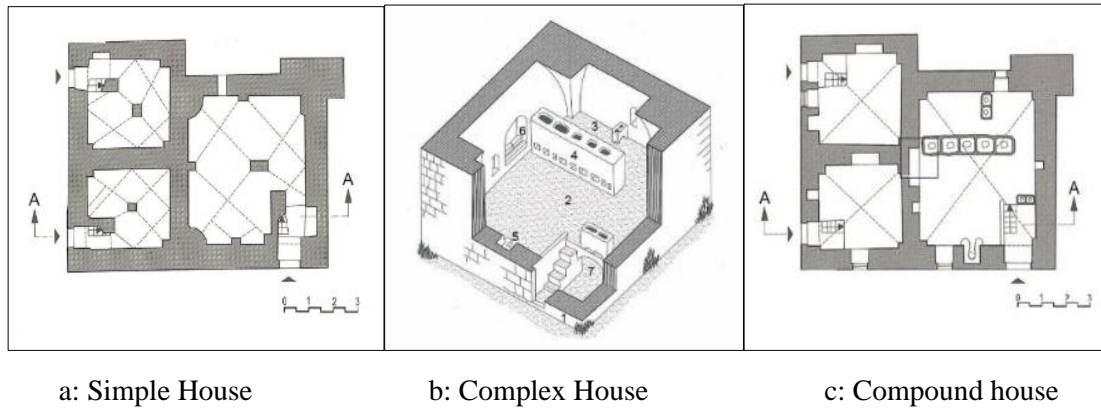


Figure 7. Spatial organization and different levels of rural houses.
Source (Awad, 2012)

The combination yard, high roof and animal spaces constituted a singular unit in Palestinian heritage house in rural society. Yard sizes and features, including types of housing, fences, doors, and other facilities, varied considerably. Researcher Hamdan (1996) has classified these yards of Palestinian houses into three categories based on their social context: simple, complex, and compound. The dimensions of a dwelling are a key determinant in distinguishing various types of houses. Simple abodes typically feature a solitary room serving multifunctional purposes such as living, sleeping, and cooking. On the other hand, more complex residences boast several rooms, including an 'Iwan', which is a space partially open to an adjoining courtyard. Whereas compound type larger structures encompass a reception area situated on the ground level, alongside distinct outdoor areas allocated for various members of the household – men, women, and servants – as well as for assorted private endeavors, as shown in (Figure 7).

The earlier traditional rural houses exhibit a modest facade that is characteristic of the vernacular architecture in the region. Constructed from stone blocks meticulously laid in limestone mortar, the structure showcases the durability and natural materials commonly used in Palestinian rural construction. The facade is understated, featuring minimal openings that likely serve to maintain moderate temperatures inside and offer protection.

The windows, or oriels, are minimal and strategically placed, suggesting a design priority for security and climate control over abundant natural light. Such restraint in openings would be consistent with the need to keep the interior cool during hot summers and warm during cool winters. This architectural style speaks to a deep understanding of the local environment and available resources, optimizing for the comfort of its inhabitants with the means at hand, as shown in (Figure 8).

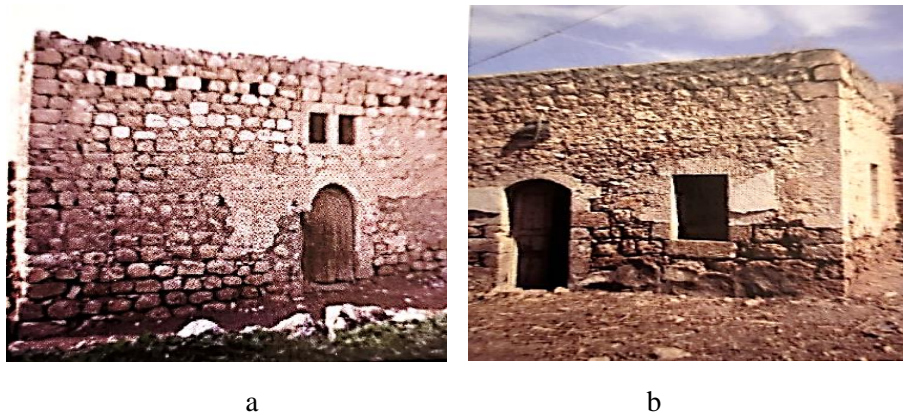


Figure 8. Openings in rural houses.
Source (Awad, 2012)

However, subsequent house designs evolved to include larger windows and walls about one meter thick to support heavy stone slab roofs. Extended families lived in adjoining houses, connected by courtyards and arranged according to their closeness to the family patriarch and their need for privacy. Sons would set up their own dwellings next to their fathers', while still remaining part of the same familial quarter. as shown in (Figure 9).

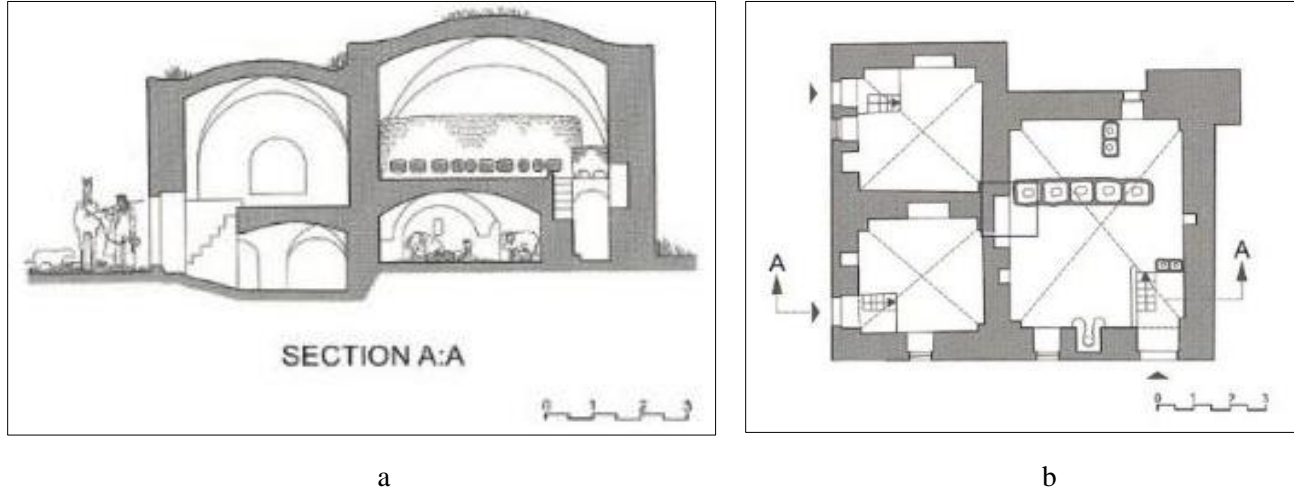


Figure 9. House of extended family.

Source (Awad, 2012)

A distinctive architectural feature found in some large traditional rural houses in Palestine is a parapet wall atop a terrace or roof, embedded with terracotta or clay water vessels. These vessels, typically positioned within the wall itself and bonded in truss formation masonry, serve both functional and climatic purposes, as shown in (Figure 10). Filled halfway with water in the evenings, embedded vessels allow warm air to pass through potted water and cool the warm air during the hot summer months. As night falls and temperatures drop, the water's retained heat is slowly released, helping to moderate the air temperature in the living spaces immediately behind the wall. This ingenious design, rooted in ancient knowledge of passive cooling, exemplifies the resourcefulness of traditional Palestinian architecture, utilizing locally available materials to create a comfortable living environment responsive to the region's arid climate (Awad, 2012; Dalman, 1964; Abuarkub, 2000; Amiry, 2003; Amiry & Tamari, 1989).

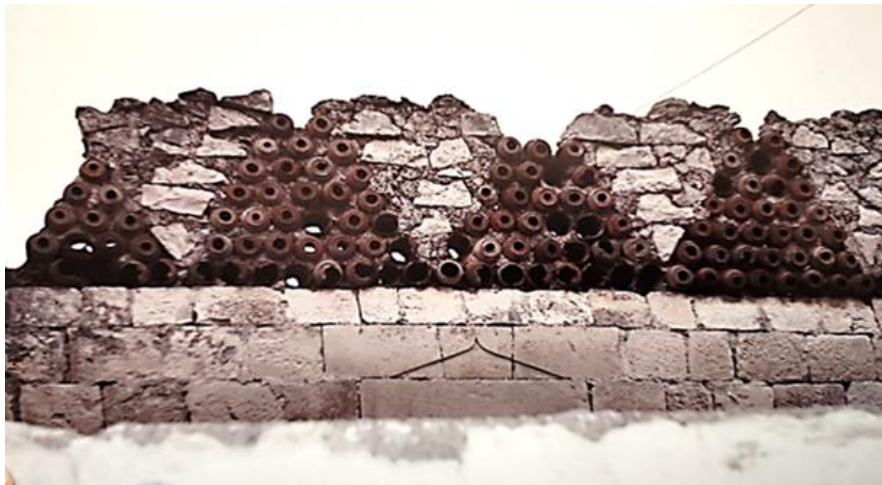


Figure 10. Parapet wall with cooling clay vessels.

Source (Awad, 2012)

In the following (Figure 11), a series of doorways demonstrate the traditional rural Palestinian house design, where functionality often takes precedence over aesthetics. The doors are simple yet sturdy, reflecting the modest design ethos common in rural settings. Above each door, there's a notable feature of perforated stone masonry, which serves a practical ventilation purpose. This element allows for air circulation while maintaining privacy and security inside the home. The perforations vary in design, showcasing an understated beauty and the skillful craftsmanship of local stonemasons who have balanced practical needs with cultural design elements. This type of ventilation technique is a testament to the ingenuity of traditional architecture in hot climates, enabling homes to remain cool and comfortable (Awad, 2012; Dalman, 1964; Abuarkub, 2000; Amiry, 2003; Amiry & Tamari, 1989).

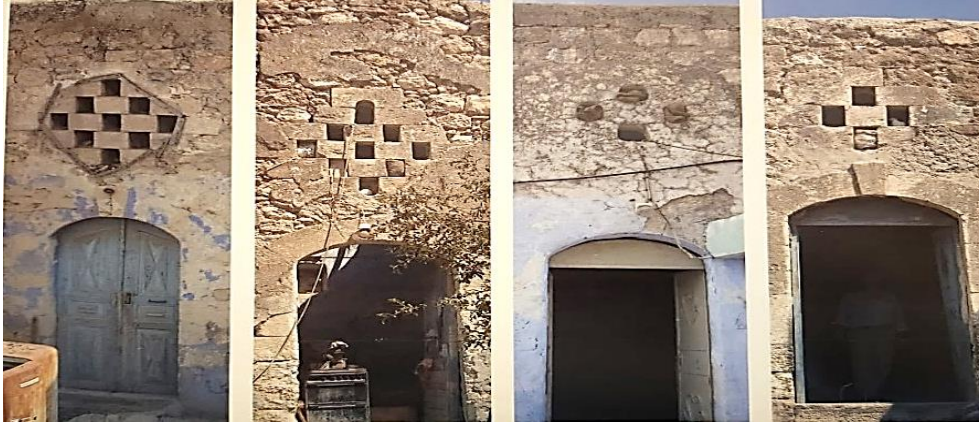


Figure 11. Door styles and ventilation combs in rural Palestinian houses.

Source: (Awad, 2012)

2.3. Need of Adaptation of Heritage Houses

Besides critical discussion on the heritage housing of Palestine, this study delves into the adaptation of heritage houses within the Middle East and Arab countries, considering aspects of conservation, tourism, and archiving this would help to accomplish objective four.

The conservation of heritage housing plays a pivotal role in preserving historical and cultural identities in these regions, bridging the gap between past and present. However, this preservation faces challenges such as modernization pressures, lack of funding, and in some cases, political instability, as seen in Syria and Yemen (Lamprakos, 2017). However, being an important Arab country, the UAE has a successful model of heritage adaptations, such as the restoration of Al Fahidi historical neighborhood in Old Dubai. Whereas in Sharjah, the whole heritage area with traditional houses, souqs and narrow alleys, was restored aiming to make it a tourist site and showcase the possibility of harmonizing traditional architecture with modern needs (Salameh & Touqan, 2023; Frymoyer, 2023).

Heritage housing has also become a key player in enhancing cultural tourism. The transformation of traditional houses in Morocco into boutique hotels exemplifies this, contributing significantly to local economies and cultural experiences (Boujrouf, 2014). In Egypt, the reuse of historic buildings in Cairo has revitalized urban tourism and supported local businesses (Shehata, 2014). Besides these advantages of heritage conservation and adaptation, advances in digital archiving, such as 3D mapping of historical sites, have revolutionized the way heritage housing is documented and preserved. Some studies present a channel to categorize 3D heritage data, either working on the texture or directly on the 3D geometry, depending on the needs and scope of the classification (Grilli & Remondino, 2019). Similarly, in Saudi Arabia, Al Sabban and Fatani (2018) have worked out the digital modeling, documenting, and archiving of a neighborhood of the Islamic architectural heritage area near the Holy Mosque in Makkah city.

During case studies at various sites in Palestine, this study noted that community involvement plays a significant role in the preservation and modernization of cultural heritage. The deep-seated sense of ownership that local populations hold over historical properties is invaluable. Engaging these communities not only taps into this inherent connection but also ensures that conservation efforts are culturally sensitive and widely supported. When residents participate in the decision-making process, it leads to a more authentic and meaningful preservation of their heritage, fostering a collaborative approach that benefits both the legacy of the past and the needs of the present.

Community engagement plays a crucial role in the effective adaptation of heritage houses. Initiatives in Beirut led by local communities have been instrumental in preserving and adapting the city's heritage houses, emphasizing sustainable practices that respect cultural norms (El-Bastawissi et al., 2022). Correspondingly, Elie (2020) reported that restoration and adaptation projects in historical cities like Sana'a, Yemen, reflect this community-centric approach. However, certain directions and limitations are required to perform such practice. In this regard, effective policy frameworks and international collaboration are essential for the preservation of heritage housing. The government of Oman, for instance, has successfully balanced heritage housing conservation with modern development (Nasr & Khalil, 2022). While UNESCO's involvement in places like Old Sana'a and Shibam in Yemen highlights the importance of international support (Lewcock, 2017).

The discussion above can be précised as heritage conservation and adaptation is a challenging work, one of the major challenges in adapting heritage housing is maintaining authenticity and historical accuracy. Future directions may include integrating technologies like augmented reality to enhance the experience of heritage housing without compromising its historical integrity. In summary, the adaptation of heritage housing in conflict and war-torn regions is complex yet vital for cultural preservation, economic growth, and educational advancement. Despite challenges, especially in conflict-ridden areas, the potential benefits of these adaptations are immense. Future strategies should focus on sustainable, community-based approaches, underpinned by robust policy frameworks and global cooperation.

3.0 METHODOLOGY

This research employs a methodologically robust, four-phase approach to investigate the preservation and adaptation of courtyard houses in Palestine, aligning with proven heritage conservation practices as outlined in (Figure 12). Each phase is meticulously designed to address distinct research objectives and overcome inherent challenges associated with the conservation of architectural heritage in both local and global contexts.

The initial phase undertakes a comprehensive analysis of regional conservation policies, inspired by the methodologies of Kashihara et al. (2022). It critically assesses the effectiveness, challenges, and limitations of these policies by examining UNESCO reports, regional policy documents, and legal frameworks, to understand their implementation and efficacy in safeguarding heritage buildings. This phase highlights methodological constraints in the form of policy interpretation and regional legislative variations, which could affect the applicability of findings.

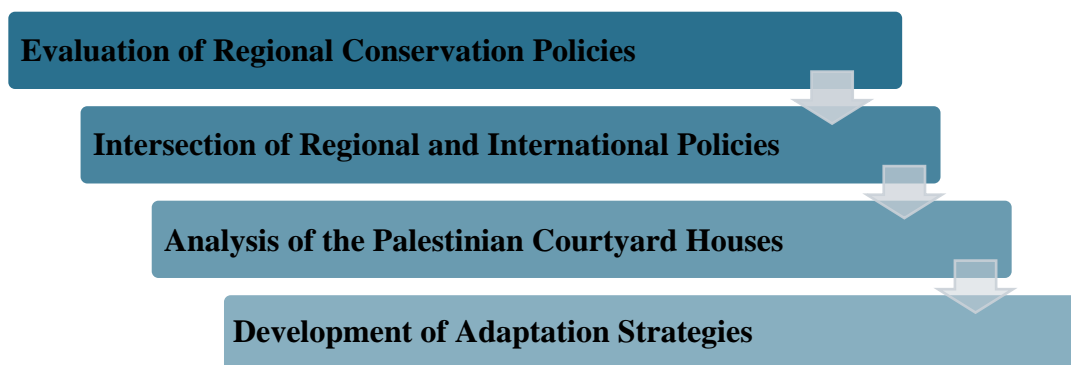


Figure 12. Research Methods.

Subsequently, the research incorporates a comparative analysis, following the methods of Madgin and Lesh (2021), to evaluate the alignment or discrepancies between Palestinian and international conservation standards as established by UNESCO. This phase rigorously reviews global conservation practices to identify best practices and gaps, providing a broader perspective on the effectiveness of local conservation efforts. Data collection methods in this phase include comprehensive literature reviews and comparative policy analysis, which are essential to understanding the broader context of heritage conservation.

The third phase involves detailed classification and analysis of courtyard houses, utilizing field surveys, case studies, and architectural evaluations akin to those conducted by Bostenaru Dan et al. (2024). Through on-site inspections, photographic documentation, and architectural mapping, this phase categorizes the architectural styles and historical importance of these structures, pinpointing specific conservation needs. However, challenges such as access to sites, the current state of buildings, and obtaining accurate historical data pose significant methodological constraints. Analytical approaches in this phase include typological analysis and condition assessments, crucial for developing effective conservation strategies.

In the concluding phase, leveraging the participatory design approaches advocated by Davis et al. (2021), the study involves local stakeholders in workshops to create adaptive strategies for the modern use and conservation of courtyard houses. This phase ensures that the proposed solutions are culturally sensitive, technologically advanced, and feasible, promoting sustainable conservation aligned with modern living standards. The data collection methods in this phase involve stakeholder interviews, workshops, and participatory design sessions, ensuring that local insights are incorporated. Analytical approaches focus on synthesizing community feedback with technical assessments to propose balanced conservation strategies.

Throughout the research, a dynamic and iterative approach is maintained, permitting continuous adaptation based on real-time findings and feedback from stakeholders. This methodology not only enhances scholarly understanding of heritage conservation in areas marked by conflict but also delivers practical, implementable strategies for the sustainable adaptation and preservation of historical structures in Palestine. This comprehensive approach acknowledges the inherent limitations and challenges in heritage conservation, while also leveraging methodological rigor to navigate these complexities effectively.

3.1. AI Design Strategies for Courtyard Houses in Palestine

In addition, this research posits that integrating Artificial Intelligence (AI) into architectural conservation marks a pivotal shift in the methodologies employed for preserving and adapting historic structures, which focus on heritage conservation in Palestine and the overarching need for such conservation efforts. Particularly relevant to courtyard houses, this approach enables these culturally and historically significant buildings to be transformed into modern amenities such as boutique hotels, galleries, and restaurants. This strategic integration of AI not only aligns with Section 4's objectives by enhancing the adaptive reuse strategies but also ensures that the essence of the heritage is meticulously maintained, thus bridging traditional values with contemporary needs. This synthesis of innovative technology with traditional conservation practices exemplifies the study's commitment to revitalizing historical architecture while safeguarding its integrity. Many studies have endorsed such development and ambitious plans of conservation and adaptation (Salameh & Touqan, 2023; Frymoyer, 2023; El-Bastawissi et al., 2022).

In the case of adapting courtyard houses for contemporary uses, AI emerges as a crucial tool, balancing the preservation of historical integrity with the demands of modern functionality. It enables the analysis of structural integrity and supports the creation of virtual adaptation models. According to Rane (2023), AI technology plays a pivotal role in spatial planning, ensuring that modifications to transform a courtyard house into, say, a boutique hotel, do not compromise the building's historical essence. In spaces such as galleries or trade centers, AI can efficiently plan for optimal space usage and visitor circulation. This study aims at that AI's contribution extends to enhancing the visitor experience in case studies (Section 3.2.), for tourist attractions, boutique hotels, restaurants, and cafes located within heritage houses. AI-driven systems can offer interactive and educational insights into the building's history and in addition, AI can set blueprints of adapted building operations, from personalizing customer service to managing reservations and inventory (Hegazy & Saleh, 2023; As et al., 2018).

In this context this study has put forward the development of a specialized methodology utilizing Promeai's application (Image-To-Image) technology to showcase the innovative potential of AI in the architectural redesign of historic structures like Al Nimr House and Ibrahim Touqan House in Nablus, Palestine. This approach is specifically designed to ensure that modern technological applications honor the cultural and architectural integrity of these heritage sites, as shown in (Figure 13).

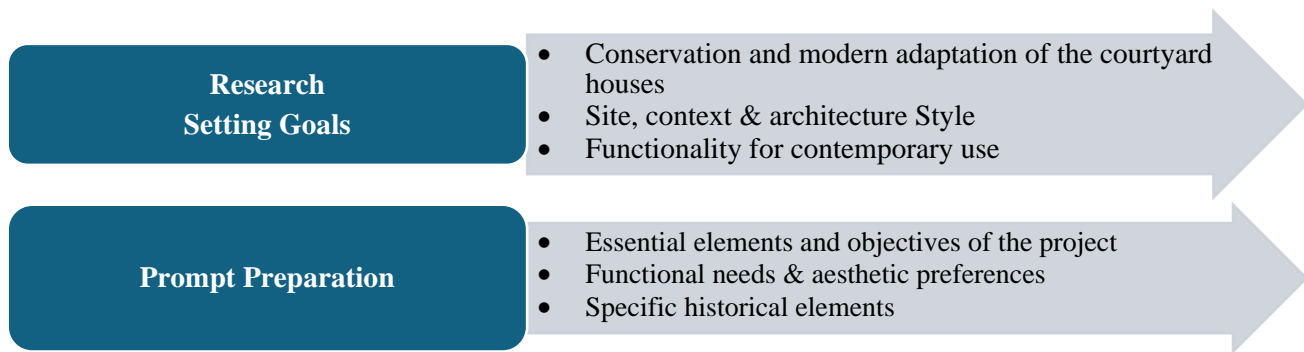


Figure 13. Methodology for AI Generative Design.

Project Definition and Preliminary Research: This stage is crucial for setting clear goals related to the conservation and modern adaptation of the courtyard houses. It involves an intense review of the historical and architectural importance of these buildings, aiming to maintain their cultural significance while updating their functionality for contemporary use. This process includes a detailed examination of the site's environmental and cultural context to ensure that new designs are harmoniously integrated with the traditional landscape.

Input Preparation: Effective AI-generated design requires precise and thoughtful input preparation. A comprehensive design prompt is created, outlining the essential elements and objectives of the project, including functional needs, aesthetic preferences, and specific historical features to be preserved. Reference images are carefully selected to guide the AI, depicting both the traditional aspects of Nablus courtyard houses and ideas for their contemporary adaptation. The style parameters are set to blend traditional architectural motifs with modern design principles, enhancing the property's historical value while equipping it for modern demands. This methodically structured approach leverages advanced AI capabilities to foster architectural innovation, ensuring that the enhancements are sensitive to the historical essence and cultural context of Palestinian courtyard houses.

3.2. Case Studies of Heritage Houses in Palestine

The selection of case studies in the old city of Nablus is underpinned by its distinguished historical significance. Recognized as one of Palestine's oldest continually inhabited cities, Nablus holds a prestigious spot on the UNESCO World Heritage list, reflecting its deep historical and cultural heritage. The city serves as a prime exemplar of early urban centers, having been a hub of human activity for over two millennia (Awad, 1996).

Nablus stands out as a quintessential representation of traditional Islamic urban design, showcasing a wealth of courtyard houses that are architecturally significant. These structures embody the architectural and communal living styles that are characteristic of the region, making them invaluable for academic and preservationist studies. Furthermore, Nablus has historically functioned as a vital commercial and industrial nexus within Palestine, fostering robust trade relationships with other major regional centers, including Damascus and Aleppo. This dynamic has contributed to its rich tapestry of cultural and economic exchanges, reinforcing its status as a critical study location for understanding the complex interplay of history, architecture, and commerce (Dalman, 1964).

The case studies section has delved into a selection of Palestinian courtyard houses, meticulously chosen for their historical significance and adaptability. Each house showcases unique architectural designs and offers insights into traditional construction methods and materials. Key selection criteria include the historical and antiquity value of the houses, underscoring their architectural and cultural significance in the Palestinian heritage landscape. Additionally, the proximity of these houses to other heritage sites and tourist attractions is a vital factor,

enriching their cultural relevance and situating them within Palestine's historical context. In this regard, two samples of heritage houses were selected to review the prospectus of adaptation with the help of Artificial Intelligent Design (AID) in these houses. The two considered cases are "Al Nimr House" and "Ibrahim Touqan House," both of which are notable due to their historic importance and location in Nablus city.

3.3. Al Nimr House in Nablus

The architectural layout depicted in Figures 14-15 is that of Al Nimr House, a notable example of traditional Palestinian architecture situated within the historical and cultural context of Palestine. This architectural plan showcases a large house with a central courtyard, characteristic of the region, designed to accommodate a moderate-sized family, integrating both communal and private living spaces within its confines.

Central to the house's architectural design are two prominent arched halls or 'Iwans' which serve as the family's communal chambers. These Iwans are elegantly structured, each crowned with a vaulted roof supported by high, pointed arches that not only augment the aesthetic appeal of the space but also contribute to its structural integrity. The presence of a fountain within the main Iwan is a critical element, strategically incorporated to enhance thermal comfort. This feature is traditional, exploiting the cooling properties of water evaporation to moderate the temperature within the space, making it a comfortable gathering area during warmer climates.



Figure 14. Views of Al Nimr House.

Source: (Authors)

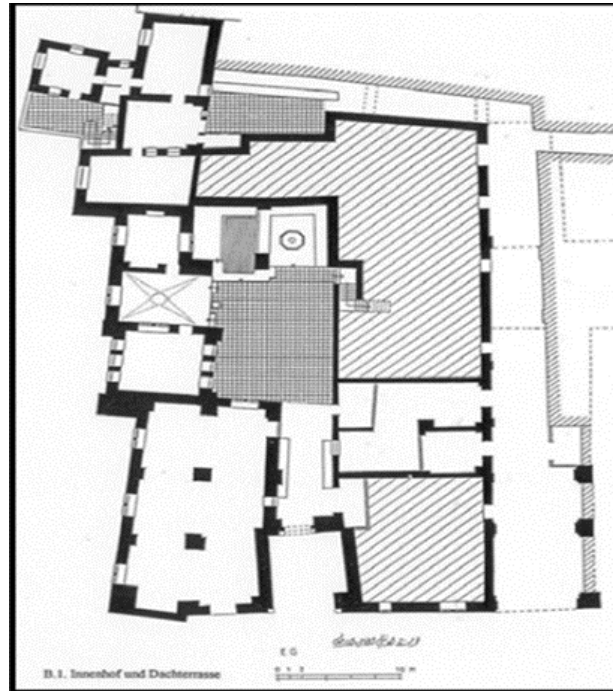


Figure 15. Plan of Al Nimr House.

Source: (Awad, 1996)

The house is structured around a central courtyard, which serves as a light well and ventilation hub, centralizing the flow of natural light and air into the surrounding rooms. The layout effectively segregates the living quarters, sleeping areas, kitchens, and service zones, with each space methodically arranged around the courtyard. The solid stone construction of the walls, varying in thickness from 0.5 to 1 meter, exemplifies the traditional building techniques aimed at ensuring the structure's durability and thermal mass.

The roofs and terraces that cap the building enhance its functionality, offering additional outdoor living spaces and opportunities for passive cooling. Despite its current state of abandonment, Al Nimr Household has substantial potential for revitalization and adaptive reuse. Its architectural features and historical significance make it an ideal candidate for transformation into a tourist information center.

The proposed adaptation could include the establishment of an open gallery, a souvenir shop, spaces designated for handicraft training, and a small café. Such enhancements would not only preserve the architectural integrity and historical essence of Al Nimr House but also introduce a functional space that contributes to the local economy and cultural tourism. This adaptive reuse strategy would breathe new life into the structure, turning it into a vibrant cultural hub that showcases the rich heritage of Palestine while providing practical amenities to both tourists and locals.

This undertaking is not just a commercial venture; it is a cultural mission, melding preservation with progress. The prospective enterprise would provide economic stimulus to the local community while safeguarding a treasured chapter of Palestinian history. Through such endeavors, the architectural marvels of Palestine's urban heritage can be celebrated and sustained for generations to come, their stories resonating through time.

3.4. Ibrahim Touqan House

Within the fabric of Old Nablus' historic urban tapestry, a blueprint emerges, revealing an architectural marvel steeped in Palestinian tradition. The house belongs to the famous Palestinian poet "Ibrahim Touqan." A trapezoidal edifice unfolds in vertical symmetry, portraying two stories of stone masonry façade (Figure 16). The structure's past is evident, carved into each block and corridor.

The blueprint unveils a quintessentially Palestinian typology: a courtyard dwelling meticulously organized to foster family life within its confinements. The rooms around the central courtyard, geometrical in form, providing solace and communal space for inhabitants. These inner chambers of serenity are enveloped by the bustle of domesticity, with living rooms, bedrooms, culinary spaces, and functional zones emanating from this nucleus, embracing both seclusion and social congregation.

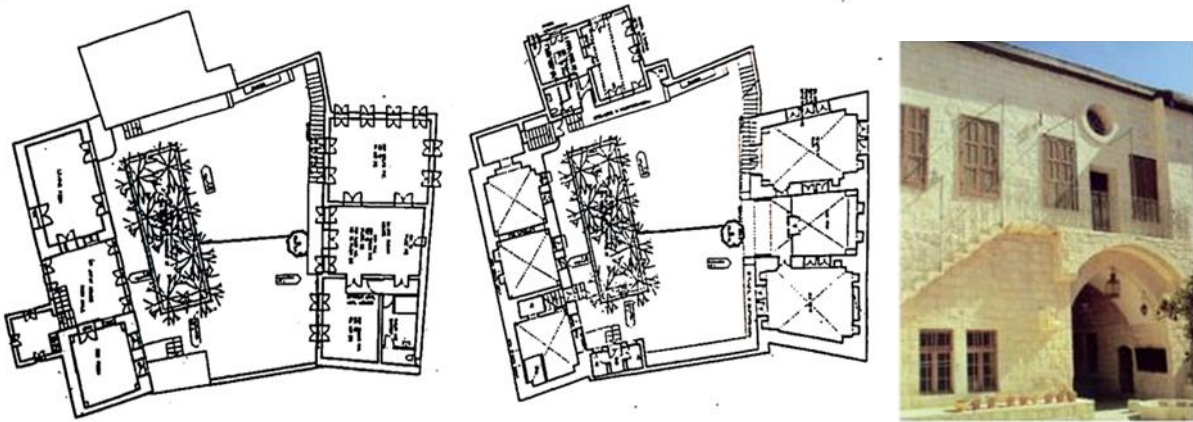


Figure 16. Plans of Ibrahim Touqan House.

Source: (Arch. Jafar Touqan, son of Ibrahim Touqan)

The construction techniques chronicled in the plan are a testament to the vernacular masonry that characterizes the region. Towering walls, their thickness oscillating between formidable half-meter spans to a full meter's breadth, exhibit the load-bearing capacity and defensive qualities inherent in traditional urban Palestinian architecture. These strong walls are mounted by terraces and flat rooftops, creating a stratified outline against the skyline, each tier offering a potential for repose or community gathering.

At present, the house stands in repose, echoing with the silent stories of yesteryears. Its abandonment belies the latent vitality within, ripe for transformation. The proposition of reanimating the structure as a nexus for tourism ignites the imagination. Envision a space where local and global narratives intertwine—an open gallery breathing new artistic life into ancient walls, a souvenir shop celebrating Palestinian crafts, workshops echoing with the sounds of artisans sharing their time-honored skills, and a café offering a taste of local hospitality.

The envisioned adaptation reaches beyond mere renovation; it seeks a symbiotic relationship between the edifice's historic soul and the contemporary pulse of the city. It envisages a place where heritage is not only observed but experienced, where visitors can navigate through layers of history translated into tangible, interactive spaces. The outcome will be a harmonious blend of education, commerce, and cultural exchange, casting the old stones in a new light that honors their legacy while infusing them with present-day relevance.

4.0 FINDINGS

The findings from traditional Palestinian courtyard houses reveal a diverse array of residential designs, all centered around the critical element of open spaces. The typology of these houses is intricately defined by the presence, layout, and cultural significance of courtyards, which play a pivotal role in Palestinian housing. This open space, whether it is a ground floor courtyard or an upper floor terrace, holds immense value in the private and social lives of Palestinian families, signifying a deep respect for the intimate familial sphere. These studies have shown that large courtyard houses, often found in rural Palestine and resembling palaces or castles, showcase a distinct urban architectural style. Their design, volume, and details bear a striking resemblance to the homes of

wealthy merchants in Palestinian cities. This similarity underscores the influence of urban architectural styles on rural dwellings, particularly in terms of the size and function of their inner courtyards.

Extensive review and case studies taken in this research has led to the typological categorization of Palestinian courtyard houses into seven distinct groups, each defined by their architectural planning and orientation. These categories include:

- Houses with internal yards and rooms orientated towards these yards.
- Houses featuring internal yards with rooms facing both inwards and outwards.
- Residences with staircases situated within the yard.
- Homes with front yards.
- Dwellings with backyards.
- Structures combining internal and front yards.
- Abodes with lateral yards.

These typologies reflect the diverse architectural preferences and functional requirements in Palestinian residential architecture. The orientation of rooms, whether inward towards the courtyard or outward, the positioning of staircases, and the presence of front, back, or lateral yards, all contribute to the unique character and functionality of each house. This rich variety in design and layout highlights the adaptability and evolution of the traditional courtyard house in the Palestinian architectural landscape.

4.1. Evaluation of International & Regional Conservation Policies

Researchers like Abdelhamid (2020) and Hammami (2012) have been pivotal in developing a structured heritage conservation policy in Palestine, despite ongoing conflict and lack of formal policy. Their work has significantly enhanced awareness and ensured adherence to international conservation norms, as detailed in Table 1. They emphasize safeguarding Palestinian cultural heritage, aligning with UNESCO's guidelines, and advocating for local and global preservation efforts. The challenge is to translate their contributions into effective policies through continuous research, advocacy, and community engagement.

Table 1. Palestine Heritage Conservation Policy.

No	Palestine's Heritage Conservation Policy Recommendations
1	Accelerate the approval of the new Plan and Building Act to support national physical planning policies and local level planning.
2	Incorporate cultural, historical, and natural heritage considerations in urban and rural structural plans.
3	Form the Legislative Protection of Cultural and Natural Heritage in Palestine.
4	Establish legal frameworks to encourage private and public bodies in conserving historic buildings, monuments, and areas.
5	Support conservation legislation with careful planning policies.
6	Allocate or seek financial support for conservation projects.
7	Develop educational and training programs in physical planning and conservation to provide skilled staff.
8	Enhance public awareness of the importance of preserving cultural and natural heritage.
9	Encourage public participation in community revitalization and conservation, fostering a sense of belonging.
10	Improve cooperation and coordination among ministries, institutions, authorities, the private sector, and NGOs in conservation and preservation efforts.

Furthermore, UNESCO's Agenda for Sustainable Development 2030 highlights cultural heritage and artistic innovation as key drivers of sustainable progress. In Palestine, UNESCO promotes cultural vibrancy and preserves historical legacies, aligning with global conservation commitments. Collaborating with Palestinian institutions and experts, UNESCO integrates cultural heritage into development goals, with the Ramallah office providing technical advice and policy guidance (UNESCO Ramallah, n.d.). Key efforts include maintaining Al-Khalil Old Town on the World Heritage List, listing the Church of the Nativity as endangered, and recognizing the cultural landscape of Southern Jerusalem, Battir, and prehistoric ruins near Jericho, Table 2 portrays the listing of declared world heritage sites (UNESCO World Heritage Convention, n.d.; Wikipedia). These actions underscore UNESCO's role in active preservation and international advocacy, crucial for protecting cultural sites amidst regional conflicts and fostering peace and security through cultural identity and international cooperation.

Table 2. Heritage Sites in Palestine

Site No	Site Title	Location	UNESCO Decision
1	Al-Khalil Old Town (C 1565)	Hebron (Palestine)	The status of Al-Khalil Old Town relating to the World Heritage List remains unchanged as reflected in Decision 41 COM 8B.1 of the last World Heritage Committee.
2	Birthplace of Jesus: Church of the Nativity and the Pilgrimage Route, Bethlehem (C 1433)	Bethlehem (Palestine)	To retain the Birthplace of Jesus: Church of the Nativity and the Pilgrimage Route, Bethlehem (Palestine) on the List of World Heritage in Danger.
3	Landscape of Southern Jerusalem, Battir	Battir (Palestine)	To retain Palestine: Land of Olives and Vines, a Cultural Landscape of Southern Jerusalem, Battir (Palestine) on the List of World Heritage in Danger.
4	Jericho in the occupied West Bank as a World Heritage Site in Palestine.	Jericho (Occupied West Bank) Palestine.	A United Nations committee has voted to list prehistoric ruins near the ancient city of Jericho in the occupied West Bank as a World Heritage Site in Palestine.

In addition to the above, various other tourist sites in Palestine are considered as heritage sites that need to be conserved. Table 3 shows a few of these:

Table 3. Heritage and Historical Sites in Palestine. Source: (UNESCO World Heritage Convention, n.d.)

1	El-Bariyah: wilderness with monasteries	7.	Sebastia
2	Qasr Al Basha in Gaza City	8.	Anthedon Harbour in Gaza
3	Wadi Natuf and Shuqba Cave	9.	Wadi Gaza Coastal Wetlands
4	Old Town of Nablus and its environs	10.	Baptism Site "Eshria'a" (Al-Maghtas)
5	Tell Umm Amer	11.	Hisham's Palace/ Khirbet al- Mafjar
6	Throne Villages	12.	Mount Gerizim and the Samaritans, Nablus

At this stage of research, it is evident that Palestine holds significant historical importance, especially for its religious structures. The history of courtyard housing in Palestine is as ancient as that of established world heritage sites. Despite this rich heritage, UNESCO's conservation efforts have primarily focused on religious sites like the birthplace of Jesus Christ, with limited attention to residential buildings. Ongoing conflict and territorial occupations threaten these heritage structures, necessitating scholarly research to document and formulate policies for their protection. Therefore, this study utilizes AI to archive and adapt Palestinian housing as presented in the

following section of this paper, ensuring cultural integrity while meeting modern needs. Integrating AI offers innovative conservation solutions, blending traditional values with advanced technology, thus supporting sustainable preservation and boosting tourism.

4.2. AI Design for Al Nimr House in Nablus

Figure 17 showcases a (Option 1) of potential AI-generated design adaptation for Al Nimr House in Nablus, Palestine. This visualization offers a transformative view of the courtyard, reimagined as a cafe and restaurant space, enhancing its functional appeal while preserving the architectural heritage of the building. Central to this redesign is the emphasis on the Iwan, a traditional element of Palestinian architecture, which serves as a focal point, enveloping the space with a sense of historical continuity and cultural depth.



Figure 17. AID Option No. 1 of Al Nimr House

In this design option, the facade has been meticulously rendered with wooden effects, a choice that infuses the structure with the delicacy of local crafts, resonating with the traditional architectural features of Nablus. This approach not only maintains the aesthetic authenticity of the building but also highlights the craftsmanship inherent to the region's architectural practices.

The interiors of the Iwan have been tailored to reflect an ambient, dim lighting scheme, an homage to the historical use of gaslit lanterns and candles that would have once illuminated such spaces. This lighting choice casts soft shadows and warm glows across the stone and wood, inviting visitors to immerse themselves in a setting that bridges the historical with the contemporary. This design cleverly harmonize functionality with historical reverence, proposing a space that is both a vibrant social hub and a living testament to the architectural heritage of Al Nimr House.

Whereas Figure 18 depicts "Option 2" for the AI-designed transformation of the Al Nimr House in Nablus, Palestine, employing a contemporary vision while maintaining traditional architectural integrity. This design diverges from the previously discussed traditional approach by adopting modern lines to recreate the courtyard as a vibrant, tropical cafe and restaurant.

In this adaptation, the facade is washed in white, a color choice that symbolizes peace and purity. This not only brightens the space but also accentuates the communal chamber, known as the "Iwan." The starkness of the white facade serves to highlight this central element, making it a prominent feature of the design. Further modifications include alterations to the wall adjoining the Iwan, reconfigured to support additional functional

spaces conducive to a boutique hotel. This ensures that the new structures are seamlessly integrated, providing essential services without detracting from the courtyard's aesthetic and functional appeal.

The courtyard itself is transformed into a tropical garden, with plantations that evoke a sense of being in a verdant oasis. This choice of flora complements the modern cafe setting and invites a relaxed, natural environment that contrasts with the urban surroundings. The flooring is composed of small, irregular concrete blocks that nod to the old, paved streets typical of historical Nablus, thus grounding the contemporary design in historical context.



Figure 18. AID Option No. 2 of Al Nimr House.

Overall, this design represents a compelling fusion of modern interiors with the traditional architectural elements of a courtyard house in Nablus. It skillfully blends the new with the old, creating a space that is not only functional as a boutique hotel and dining area but also resonant with the cultural and historical heritage of the location. This blend ensures that Al Nimr House remains a relevant and attractive site for both locals and tourists, providing an enriching experience that honors its past while looking forward to the future.

4.3. AI Design for Touqan House in Nablus

The transformation of the traditional courtyard of the Ibrahim Touqan House in Nablus, Palestine into a boutique hotel and contemporary café embodies a thoughtful interplay of historical reverence and modern innovation, as shown in “Option 1” Figure 19. This adaptive reuse respects the building's original essence while catering to current functional needs, showcasing a harmonious blend of past and present architectural styles.

The trapezoidal courtyard has been ingeniously remodeled to serve as a vibrant public space for dining and social interaction. The arrangement of seating within this area is meticulously designed to align with the historic architectural context, thereby preserving the cultural ambiance while enhancing usability. Central to the redesign is the preservation of the Iwan, a quintessential architectural element characterized by its majestic arch. This feature serves as a visual anchor, drawing the eye through the courtyard and extending the sightline beyond, thus creating a continuous narrative between the old and the new.

The integrity of the façade is meticulously maintained, retaining the original stone and color palette to uphold the authenticity of the architecture. This preservation is contrasted with the addition of modern aluminum windows, infusing a subtle contemporary flair suggestive of a boutique hotel atmosphere.



Figure 19. AID Option No. 1 of Touqan House

Adding to the textural diversity, wooden elements are introduced above the passageway leading to the upper-floor rooms. These wooden projections contribute a tactile warmth and serve as a transitional feature linking the historical aspects with modern interventions.

Internally, the design strategy emphasizes a sleek integration of modern lines with the traditional features of the Iwan. This approach not only respects the architectural heritage but also introduces a fresh, contemporary aesthetic that coexists seamlessly with the old. However, the inclusion of greenery through strategic placement of planters both in the courtyard and on the balconies enhances the connection to nature and opens up the space. This integration of natural elements plays a crucial role in softening the built environment and enriching the sensory experience of the visitors.

Figure 20 presents “Option 2” for adaptation of Ibrahim Touqan House in Nablus, Palestine. The modern redesign of the trapezoidal courtyard within the historic, transformed into a backpack hotel and restaurant. This adaptation carefully blends old architecture with contemporary design, optimizing the space for modern usage while preserving its historical essence.

The courtyard is strategically outfitted with a layout that maximizes comfort and visual appeal. Planters are interspersed throughout, enhancing both aesthetic and environmental quality, making the space more inviting. The arrangement of furniture is thoughtfully placed to encourage social interaction and provide a relaxing environment for visitors. At the heart of the courtyard is an Iwan, emphasized by a high arch that not only serves as a dynamic focal point but also enriches the visitor's experience by creating a sense of depth and continuity in space. This feature guides the visitor's gaze and encourages further exploration of the café.



Figure 20. AID Option No. 2 of Touqan House

The facade of the building maintains its original stonework and color, preserving the architectural legacy, while the introduction of modern aluminum windows adds a contemporary touch, hinting at the sophistication of a boutique hotel. A wooden projection above the passage to the first-floor rooms integrates a natural, tactile element that complements the historical with the modern. Overall, the redesigned courtyard is a vibrant, functional space that respects its historical roots and adapts to contemporary demands, ensuring the heritage of the Ibrahim Touqan House is both celebrated and practical for today's use.

5.0 DISCUSSION

In the realm of architectural conservation, beyond the conservation of religious sites by UNESCO, the adaptive redesigns of Al Nimr House and Ibrahim Touqan House exemplify how heritage buildings can be sensitively transformed to meet contemporary needs while respecting historical integrity. Each project illustrates distinct approaches to integrating modern functionalities within historical contexts, underscoring the dynamic potential of adaptive reuse.

Al Nimr House: The redesign approaches of Al Nimr House, as depicted in two different options, demonstrate varied methodologies in conserving and enhancing the architectural fabric. Option 1 emphasizes the facade's renovation with intricate wooden detailing that reflects the traditional craftsmanship of Nablus, thereby maintaining the building's historical aesthetics while embedding local artisanal qualities. Internally, the use of dim, ambient lighting in the Iwan, inspired by historical gaslit lanterns, creates a soft illumination that enhances the period character, making it both a contemplative and socially vibrant space.

Conversely, Option 2 adopts a more radical approach by whitewashing the facade, a gesture that symbolizes renewal and purity, thus visually expanding the space. This modification serves to accentuate the Iwan as the pivotal element, with additional structural adaptations to accommodate the functional demands of a boutique hotel. The courtyard's transformation into a lush tropical garden serves as a green sanctuary within the cityscape, with paving that recalls the historic streets of Nablus, thereby grounding the contemporary alterations within a historical narrative.

Ibrahim Touqan House: Similarly, the Ibrahim Touqan House showcases how adaptive reuse can invigorate a historic site. Both design options transform the space into a boutique hotel and café, revitalizing the courtyard as a central, multifunctional hub that encourages social interaction. The thoughtful placement of modern design elements such as planters and strategic furniture arrangements not only enhances the functionality of the space but

also preserves its architectural essence. These interventions ensure the building remains culturally relevant and operationally efficient, demonstrating an exemplary balance between preservation and modernization.

The comparative analysis of these projects highlights the importance of a tailored approach to the conservation of historical architecture. Each design strategy, whether through subtle integration or bold reinterpretation, seeks to honor the architectural heritage while providing for the evolving needs of the community. This nuanced handling of historical sites showcases adaptive reuse as a crucial strategy for sustaining architectural and cultural continuity in the face of urban development pressures.

6.0 CONCLUSION

This study establishes a comprehensive roadmap for future conservation efforts, underscoring that the sensitive integration of contemporary elements within historic frameworks can enhance rather than detract from the value of heritage sites. The adaptive reuse strategies employed in the Al Nimr House and Ibrahim Touqan House projects illustrate an exemplary synthesis of heritage conservation and modern functionality, with broad implications for the social, cultural, and economic revitalization of Palestine.

The adaptive reuse strategies at Al Nimr House exemplify this balance through two distinct methodologies. Option 1 skillfully preserves the facade, incorporating traditional wooden craftsmanship that seamlessly integrates with modern enhancements such as ambient lighting within the interiors. This approach respects the building's historical integrity while adapting it for contemporary use, making the Iwan a versatile space conducive to both solitude and social engagement. Conversely, Option 2 adopts a bold visual transformation, whitewashing the facade and converting the courtyard into a lush, tropical setting. This method expands the functional use of the space while anchoring it within the historical context through the use of locally inspired materials.

Similarly, the transformation of Ibrahim Touqan House aligns historical reverence with modern requirements, converting the structure into a boutique hotel and café. The thoughtful placement of modern elements such as planters and furniture in the courtyard complements rather than competes with the historical architecture, enhancing the site's functionality and ensuring it remains an inviting and vibrant community space.

These projects highlight the potential of adaptive reuse to not only preserve but also breathe new life into historic structures, ensuring their relevance and functionality in the modern age while fostering a deep connection between the past and the present. Adaptive reuse can serve as a catalyst for social cohesion, cultural continuity, and economic development in Palestine. By revitalizing historical buildings, communities can maintain their cultural identity, attract tourism, create jobs, and generate economic growth, all while preserving their rich heritage. For future projects, architects and planners should consider the following strategies to ensure successful adaptive reuse:

- **Material Continuity:** Use materials that echo the historical context of the building while providing durability and sustainability. This maintains a visual and structural link to the past.
- **Functional Adaptability:** Design spaces that are versatile, allowing them to serve multiple purposes. This adaptability ensures that heritage buildings can meet contemporary needs without compromising their historical value.
- **Visual Integrity:** Maintain the visual integrity of historical structures even when introducing modern elements. Subtle integrations that complement the original design can achieve this.
- **Community Engagement:** Involve the community in the redesign process to ensure that the adaptations meet local needs and respect cultural significance. This fosters a sense of ownership and respect for the heritage site.

By adopting these principles, adaptive reuse can continue to be a powerful tool in the field of architectural conservation. It preserves the essence of heritage while ensuring its continued relevance and functionality in a modern context. This approach not only protects our architectural legacy but also enriches our cultural fabric, fostering a deeper connection between past and present and contributing to vibrant, living communities that respect their historical roots.

DECLARATIONS

Author Contributions

Conceptualization, M.A., and J.A.; methodology, A.H.C.; formal analysis, A.H.C; investigation, J.A. and F.N.; resources, M.A.; data curation, F.N and A.H.C.; AI design, F.N; writing original draft preparation, A.H.C., J, A.; writing review and editing, A.H.C., J.A. and M.A.

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Conflict of Interest

The authors declare no conflict of interest.

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