

Empowering Criteria for Effective Adaptive Reuse of Heritage Buildings in Egypt

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ABSTRACT

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This study identifies a list of effective criteria for the adaptive reuse of heritage buildings in Egypt. Adaptive reuse is one of the most important conservation strategies. The qualitative nature of this approach and its reliance on many diverse and often conflicting heritage factors and values has made decision-making complex, difficult, and fragmentarily supported in a way within the framework of sustainability. The research examines the factors influencing the adaptive reuse of buildings to determine effective and influencing criteria in Egypt for changing resistant perspectives. Criteria from previous studies were reviewed and evaluated for their potential use through a questionnaire tool targeting professional and non-professional, then analyzed by the SPSS statistics program. The results showed five empowering criteria for effective buildings adaptability in Egypt. Based on the analysis for principal components, identified criteria are grouped into seven principal components; heritage value management, integration with the demand of development, environment adaptivity, environmental performance and sustainability, public intervention, adaptation Plan, and financial and investment. The identified empowering criteria and principal factors are considered as a reference for stakeholders and governments to get a clearer vision of adaptive reuse to achieve better and more sustainable planning, and management.

1. INTRODUCTION

Heritage buildings are the masterpieces of cities, they present the special identity of the place by telling the history of the past life lived through ages. These buildings are an essential in social life and their protection provides social, cultural, and economic benefits to urban communities [1]. Regenerating and reviving those buildings should be sensitively treated, it should respect all past, present, and future lives of the building within its surrounding environment. A sustainable way to reap the benefits of heritage building's originality and quality, and embodied energy, can be through adaptive reuse. To encourage this type of projects and continued sustainability of building stock, there is a need to develop adaptive policies and strategies according to empowering and motivating criteria [2]. The choice to building reuse requires a complex set of guidelines including location, heritage aspect, architectural style, environmental treatments, and market trends [3].

1.1 Adaptive reuse as an approach to sustainable development

Lately, the building conservation character has changed from being building protection, to act like a major part of a comprehensive strategy for sustainability and urban regeneration. This makes adaptive reuse a strengthening plan for controlling this change [4]. It is also the most effective way for dealing with sustainable urban regeneration. It is a process that increases the building's life and stops the destruction of waste, promotes reuses of the embodied energy, and also

suggests that the major social and economic benefits to the community, it even embraces the different aspects of sustainability [5]. Reuse is the most important way to preserve historic buildings, it helps the historic building to stay away from the cycle of decline. To protect heritage values, the function of a building or heritage site can be modified for new use through adaptive reuse. Adaptation may involve the introduction of new jobs and services. A good adaptation deals with the existing building and its historical context through makes changes that improve and complement the historical values of the heritage place. In addition to providing the term sustainability for the heritage place and achieving its vocabulary. Environmental benefits are important in adaptive reuse, as historical buildings offer much to the landscape, character, and comfort of local communities. Embodied energy is an essential environmental characteristic of building reuse. Where its embodied energy is retained, making heritage buildings more environmentally sustainable than new buildings. The preservation and reuse of heritage buildings have far-reaching social benefits, including greatly benefiting future generations. In addition to improving the lifestyle and providing job opportunities and multiple investments to enhance the livability and sustainability in the community. As well as providing a permanent source of financing [6].

The concept of reuse according to function consists of three methods: original reuse, adaptive reuse, and integral reuse [7]. Those can ensure an endless building life cycle and stop deterioration. It can help heritage buildings to be more controlled spaces and useful places, it can also provide extra benefit to regenerate a well-protected area with a sustainable plan. Decision-makers have begun to recognize that reusing

heritage buildings is an essential part of any regeneration strategy [8]. In order for the heritage building to do a new function, it is not enough to preserve it, but the existing fabric connected to the heritage building must be analyzed to ensure its authenticity is preserved [9]. It is important to renew the heritage area sustainably, after reusing the historical buildings and converting them into easily accessible places. The re-use of historic buildings with a new function is an effective way toward preserving self-financing, contributing to the economic standards of sustainable development [10].

1.2 Adaptive reuse in Egypt

Egypt has a unique built environment that includes a large number of heritage buildings and palaces unique by their historical background and special architecture style. After the Egyptian revolution in 1952, some of those palaces were reused as museums, hotels, and some as public schools. Unfortunately, most of the palaces that are reused as schools; Figure 1 are neglected and deteriorated or partially demolished, which made them lose their aesthetic value. Unlike palaces that were reused as museums which preserved their beauty Figure 2. Hotels have been mostly preserved and restored [7].



(a) Princess Helmia Ibrahim, Champollion st., Cairo



(b) Ali Abdel-Latif palace, Tahrir, Cairo

Figure 1. The palaces that were reused as schools
(<https://www.albawabhnews.com>)

According to Law No. 117 of 1983 in Egypt, no specific profession for historical buildings has been identified, but this must require the approval of the Permanent Committee of Antiquities for any project related to the monument [11]. A set of regulations and conditions must be present in the proposed reuse [12]. There are many problems facing the reuse of historical buildings [13], and there are different categories for appropriate functions. The adoption of the heritage-building reuse approach on many diverse and often conflicting heritage factors and values has made decision-making complex and difficult [14]. In addition to the method of applying the sustainable conservation strategy within some cities in a fragmented manner by owners, users, planners, and stakeholders. Therefore, there is a need to examine the factors

that influence the adaptive reuse of buildings and to know the starting points and empowering criteria for changing visions. It is necessary to consider the different needs and requirements of the heritage building, achieve reuse goals, and understand the causes of the problems [4]. The process of setting empowering criteria for reuse is useful for policymaking and for guiding future adaptation projects [15]. To date, some countries lack enabling criteria to ensure successful reuse [16].



(a) Royal Jewellery Museum, Alexandria, Egypt



(b) Alexandria national museum, Alexandria, Egypt

Figure 2. The palaces that were reused as Museums

Successful and empowering criteria include issues critical to the current operating activities for historical buildings and their future development. Empowering criteria allow many criteria to be reduced to several manageable but "critical" ones so that limited resources can be allocated and aligned effectively and efficiently to maximize profits and improve overall results. This approach has been widely used in many research areas. Therefore, the critical empowering criteria method is used in this study to help different stakeholders better understand building adaptation. In this regard, and to promote more comprehensive decision criteria, the study started with an overall review of the standard previous literature that was conducted to identify a list of effective criteria that influence the heritage building's adaptive reuse to aid decision-making. These factors were studied and developed to meet the new sustainable strategies and environmental development. Those were then tested by a practical questionnaire to measure their applicability in the field for the Egyptian market. The questionnaire tool was applied to different samples of professionals and non-professionals for discussion and analysis. Later than, the responses were evaluated by the SPSS analytical program that has reorganized all active criteria to be reprocessed and new factors to be followed by conservation teams respecting all recent developments and sustainable strategy. The identified empowering criteria and principal to help different stakeholders to gain a clear vision of adaptive reuse. As well as, the government to evaluate the current policies set for adaptive reuse and to arrive at a better and more sustainable planning and management.

2. METHODOLOGICAL FRAMEWORK

This research is based on a detailed analysis of previous studies concerning historic building's adaptive reuse. This study helps by concluding the main factors used by stakeholders and decision-makers to adopt any conservation project for historical building adaptation. To create an up-to-date criterion for this type of project, respecting new technologies and environment behavior, a study-based questionnaire was created to evaluate all needed processes from the point of view of professionals in the field of conservation and all non-professionals users. The survey questionnaire mechanism was used for its effectiveness in collecting data and identifying various problems that cannot be directly observed. It also produces data amenable to statistical analysis [17]. The standards have been carefully included, along with their definitions taken into account from the relevant preceding.

2.1 Previous studies analysis

Although adaptive reuse is considered a more sustainable option than development, the decision is very sensitive due to the developments and problems related to the requirements of sustainability and the needs of society from one place to another. It is important to overcome these challenges and take advantage of the benefits of adaptive reuse to improve living conditions while preserving historical authenticity and meeting the requirements of sustainable development in different places.

A list of criteria was defined by an in-depth review of studies of adaptive reuse of different types of heritage buildings and by a systematic literature review using a defined set of keywords; it included adaptive reuse, successful standards, sustainable development, and decision-making. Analytical review was conducted in this study, as a scientific method of literature review, which can identify the list of effective criteria for adaptive reuse. Both cited articles and references were extracted from the available databases of

ScienceDirect, Google Scholar, Scopus, Taylor, Francis, and Sage. In fact, most of the articles reviewed were retrieved from highly-rated journals. Including Sustainable Operations Management, Social and Behavioral Sciences, Habitat International, Sustainability, Sustainable Development and Planning, Cities, as well as government reports, inventories, and conference papers. Some researchers have briefly defined the multi-criteria assessment of adaptive reuse under four aspects, namely, economic, technological, environmental, and social aspects [15-17]. Others classified other criteria into five areas: architecture, economics, environmental, legislative, and social [18]. These five main factors include 26 criteria that should be taken in consideration during an adaptive reuse project. The list of criteria from previous studies of adaptive reuse is summarized in Table 1.

Previously identified criteria for adaptive reuse contain many challenges; due to some deficiency in keeping up with developments related to modern problems and the requirements of sustainable development. For example, reduced energy efficiency and increased urban density. The heritage buildings are not supported by environmental technologies. Existence of intangible obstacles to sustaining the daily life of the surrounding community. The necessity to implement current building regulations, maintenance guidelines, and planning requirements. Incompatibility of new materials with the existing one. Lack of skilled local workers in repair. Limited support from stakeholders and investors to make the buildings sustainable. High cost of maintenance and repair. Lack of awareness and misconceptions about reuse. The idea that adaptive reuse is expensive, and demolition provides reasonable profits is common. Additional costs and time delays due to pollution in buildings. Lack of accurate information on defects or inconsistencies in the dimensions, materials, and drawings of heritage buildings. Requirements for new technologies, technical installations, and innovative solutions. etc. Therefore, reuse must be assessed on a case-by-case basis according to each country, with an innovative approach to enhancing the building's long-term sustainability through adaptive reuse [4, 18-20].

Table 1. Adaptive reuse criteria identified and shaped survey items

Code	Criterion	Ref.
C1	Exterior Architectural features	[21, 22]
C2	Interior Architectural features (building materials, finishes, fabrics and decorations and historical value).	[21-25]
C3	The importance of maintaining significant interior spaces / Space layout/ Space gain and change/space dimensions and distribution.	[21-25]
C4	Historic integrity of the building / Historic authenticity	[25-27]
C5	Availability of technical support information for old building	[28]
C6	Availability of Professional handcrafts men for conservation projects depending on the building type and history	[29, 30]
C7	Structural condition/ the importance of original structure.	[23, 31]
C8	Functional changeability / Building suitability.	[23-25, 31, 32]
C9	The importance of telling the story of earlier uses and users.	[33]
C10	Retain historical setting and urban / Create livelier urban environment due to new economic and social activities	[34-36]
C11	Enhancing the Community participation / Involving the public into the design stage to strengthen the project and the new use / The public needs	[37, 38]
C12	Add new value for cultural aspects	[39]
C13	Following the regional development policies	[40]
C14	All adaptive reuse projects should follow a specific protection law for heritage and historic buildings.	[3, 41, 42]
C15	Condition of services & systems / technological value	[18, 40]
C16	Examination of new use adaptation in relation to building local environment.	[43-45]
C17	Material consumption and recycling/ energy efficiency in building.	[31, 46, 47]
C18	The number of jobs created by the new use which contributes to the local and national economies.	[35]
C19	Different commercial activities in order to sustain financially	[31, 48]

Code	Criterion	Ref.
C20	Cost efficiency	[5, 49]
C21	Potential market / Income generated from business/ Demand for the use of spaces	[5, 19, 31, 37, 50]
C22	Promote the cooperation between investors and users of the building	[51, 52]
C23	Annual plan for maintenance	[19, 31, 37, 49, 50]
C24	Public awareness / Sense of place and identity	[5, 53]
C25	Generate tourism industry and revenue in the area and the country	[5, 54]
C26	Location/ accessibility and integration with the surrounding urbanism.	[18, 31, 40, 50, 55]

2.2 Survey questionnaire for criteria of adaptive reuse

A questionnaire was developed from the previous criteria and given to different related professions, such as, architects and architectural students, academic professors, administrators, project managers and consultants, others who have contributed by their experience and knowledge in the field of adaptive reuse projects, Figure 3. A five-point Likert scale was used for surveying, with "5" denotes strongly agree, "4" agree, "3" Neutral, and "2" disagree, and "1" strongly disagree. Respondents had to choose the importance of each criterion of adaptive reuse identified in Table 1. They were also encouraged to add any other factors that could help the survey and were not included in the original text. Based on reviewing the literature, a detailed questionnaire was developed from the treatment of previous criteria, and a total of 350 samples questionnaires were considered in this study.

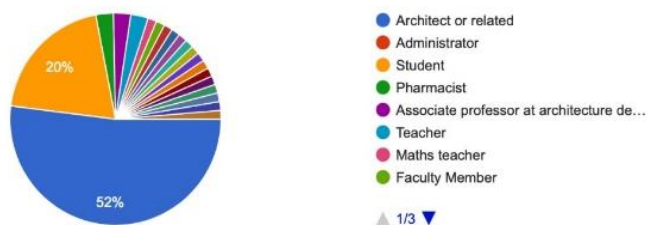


Figure 3. Distribution of responses' profession

To evaluate survey responses, an analysis was developed using Statistical Package for Social Sciences (SPSS version 25.0) "SPSS," correlation analyzes, initial Eigenvalues, and factor analysis. It is a statistical package designed by IBM, widely used worldwide by academics and researchers. It helps provide high accuracy and quality in decision-making, as it is characterized by quickly understanding large and complex data sets through advanced statistical procedures. It is characterized by comprehensiveness, ease of use, interpretation of results, and multiple statistical tests that the program can perform. Also displays spreadsheets easily and quickly. The main limitation of SPSS is that it cannot be used to analyze a very large set of data and can only find a mechanism for a causal theory by drawing patterns and correlations from the data. This statistical software performs statistical tests of comparison and correlation in the context of univariate, bivariate, and multivariate analysis of both parametric and nonparametric statistical methods. Through SPSS statistics, correlation analysis and raw Eigenvalues were used to interpret the data.

The SPSS is a suitable statistical package if the researcher intends to refine the variables because it provides comprehensive output compared to other statistical programs. There are two methods for determining the primary dimensions of a data set: factor analysis and principal component analysis. These techniques differ in the estimates of the commons used. Principal component analysis was

chosen because it is less conceptually complex than factor analysis.

Through the use of Cronbach's alpha, the reliability of the study tool (the questionnaire) was verified. As the internal consistency of the data collected was tested based on the average correlation between the items, reliability ranges were from 0 to 1. Internal consistency is proposed as acceptable if the alpha value in Cronbach is greater than 0.7 [56]. The minimum coefficient alpha Cronbach data collected is 0.83, indicating good internal consistency of these factors.

2.3 Analysis of criteria ranking

Rank Cases procedure is an approach widely used in many fields of research, where the rank variable represents the order of the values of the numeric variable. To reduce many of the criteria for reuse to several criteria that are very important for the case of Egypt, and according to the analysis of the questionnaire data that was conducted, calculating ranking variables was used using the Rank Cases procedure. Five factors were identified as the most empowering criteria to serve as starting points for stakeholders and governments for adaptive reuse in Egypt with an average value above 4 as shown in Table 2.

According to Table 2, all these factors are discussed as follows; Rank No. (1), Add new value for cultural aspects (C12) ranked to be the most important criteria for building adaptation, with a mean value of 4.35. This indicates that adding new value to cultural aspects is the main empowering factor of adaptive reuse of historical buildings in Egypt. This is done by presenting a positive image to preserve the memory to contribute to the generation of new values and to look at a more comprehensive vision. Because of the intrinsic nature of heritage buildings in transmitting the socio-cultural identity to future generations, and to achieve more benefits from adaptive reuse contemporary, these buildings are being adapted for different uses. This creates usable places to breathe new life into an existing heritage building. Which helps develop the identity of the place or act as a landmark by adding new values without erasing the previous ones [43, 57].

Another Empowering factor is the commitment to examine the adaptation of new use in relation to the construction of the local environment (C16), with a mean value of 4.3. It is a problem addressed by local governments around the world. In most developed countries, more spending is on adaptation than on new construction. Innovations in decision-making are major contributions to better understand the best practices for existing historic buildings' sustainable adaptations, thus providing new practical and theoretical insights. The focus is on applying a balanced approach that includes sustainable and exemplary approaches to the effective management of sustainable adaptation [45].

Rank No. 3. Architectural features of the building's exterior factor (C1) is the third most important empowering factor for the reusing of historical buildings in Egypt, with a mean value of 4.2. The architectural aspect is critical to consider when

making any decision regarding adaptive reuse. The architectural style for heritage buildings including openings, colors, uses of materials [58], must be preserved to respect the prior (artistic) workmanship, features, and historical values [59]. Architectural features including building facade, interior items, finishing, material, function and surrounding site plan, all must be carefully evaluated to identify needed interventions.

Rank No. 4. Retain historical setting and urban or create a livelier urban environment due to new economic and social activities (C10), with a mean value of 4.1. Incorporating the urban aspect into assessing the adaptive reuse potential of existing buildings, is critical to achieving sustainable development. These criteria focus on the neighborhood and landscape/context condition to maintain a comfortable relationship between users and the built environment. The priority of special consideration of activities that may affect the environment, reduce resources, and energy consumption. Retaining the sense of place is related to an appreciation of the general significance of the place by providing a better understanding and recognition of cultural significance and values. Therefore, the use of new sites should be avoided in most adaptive reuse projects [60]. Furthermore, also organized social links can be preserved and strengthened by not severing clear links with the past lives of buildings and sites. These links can be maintained while encouraging diversity through adaptive reuse projects and activities that bring together new and old meanings, also by a sense of place and connections, the impact of heritage buildings on the community thus can be illustrated [37]. Rank No. 5. All adaptive reuse projects should follow a specific protection law for heritage and historic buildings (C14), with a mean value of 4.05. The standards of the legislative aspect must be taken into account when making decisions to reuse and encourage heritage buildings. In terms of regulating the use of land and buildings located on it. As well as official plans, zoning regulations, and building rules.

In addition to the requirements of the organization and heritage design, comply with relevant laws, acts, and regulations set by authorized parties. Finally, the availability of building materials, design, workmanship, and setting authenticity [37].

2.4 Principal component analysis

Researchers used the Kaiser–Meyer–Olkin (KMO) measure of sampling adequacy and Bartlett’s Test of Sphericity for extracting individual factors [61]. The analysis extracted a seven-factor solution, each with eigenvalues above one Figure 4. The KMO was 0.630 indicating a meritorious level based on Kaiser and Rice (1974). The principal component method was analyzed using the SPSS computer package for extracting individual factors. As a result, the 26 factors were grouped and reduced into only seven principals when the rotation converged in their iterations (Table 3). Principal component analysis (PCA) is considered as one of the extraction methods used in many applications, due to its simplicity and efficiency. The SPSS FACTOR program includes different rotation methods [62]. It has three modes of orthogonal rotation (varimax, quartimax, and equamax), and the output depends on the method being chosen because each method differs in how the factors are rotated. Interpretation of variables becomes easier using the Quartimax rotation method because of the greater spread of factor loads for a variable across all factors. But that results in variables being overloaded too much on a single factor. In contrast, the Varimax method increases the dispersion of payloads within factors. Thus, significantly fewer variables are loaded onto each factor, resulting in more explicable combinations of factors [63]. Therefore, Equamax was chosen as it is a combination of the other two approaches due to behaving fairly (erratically). Therefore, it has more interpretable results than other methods [64].

Table 2. Ranking empowering criteria affecting adaptive reuse of heritage buildings (Researchers, 2021)

	Criterion	Mean
C12	Add new value for cultural aspects	4.350
C16	Examination of new use adaptation in relation to building local environment.	4.300
C1	Architectural features of the building’s exterior	4.200
C10	Retain historical setting and urban / Create livelier urban environment due to new economic and social activities	4.100
C14	All adaptive reuse projects should follow a specific protection law for heritage and historic buildings.	4.050
C24	Public awareness / Sense of place and identity	3.950
C22	Promote the cooperation between investors and users of the building	3.950
C19	Different commercial activities in order to sustain financially	3.950
C11	Enhancing the Community participation / Involving the public into the design stage to strengthen the project and the new use / The public needs	3.950
C8	Functional changeability / Building suitability.	3.950
C18	The number of jobs created by the new use which contributes to the local and national economies.	3.950
C9	The importance of telling the story of earlier uses and users.	3.900
C17	Material consumption and recycling/ energy efficiency in building.	3.850
C25	Generate tourism industry and revenue in the area and the country	3.750
C4	Historic integrity of the building / Historic authenticity	3.750
C21	Potential market / Income generated from business/ Demand for the use of spaces	3.700
C26	Location/ accessibility and integration with the surrounding urbanism.	3.650
C13	Following the regional development policies	3.650
C2	Architectural features of the building’s interior (building materials, finishes, fabrics and decorations and historical value).	3.600
C20	Cost efficiency	3.450
C23	Annual plan for maintenance	3.300
C3	The importance of maintaining significant interior spaces / Space layout/ Space gain and change/space dimensions and distribution.	3.300
C15	Condition of services & systems / technological value	3.100
C7	Structural condition/ the importance of original structure.	2.750
C5	Availability of technical support information for old building	2.550
C6	Availability of Professional handcrafts men for conservation projects depending on the building type and history	2.000

Table 3. Rotated component matrix

	1	2	3	4	5	6	7
C3	0.848						
C2	0.791						
C1	0.741						
C8	0.615						
C9	0.475						
C21		0.832					
C13		0.653					
C10		0.652					
C16			0.779				
C25			0.687				
C14			0.677				
C12			0.563				
C15				0.868			
C4				0.643			
C19				0.548			
C17				0.392			
C24					0.961		
C11					0.961		
C6					0.368		
C23						0.818	
C26						0.812	
C5						0.700	
C7						0.430	
C22							0.803

C20	0.707
C18	0.593

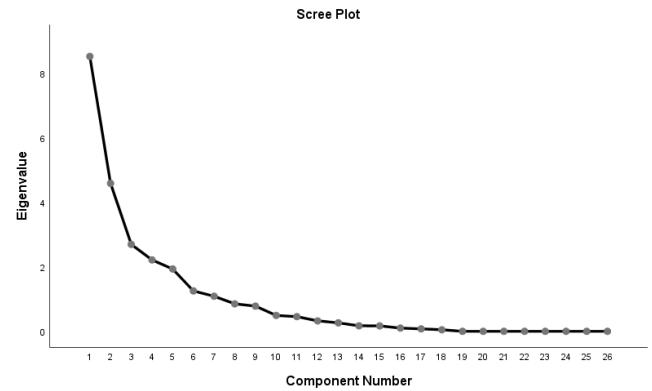


Figure 4. Seven-factor solution, each with Eigenvalues above one

As a result of the factor analysis studies, all grouped seven factors were studied in detail and given new majors shown in Table 4, to be clearer and easier to use and follow by decision makers.

All major factors are introduced and described as follows:

Table 4. Seven principal components of 26 factors

1- Heritage value management	
C3	The importance of maintaining significant interior spaces / Space layout/ Space gain and change/space dimensions and distribution.
C2	Architectural features of the building's interior (building materials, finishes, fabrics and decorations and historical value).
C1	Architectural features of the building's exterior
C8	Functional changeability / Building suitability.
C9	The importance of telling the story of earlier uses and users.
2- Integration with the demand of development	
C21	Potential market / Income generated from business/ Demand for the use of spaces
C13	Following the regional development policies
C10	Retain historical setting and urban / Create livelier urban environment due to new economic and social activities
3- Environment adaptivity	
C16	Examination of new use adaptation in relation to building local environment.
C25	Generate tourism industry and revenue in the area and the country
C14	All adaptive reuse projects should follow a specific protection law for heritage and historic buildings.
C12	Add new value for cultural aspects
4- Environmental performance and Sustainability	
C15	Condition of services & systems / technological value
C4	Historic integrity of the building / Historic authenticity
C19	Different commercial activities in order to sustain financially
C17	Material consumption and recycling/ energy efficiency in building.
5- Public intervention	
C24	Public awareness / Sense of place and identity
C11	Enhancing the Community participation / Involving the public into the design stage to strengthen the project and the new use / The public needs
C6	Availability of Professional handcrafts men for conservation projects depending on the building type and history
6- Adaptation Plan	
C23	Annual plan for maintenance
C26	Location/ accessibility and integration with the surrounding urbanism
C5	Availability of technical support information for old building
C7	Structural condition/ the importance of original structure.
7- Financial and investment	
C22	Promote the cooperation between investors and users of the building
C20	Cost efficiency
C18	The number of jobs created by the new use which contributes to the local and national economies.

2.4.1 Heritage value management

The criteria in this group relate to the building's physical characteristics, such as the condition and age of the building,

current use, architectural features, structural elements, and physical conditions for exterior texture and indoor finishing. To determine the required level of repair and capital cost, a full

survey is required to assess the physical condition of the building and refer if conservative adaptive reuse may not be a viable option in some cases [2]. The adaptive reuse of these buildings must meet the optimization of space use, new functions should follow a planned design and execution qualified to be valued in present and sustainable for future use.

The significance of a place is identified, first by understanding its value, and causes of decay over time; and then by considering the user's intervention, setting, and context of the place [65].

2.4.2 Integration with the demand of development

Market demand can determine the need for adaptive reuse of old buildings. This conservation type can provide a quick solution to fill in the missing uses into the built environment, as offices, museums, cultural centers, or motels [57].

Heritage building requirements vary by function, country, and location. It is important to inspect the entire building to see how well the future function can meet the requirements. It is necessary to follow protection laws, both at the national, regional, and city levels. Both concerning the building itself where official regulations must be adhered to architectural interventions related to the reuse of the building may affect both architectural solutions and functions, dimensions, technical and sanitary points, etc. The same is true for the formation of the environment [40].

Conservation strategies should aim at protecting the physical structures and basic qualities of historical sites, along with their living resident communities and the preservation of local activities. Sustainable urban conservation must provide conservation projects with appropriate technical and social solutions that serve the different needs and resources within the developing world. Uncoordinated efforts and contradictory approaches to preservation can cause historical and heritage sites to disappear or when turning into unplanned open-air museums, this could be physically enjoyable, but socially lifeless [34].

2.4.3 Environment adaptivity

The preservation of historical buildings, while trying to integrate the surrounding environment, is a reason for the success and safety of conservation principles. So that the building is preserved by adapting to contemporary uses.

Heritage values act as the public interest in places, in any case of ownership. The use of the law, public policy, and public investment are justified to protect that public interest.

Historical and cultural heritage plays a huge role in the tourism development plan. It gives great opportunities for economic, social, and cultural recovery. Information and educational values come from cultural tourism to serve tourists and local residents. The positive value of tourism lies in the improvement of the settlement infrastructure and land. On other hand by increasing awareness and pride in the historical and cultural value [54].

2.4.4 Environmental performance and sustainability

The application of green concepts along with adaptive reuse creates a better solution for neglected heritage buildings in cities. Adaptive reuse doesn't only protect the building, but it also protects original builders' efforts and skills. It can conserve different values such as historical values, architectural features, social, economic, and cultural. Therefore, it is an important method of heritage protection. Promoting strategies for sustainable reuse of heritage

buildings can be achieved through the beneficial outcomes of adaptive reuse and the intangible values of conservation. By preserving the various features that faithfully reflect the heritage values associated with it, the place can retain its authenticity. Adaptive reuse reactions include environmental sustainability (improving material and resource efficiency), economic sustainability (reducing costs), and social sustainability (a strong memory of place) [4].

Adaptive reuse of historical buildings has gradually appeared in urban conservation, especially, in developing countries. With considering heritage conservation values of the historical buildings and giving the building a present applicable use. Provided that the existing building structure is capable of operation, and adaptive reuse should occupy the upper hand for developers. To improve the long-term sustainability of heritage buildings, and innovative ways be found to case-by-case evaluations and reuse them.

Using effective insulation, heating and low-impact materials can improve the eco-efficiency of buildings. Also, the preservation of streetscapes can be fulfilled, our sense of place maintained and, attention given to the future recyclability of materials during adaptation. Using existing buildings creates the opportunity to form the overall built environment more aesthetic and productive [30].

2.4.5 Public intervention

The knowledge, beliefs, and traditions of different societies are reflected through the historical environment, so it is an important part of their cultural and natural heritage. Which provides a source of identity and continuity for those communities, by creating uniqueness, meaning, and quality for those places. Accordingly, heritage buildings participate in the culture of the community, and the preservation of these buildings can lead to the protection of their original heritage and cultural values [45]. The support and interest of the community are important to promote and support adaptive reuse and improve the use of the building after conversion. Through innovative thinking to incorporate new elements into the existing culture, the local culture can be enhanced, which is a challenge for developers. To achieve better results, both a values-based approach as well as "living heritage" sites must work by engaging a wide range of stakeholders and values.

2.4.6 Adaptation plan

The uniqueness of the location of the heritage buildings, ease of accessibility and public transportation, compatibility within the current surroundings, and neighborhood condition are important factors that help the success of the re-use and revitalization of the heritage neighborhood [43, 66]. As well as the adequacy of public facilities, including public parks and parking lots, schools and hospitals, should follow planned adaptive reuse projects. Additionally, a severe need for determining the required level of annual maintenance, and its cost, according to the technical and structural conditions for heritage buildings [67].

2.4.7 Financial and investment

The high cost of reusing the heritage building is an obstacle to successful reuse. No economic benefit may be considered to retrofit buildings to meet sustainability criteria [68]. Work must be done to enhance cooperation between investors and building users. Financial inducements can be a motivator of adaptive reuse [45]. Governments' review of current policies and the creation of innovative financial incentives are the most

important factors in encouraging the adaptive reuse of heritage buildings.

3. CONCLUSIONS

Recently, Interest in adaptive reuse of heritage buildings has increased, but there is no consensus on the appropriateness and effectiveness of the different strategies to meet the variable requirements and needs of stakeholders of the existing buildings in each country. This study aimed to identify a list of effective and empowering criteria that influence the adaptive reuse of heritage buildings in Egypt, to aid decision-makers, and also to change the viewpoints that resist the idea of reuse or separate it from sustainable development. A questionnaire tool was made for these different criteria and distributed to different samples of professionals and non-professionals users of similar projects. Then, through the different SPSS statistics, correlation analysis, and initial Eigenvalues were used to interpret the data. The results showed five enabling criteria for the effective adaptive reuse of heritage buildings in Egypt. Based on the statistics of principal component analysis, the criteria mentioned have been grouped into seven main components: heritage value management; integration with development requirement; adaptation to the environment; environmental performance and sustainability; general intervention plan adjustment; financial and investment. The specific enabling criteria and key factors serve as a reference for stakeholders and governments to gain a clearer view of adaptive reuse to achieve better and more sustainable planning and management and improve projects quality respecting all new technology and expected development.

As these results are examined from local professionals and non-professionals who worked in Egypt, so its applicability is higher into the Egyptian range but also can be guiding points for different countries and regions restricted to be respecting different local rules and local environments.

In future research, more innovative ways and sustainable solutions to adaptive reuse of heritage buildings can be explored, by making comparisons of different cases of heritage buildings in countries with different conditions, policies, and requirements of their societies.

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