

Adaptive Reuse for Traditional House from Historical Building of Old Sana'a City in Yemen

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Abstract

Traditional buildings bring character to our neighbourhoods while providing us with a peek of our past. Especially in light of the growing tendency towards preserving the world's architectural heritage, traditional houses that have persisted throughout history serve as insightful markers of the social and cultural life of societies. Adaptive reuse is currently a widely recognized and respected conservation strategy. Considering the literature review, this study has focused on practice and guidelines for adaptive reuse of traditional Sana'a houses. According to results, on adaptive reuse of historic buildings old city of Sana'a had better physical structure improvements and surrounding urban area. Even though the World Heritage Committee's assessment of old Sana'a resulted in its designation in 2008 as a UNESCO World Heritage Site, studies and research are still lacking especially that focus the research on adaptive reuse of traditional houses.

Keyword: Adaptive Reuse, Heritage and Conservation, Historic Sana'a, Traditional House.

Introduction

Inscribed on UNESCO's World Heritage List in 1986, the Old City of Sana'a has been included on the List of World Heritage in Danger since 2015 (UNESCO, n.d.). In 2003 The General Organization for the Preservation of the Historic Cities of Yemen. Government GOPHCY and UNESCO's World Heritage Centre prepared a thorough study of the Old City and surrounding surroundings for a three-year period. The survey's goal was to take the first step toward of identifying the best conservation practices for the Old City and to eventually create a rehabilitation plan that would go beyond just protecting the historic but also protect the city's urban planning (Conservation of Old Sana'a, 2018). This paper will discuss on the traditional tower house of Yemen in particular, looking at the issues and adaptive reuse strategies in historic Sana'a's urban fabric restoration and to local communities' income-generating activities to sustain cultural heritage.

An approach of preserving heritage buildings, historical structures and surrounding areas can be renovated using the Adaptive Reuse heritage building preservation technique, can maintain the buildings' structures, façades, and ornamentation while renovating the interior to accommodate the space's and modifying it for the new use (Pongsermpol & Upala, 2017). The three fundamental concerns of sustainable development—the environment, the economy, and society—are all addressed by this approach, which is the sole one for conserving architectural heritage buildings (Giddings et al., 2002). Additionally, there are some criteria for evaluating heritage buildings that relate to authenticity and heritage value, such as cultural and socioeconomic value for authenticity in form and design; Materials and essence; use and functionality; management practices, and geographic context; language and other intangible forms of heritage; spirit and emotion; and other internal and external variables (UNESCO, 2019).

The three primary approaches, gentrification, tourism, and heritage value, because the adaptive reuse of traditional homes could require a significant rehabilitation effort. First, gentrification is a term used to describe the phenomenon of urbanization. It is the slow process of converting older structures in the heart cities into modern, homes or businesses (Lees et al., 2015). This process has the potential to be a powerful factor that frequently affects a region's social, economic, and physical aspects quickly (Pongsermpol & Upala, 2017). Highlight the advantages, urban renewal can revitalize blighted areas of a city, raise asset values, boost tax revenue, reduce the percentage of vacant spaces, prevent the city from spreading out into the suburbs, and promote social integration through urban or regeneration for community (Dicicco-Bloom, 2022). Second, the management of sustainable tourism and the effects of tourism on the community are the two key problems of concern according to the tourism approach. There are three aspects of sustainable development for sustainable tourist management: (1) the environment,

(2) economy, and (3) social issues. Environmental concerns pertain to both the built environment and the natural environment, whereas economic concerns relate to the state of local communities and the concerns of individual entrepreneurs (Swarbrooks, 2001).

Finally but not least, in terms of the approach to heritage values, value kinds and authenticity in heritage evaluation are the components that strive to influence communities' view. There are two basic categories: cultural value and socio-economic value, which are more specifically represented Uniqueness, artistry, rarity, utility, are more precise terms for economic worth, social value, and political value (Jokilehto, 2006). However, it is today divided into eight categories: form and design, content and usage, management techniques and traditions, site and background, language and other intangible legacies, spirit and feeling elements are the eight areas that it is now classified into (Swarbrooks, 2001).

This article was focused adaptive reuse traditional tower houses are located in historic Sana'a Yemen, the searched for the case studies of traditional tower houses with types from the previous studies in field of heritage structure for the Sana'a old city.

Background

Sana'a, a historical Islamic city that is regarded as one of the most important historical towns in Islamic civilization, which is 2,200 meters above sea level and located in a mountain valley, has been a settlement for more than 2,500 years, constructed prior to 11th century (Al hazmy Ahmed, 2009). Sana'a City is renowned around the world as a prime example of the great urban culture that first emerged in Arabia Felix in the second century B.C. (Abd Hamid et al., 2023).

The city's surroundings have a remarkable artistic and graphical character. The buildings use regional materials and techniques with great craftsmanship. An exceptional illustration of a traditional, Islamic human residential development are the homes and public buildings in Sana'a (Soltanzadeh & Moghaddam, 2015).

As a World Heritage Site, UNESCO has graded HC of Sana'a under the following criteria (Swarbrooks, 2001);

- i. Criterion (V): The houses of Sana'a are a prime example of an incredible artwork, conventional human settlement, which have become fragile as a result of modern societal changes.
- ii. Criterion (IV): It provides an exceptional example of a cohesive architectural ensemble within its partially surviving wall, whose layout and specifics express an arrangement typical of the early Islamic periods, of place that has earned respect through history.
- iii. Criterion (VI): History of the expansion of Islam during the first hijri years is immediately and physically linked with Sana'a. The great Mosque was completed in Year 6 of the Hijri was the first mosque to be constructed away from Mecca and Medina.



Fig 1: Areal view of the HC of Sana'a Yemen. Source: [Sources: (Gelbart, 2022)]

Study Objectives

- To investigate how traditional tower residences in Sana'a's Old City have been adaptively reused.
- To assess adaptive reuse's effects on the economy, society, and environment.
- To examine how adaptive reuse contributes to community livelihoods and cultural heritage preservation.
- To pinpoint research gaps and suggest recommendations for next conservation tactics.

The Sana'a Traditional Tower Houses

The idea for traditional buildings was frequently derived from guard towers that were built with stones, Sana'a's traditional house are a combination of a blend of baked brick and stone construction. Base walls are 45 cm thick made of face stones on the outside and a core of clay plaster and debris inside. Rugged rubble is used to build cross walls, which connect to the external wall's exterior face. For convenient floor spans throughout the height of the house, the spaces produced within the cross walls are based on the module of a 3-m timber member. Between three and ten meters above the ground, brickwork is started. Because of their weight and flexibility, bricks are better suited to building the big openings in the higher walls. Several of the homes have wooden bands that act as a tensile girdle to support their stone and brick walls (Attia, 2020).

On wet gypsum plaster slabs, tracery patterns are manually made, and the interior portions are then cut away, leaving openings for the colored glass. On top of the initial slab, a second one is placed with its pattern repeated. The exterior wall is then covered featuring a second, glassless tracery with a specific pattern. Which results it results in a colorless outer surface and an imaginative display of patterns on the inside. On interior surfaces, mortar made of gypsum is widely used to create beautiful shapes. The mufrajs of many tower residences frequently contain elaborate plaster wall reliefs, some of which Quranic texts, usually resembles latticework, jewellery, or textile designs the outside and inside of the houses are ornamented with stones that frequently depict stars, snakes, and other nature aspects. The construction of some higher kinds of building uses limestone, gypsum, and brick. Gypsum and lime are used to whiten the inside walls of the buildings, while chalk and unique designs are used to embellish them (Attia, 2022).



Fig: The Sana'a traditional tower houses: [Sources: (Lamprakos, 2015)]

Doors are another place where decorations can be seen. Traditionally, doors include wood fretwork and pounded metal door knockers. The elaborate carvings on door frames convey the threshold's symbolic meaning. The arrival of metal doors to Yemen, which have all but replaced the painted and carved wooden doors, is intriguing modern phenomena (Jones et al., 2022).

The spatial layout of the space of the traditional tower house

The home is entered through wooden or metal doors, is beautifully decorated, and opens to a big space devoid of windows and two floors of rooms. Spaces on the first levels were used

as storage spaces for dry foods like veggies and grains, the spaces on the ground level were utilized as a place to breed animals.

The most private areas are the living room, dining, bedroom, which are spread across several stories up to the roof, where a space between 12 and 18 metres, room with the most elaborate decoration is the Mafraj, is only available to the home's owner and his personal guests (Attia, 2020).

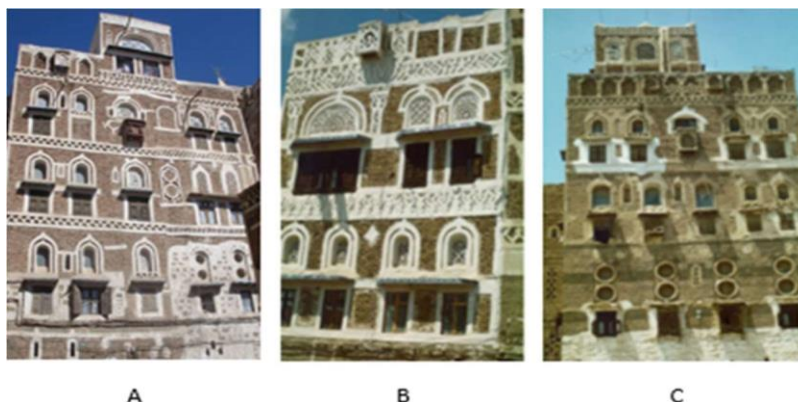


Figure: Facade traditional houses. Source: [Sources: (Attia, 2022)]

The Elements of Traditional Tower House

Architects' and owners roles are crucial roles are crucial for maintaining the design features and components of traditional houses, all household activities in traditional houses are crucial, to maintain tradition in their respective roles (Ahmed S. Attia, 2020). Stables and a wood shop were situated on the ground floor. Typically, people kept their wood, wheat, vegetables, fruits, and animals at the ground floor, they also kept some items on the next level. The rooms for the reception, the Diwan, the kitchen, and the private rooms contain bathrooms in each room on the top floor. Roof is open at upper level. The "maffraj" level on the upper level displays images of rest areas, gathering spots for friends, and special occasions like wedding ceremonies.

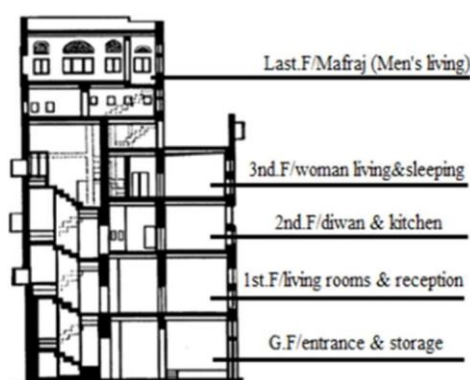


Fig: Section of the Traditional Tower House: [Sources: (Gelbart, 2022)]

Traditional House and their Related Issues

After UNESCO determined that this location to be designated a World Heritage Site since 1989, archaeologists, engineers, and other world leaders worked to come up with solutions to maintain the old Sana'a city's historic character while simultaneously enhancing and sustaining the way of life for the residents. The construction of new concrete structures was

an effort to modernize Sana'a. As Lewcock, a supporter of Sana'a's old city's preservation, put it, "A whole city of wonderful buildings working together to create an urban effect of tremendous fascination and beauty." Older traditional residences fractured and occasionally collapsed as a result of new construction.

Through financial aid and fellowships from UNESCO and other multilateral organizations, as well as Yemeni institutions, significant efforts have been undertaken to conserve the city and its historic architecture. When restoring houses and businesses, the historic buildings have received a lot of attention, they select materials that are compatible with those used in traditional buildings. In consequence, improved infrastructure will contribute to maintaining the Old City of Sana'a's integrity for upcoming generations (Khalil, Marwa; Pons Valladares, Oriol & Bosch González, 2025).

There aren't any rules for conservation, all preservation efforts have ceased, and GOPHCY lacks the funding to carry out any conservation efforts in the historic town of Sana'a. While preservationist groups have denounced the loss of Sana'a's valuable unique and valuable landmarks (Hakimi et al., 2019). There are an upsurge in the rehabilitation of buildings in residential areas that altered the urban fabric, the authenticity of the property has been eroded as a result of modern societal changes and incorrect development (Usak et al., 2019). The state of preservation has also been worse as a result of the recent deterioration in the political, socioeconomic, and security circumstances. A significant risk to the property's high value OUV exists in addition to the property's ongoing alteration and declining security, (Aydin et al., 2015).

Importance of Conservation to Traditional Houses through Adaptive Reuse

The preservation of historic architecture and AR guarantee economy of the local community, cultural, and social benefits. In terms of cultural heritage, traditional buildings found in old city neighbourhoods are significant. Humanity is widely acknowledged to be responsible for conserving historic areas, and reconstructing old structures to fulfil modern needs must carefully follow preservation principles and guidelines. For the identity of cultural assets to remain constant, preservation of these original buildings in historically significant areas and adaptive reuse of the original structure are crucial. Solutions for adaptive reuse of historic structures offer sustainable built environment advancements (Langston. Craig Ashley, 2008).

Adaptive Reuse Approach

An approach to sustainable urban development. It increases the building's lifespan, can be converted by recycling its useful parts for a new purpose, but it is also a technique and a plan that may be reused to protect cultural assets. "The act of adapting buildings old buildings that have outlived their original purposes for alternative applications or functions while keeping its historic qualities," according to one definition of the term. It updates and repairs the city's historic fabric. While maintaining the historical relevance of the building and its surroundings, AR of a property shouldn't be negative effect on surrounding area (Zahraa Adil Abdulameer, 2020). AR efforts seek to maximize the reuse and retention of existing structures while improving the economic, environmental, and social performance of buildings, and urban fabric (Bullen & Love, 2010), (Shahi et al., 2020). One component of projects is structure

conversion, or altering the use of structure or specific some components, and reusing the building's existing materials.

Adaptive Reuse of Built Assets

The most significant remnants of a society's past are its traditional houses (İpekoğlu et al., 2011). The most effective historic adaptive reuse actions respect and preserve a building's significance that adds value for the future are the most successful examples of heritage adaptive reuse (Eda Nur Bucak, 2023).

In some cases, may be the only method to conservation, reveal, or interpret a building's structure and shape while improving the use of its new role. Housing and its surroundings physically change. Changes in culture have an effect on settlement patterns, housing, and the structures that support them (Hacıhasanoglu & Hacıhasanoglu, 2006). Environmental and economic factors effectively set the priorities for adaptive re-use, and while satisfying the practical needs of reuse, the character of historic structures retained (Ashurov et al., 2024).

Historical Buildings and Adaptive Reuse

The term "cultural heritage" refers to a body of historical materials that people view because it is a mirror of and an expression of their ever-evolving values, beliefs, knowledge, and history, the enhancing quality of life and promoting human growth are the main objective of safeguarding cultural heritage (Nicolas Adell, Regina F. Bendix, Chiara Bortolotto, 2015), (art. 15).

A unique connection and conversation between the old and new, results from understanding heritage as not only a testament to the past but also as a dialogue form of cultural, social, and economic, the addition of a new modern function of architectural heritage is significant in this perspective (Sowińska-Heim, 2020), pt. 7). It is usually covered in literature in works devoted to the preservation of cultural property and is considered as a topic relevant to the restoration of monuments, or it is examined through the lens of purely architectural issues buildings their incorporation into modern society hand in hand.

Principles for Adaptive Reuse

Principles should be adopted in such a way that the buildings are:

1. Functional. They must be able to execute the function efficiently which they have been re- designed
- ii. Durable & Flexible. They must be able to withstand flexible enough for new reuse.
- iii. Contextual. They must be able to interact with their surroundings and enhance their context
- iv. Aesthetic. They must be having visual coherence and aesthetic appeal.
- v. Sustainable. The methods adopted must be low infact, energy efficient and have a minimal environmental impact.

Benefits of Adaptive Reuse

To enhance economic, environmental, and social responsible performance of historic structures and the neighborhood in which they are located benefit all stakeholders without a doubt. Therefore, AR of historical structures is thought as a suggested preservation strategy that is appropriate when reviving authentic fabric, to satisfy the needs of new users, and the

associated benefits of heritage adaptive reuse, consist of the following categories: heritage preservation and presentation, district revitalization and improvement, technological and architectural Creativity, a thriving economy, better environmental conditions, culture continuation, and a sense of place.

The Benefits of adaptive reuse of old structures go far beyond just protecting our cultural heritage. Economic, cultural, social, and environmental factors are among them (Braun & Clarke, 2019).

A- In Urban: can help to tackle current issues in urban problems. Several of these urgent urban concerns include:

B- City growth: In the largest cities, sprawl is a significant problem. The idea of adaptive reuse, particularly in city cores and older neighbourhoods, can help control the spread out to some extent

C- Abandonment: In many locations around the world, especially in crowded cities, abandonment is a rising concern. However, encouraging adaptive reuse of derelict buildings through revitalization initiatives would offer a lucrative option.

D- Crisis of housing: In order to address the demand for housing, the idea of adaptive reuse of existing structures will be used. As it is frequently a better use of resources than demolition and rebuilding, this can be accomplished through the renovation and conversion of existing buildings.

E- Cultural: Are two benefits, nostalgia for one's heritage and cultural responsiveness, also emphasized was the significance of protecting the history through the adaptive reuse of structures that can have special, profound meaning. Reusing existing structures while preserving national identity through the preservation and restoration of historic and heritage buildings.

Awareness: Reusing buildings eventually has an inherent advantage. Will contribute to the growth of environmental knowledge and responsibility and establish the groundwork for transforming consumer behavior into more environmentally conscious decisions.

F- Social: The new reuse benefits and serves the community and has a lot of positive social effects on structure. On a broad urban scale, entire neighbourhoods are regenerated, producing higher living standards, improving the environment, giving job chances for locals, and, in the best cases, lowering emigration, in older structures also have sentimental importance for people (Latham, 2000).

G- Aesthetic: In certain cases, especially in the residential sector, the quality of the older structures was superior to that of many more modern buildings, and their aesthetic appeal contributed to the distinctive and special character of the cities by:

- Preserving cultural legacy and visual amenity.
- Preserving streetscapes with a sense of place.

Adaptive Reuse Benefits for the Heritage Buildings

Communities, governments, and developers can use adaptive reuse to lower the price of additional the growth of cities and growth on the environment, society, and the economy (Ballice, 2019). It Help to make historic structures usable and accessible while also adding the extra advantage of sustainable neighborhood regeneration. It has the added benefit of sustainable regeneration of a region and can convert old buildings into spaces that are

accessible and usable. It can make historic structures usable and accessible while also adding the extra advantage of sustainable neighborhood regeneration. Moreover, giving old buildings new uses is thought to be a good way to self-finance preservation, which supports the economic pillar of sustainable develop, restoring the entire site and preserving its components as much as you can are both requirements for adaptive reuse (Jayantha & Yung, 2018).

The Best International Practice on Conservation and Adaptive Reuse

According to the European Union, the primary motivator for development strategies is a city's cultural legacy, this viewpoint, adaptive reuse can be extremely important in terms of extending a lifespan heritage as well as a successful urban approach creating brand-new social, cultural, and economic principles, enabling novel local development dynamics (Spina, 2020). Buildings that already exist can be reuse and restored so that they can be used in the future this has become a creative and intriguing challenge for architects (Kiroff, 2015).

This method of completely changing a building's usage is known as "adaptive reuse" (Brooker, 2004), mentions that to be method in the direction of cultural preservation, "with function being the most evident modification. However, other alterations may be made to the structure itself (Renata F. Peters, Iris L. F. den Boer, 2020).

Practice of adaptive reuse projects in Yemen

The Yemeni government, with UNESCO's assistance, founded the General Organization to Conserve Older Sana'a in 1984 as the world community became interested in preserving the country's distinctive history following UNESCO's designation historic Sana'a as a world historic site. UNESCO and UNDP provided assistance to GOPHCY as it pursued the preservation of Sana'a's ancient city, their target was buildings in risk like private sectors, including hotels, private businesses, and privately held homes with significant architectural value (Haidar, 2019a).

The international organization that worked with the local government to support traditional handicrafts launched the adaptive reuse movement. Samsara's Al-Mansorah caravanserai has been transformed into a crafts store, and the Al-Mutahar mansion, which was converted into a women's technical Centre, are two instances of how the movement for adaptive reuse got started (Michael Petzet, 2004), projects have improved public life and city infrastructure.

May be categorized the adaptive reuse Projects into two types as follow:

- A- Projects funded by the government: Can be divided into two categories. The first is working in the most common approach, in partnership with international organizations, in particular for locations with rich histories, donations from foreign embassies have also been used to maintain the historic city's buildings (Haidar & Talib, 2015a).
- B- Investors or private ownership residences: This category is recognized as a standard practice due to the abundance of private homes, particularly in the Bab El Yemen area of Sana'a's Old City. The authority approves and manages the building conservation work, while the owner provides the funding for the project (R. B. Lewcock, 2018) the people of Sana'a's old town use sustainable reuse techniques while building structures and using building materials (Usak et al., 2019).

Yemeni Conservation and Adaptive Reuse Guidelines

The Minister of Culture and Tourism established a Ministerial Decree (number-204) outlining the rules and regulations for development in historic city. Article 5-11 forbids changing a building's use without the GOPHCY's express consent, and the rules also include instructions for performing maintenance work. Penalties will be assessed for failure to comply with the Acts. The exterior of the house should be maintained in its original condition in accordance with current conservation principles and recommendations (Haidar, 2019a). In most circumstances, adaptive reuse is defined by the owner's decision to use the historic structure for a new use and spatial arrangement, whether completely or in partially, as well as by the owner's request for official approval for preservation work. The authority's main objective is to maintain facades with equivalent conventional materials while allowing owners to make internal adjustments. A house owner must first get two building permits before beginning conservation work, described as table.

Table

Permissions type. [Sources: (Haidar, 2019a)].

Criteria	General authorization of preservation	A Permission for Commercial
Permissions	General organization of preservation for a historical cities Yemen, (GOPHCY)	Type of Use
Request	Owner	Owner/ Investor
Request sections	Location, building orientation, maintenance type	Required practice- information of owner's
Guideline	Preservation outside design of the building in the traditional styles.	Not adopting modern style in the rooms and save the traditional style.
Inspection conservation sites	Conservation work, during, before, after	Conducting verification after the building's maintenance and repair

Traditional Sana'a houses that have been modified for adaptive reuse

Through adaptive reuse, the residential tower houses have been converted to commercial usage. There are two different types of projects, which are divided into the following kind: One involves a government-funded project, and the majority of the projects collaborate with global organizations, to obtain specialists, and funding. Typically, chosen houses for the project have been significant historically. The second type of ownership is local private ownership, in which the owner makes all of the decisions regarding the project's funding, function selection, and level of building intervention. This group is the most common and is not within authority's control (L. Haidar, 2015).

The two types of adaptations are total adaptation for all levels and partial adaptation of first floor on the street alone, the tower houses clearly show the shift in building function, as a result of the more activity in ground-floor stores visible from the street and the addition of new features to it.



Fig. fully and partially adaptive reuse of the tower house. [Sources:(Lamprakos, 2015)]

Converter an old Sanaa residential tower by adaptive reuse to a Hotel Dawood:

The building's facade is still constructed of its original materials, with small openings with Qamariah and the first and ground-floor walls made of black volcanic stone (Gypsum and colored glass). A decorative belt of gypsum is added below the windows on the second and third floors to draw attention to the level that supports the brick walls. Larger windows and ornamental glass (Qamariah) are located on the fourth story. A decorative belt of gypsum is added below the windows on the second and third floors to draw attention to the level that supports the brick walls. The windows on the fourth story are larger and ornamental glass (Qamariah). In order to fully enjoy the mountain views, openings on the top floor have been enlarged, and open arches have been added to the roof terrace. Currently, the newly refurbished main building features a ground- floor hotel lobby, 17 rooms, and 15 bathrooms.



Fig. Adaptive reuse to a Hotel Dawood. [Sources: (Haidar, 2019b)]

Two new toilets were installed on each floor, and plumbing and electrical systems were updated. Changes have been made to the interior space plan, original spaces are being used for new purposes, and such is a hotel lobby, business center, staff area, and upper terrace (Haidar & Talib, 2015b).

Conclusion and Discussion

An essential part of sustainable development is adaptive reuse, which is less expensive and more environmentally friendly than demolishing and rebuilding existing structures with an emphasis on preservation, to satisfy meet the expanding social demands while preserving historic buildings' heritage value and sustainability, it is more than only heritage preservation that is being pursued.

This study is a research entitled, 'The benefits of adaptive reuse for traditional houses from historic buildings in old Sana'a city in Yemen. There are three main impact issues classified as the environment, economy, and social including value perception.

As a study, the results can be generalized to all other AR–HB projects surrounding area, but they can make interested people realize the positive impacts that have been from AR – traditional house. For positive changes, this study explains that adaptive reuse- traditional house could improve the physical environment, livable area, and motivation for renovation in the community.

- It is important to preserve old homes and use them for new purposes. Doing so will offer locals and visitors a variety of advantages and chances.
- It is certain that adaptive re-use will be used to preserve traditional homes and pass them on to future generations, conservation and reuse of neglected traditional house will improve city socio- sustainability for accommodation and livability. Sociological, economic, and physical factors should all be considered holistically to ensure the continuity of heritage structures.
- Preservation the adaptive reuse for traditional houses by raising promoting public awareness about the benefits of the re-use ensures social and cultural sustainability, especially by universities.
- It is important to design adaptive reuse solutions so that traditional homes can continue to serve their original purposes, other acceptable performance, without harming architecture identity of buildings

By situating traditional Yemeni tower houses within larger frameworks of sustainable development and heritage conservation, this article adds to the theoretical discussion on adaptive reuse. Contextually, it adds to the scant literature on Sana'a by illustrating how adaptive reuse can both maintain architectural identity and provide socioeconomic advantages for nearby communities. The study increases knowledge of adaptive reuse as a preservation approach and a tool for sustainable urban development in historic environments affected by conflict by integrating global conservation principles with local practices.

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