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Sustainability Comparative Assessment of Adaptive Reuse of Heritage Buildings as Museums: A Case of Tlemcen

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The question of adaptive reuse offers harmony between a physical character and the function of historical buildings. It becomes an effective strategy in order to enhance its sustainability and revitalize the overall appearance of the city. The interaction between the decision of reuse and sustainability aims only to find a balance between the project and sustainable development criteria. It mainly relies on the constant evaluation of historical building's sustainability. In the case of Tlemcen city, the event "Tlemcen Capital of the Islamic Culture" has been a chance for the reuse of monuments in museums in order to endure over time. This document aims to examine how sustainability changes from one monument to another to identify issues affecting the sustainability of reused monuments. Based on an empirical approach, the document makes a comparative assessment of six monuments reused as museums in Tlemcen city, which is a qualitative study based mainly on 80 semi-directive interviews with the three samples of the population: heritage specialists, managers and ordinary citizens. The research also began with a document analysis to review the changes brought by historical stratification and an in-situ observation that provides an opportunity to analyze monuments in the field. Finally, the quantitative evaluation was carried out using an evaluation grid containing an evaluation scale and the set of indicators obtained from the interview conducted. The results obtained from this study reveal that sustainability varies from on case to another depending on the primary characteristics of the monument that directly affects the sustainability's score of each criterion that influences the adaptive reuse process. Indeed, the new "museum" function installed does not ensure by itself a unified sustainability of the studied monuments.

Keywords: heritage buildings, adaptive reuse, sustainability, comparative assessment, Tlemcen (Algeria).

Introduction

Architectural conceptions inherited from succession of civilizations (Elsorady, 2014) represent people's identity. The management of this architectural patrimonial legacy diversifies between restoration, preservation, rehabilitation, etc. (Elsorady, 2014). Actions are designed to reset it in its best state (Radiziszewska & Sladowski, 2014) to pursue its own existence over time (Radiziszewska & Sladowski, 2014). Yet, buildings which have lost their primary function become obsolete and do not respond to contemporary requirements, which lead to their degradation. Their reuse can ward off its abandon. Adaptive reuse allows the amelioration of both physical and functional character of the building enabling harmony and compatibility between the monument and the newfound purpose (Misirlisoy & Gunçe, 2016 a; Bullen, 2007). A new found purpose highlights the architecture of the place (Elsorady, 2014), only it has to respect its authenticity (Ijla & Broström, 2015; Misirlisoy & Gunçe, 2016 b). Indisputably, the reuse of a patrimonial building manifests its durability, as previous researches unveil. The reuse extends a useful building's life through its conversion (Ijla & Broström, 2015). It represents an effective strategy to improve the existent building's durability and to compete with the city's lifetime (Douglas, 2006). This process is inextricably linked to social, economic and environmental requirements (Misirlisory & Gunçe, 2016 b). The final decision must be based on constant balance between an established project and the factors influencing its sustainability; it is generally played on the evaluation of the durability of historical buildings (Sharifi & Murayama, 2013; Pope et al., 2014).

This research explores the case of Tlemcen city. The event "Tlemcen, Capital of the Islamic Culture" has given the occasion to proceed to the re-usability of monuments as a whole being almost with all reconverted to museums. In order to accomplish the comparative evaluation of the monument's durability, this research work relies on the empirical method, allowing a qualitative investigation on the research topic. First, a semi-directive interview was realized with patrimonial specialists, managers and citizens of Tlemcen city. Then, the documentary analysis was complimented with an in-situ observation called upon different plans, pictures and a diagnostic report, to discern numerous conversions on museum monuments. Besides, in order to verify the hypothesis of this research, an evaluation grid was established to measure the durability score of each monument reconverted into a museum in Tlemcen city. Finally, we proceeded by comparing their sustainability profiles.

Assessment of a monument's durability

There are many abandoned buildings despite of numerous attempts to take charge. Yet, several recent researches have shown that it is not only through the re-usability adaptive process that historical monuments can blend in the new city character (Park, 2006; Elsorady, 2014). This is because the reuse allows the previous installations to acquire current levels of performances (Cooper, 2001). Adaptive reuse coordinates between ancient forms and the new function (Bullen, 2007) in order to showcase the architecture of place (Elsorady, 2014). However, to achieve the reuse, it is crucial to maintain the authenticity of a place (Misirlisoy & Gunçe, 2016 a; Douglas 2006), the architectural character of which takes precedence over the type of use (Misirlisory & Gunçe, 2016; DEH, 2004; Ijla & Broström, 2015). It is worth noting that the complexity of adaptive reuse (Ferretti et al., 2014; Bullen and Love, 2011) lies in the will to extend the useful life of the building (Misirlisoy & Gunçe, 2016 a; Bullen, 2007), simultaneously, via the amelioration and the conversion (Ijla & Broström, 2015), therewith to guarantee its durability (Douglas, 2006; Cooper, 2001; Bullen & Love, 2010). Adaptive reuse analyses the building in entirety, yet durability interprets a pairing evaluation and sustainable development (Sharifi, 2013; Pope, 2014; Bullen & Love, 2011). Adaptive reuse represents a decisional process that takes into consideration dimensions as a whole (Misirlisoy & Gunçe, 2016 b) in a way contributing to the durability of historical buildings together with the city's reinvigoration (Ijla & Broström, 2015; Douglas, 2006). It reflects the reflexes in the construction's re-usability (Douglas, 2006) for the purpose to adapt and to respond to the time requirements (Misirlisoy & Gunçe, 2016 b). In this sense, the interactive relation between durability and adaptive reuse (DEH, 2004) ensures development by taking

into account social, environmental and economic objectives (Mohamed et al., 2017; Grazuleviciuté, 2016). The project of adaptive reuse allows the historical building to find its place in its environment (Bullen & Love, 2010). Yet, to succeed with a building's reuse, it is important for the society to understand the future of the building in a site and in a précised moment (Misirlisoy & Gunçe, 2016 b). Thus, the building will find life again, and it will grow as a prime economic source (Ijla & Broström, 2015). But in spite of the adaptive reuse advantages, taking such a decision depends on changing dimensions (Bullen, 2007), arguments differ and are no longer unified in space and time. That is why the question of durability is in a constant doubt. Nonetheless, the assessment of durability is a tool to ensure success (Pope et al., 2014); it allows reviewing the balance between the criteria of sustainable development (Sharifi & Murayama, 2013). Despite the rarity in assessment examples of the durability in the world (Pope et al., 2014), there is no specific method to evaluate the durability of historical buildings (Radiziszewska & Sladowski, 2014) where evaluation tools must be personalized according to the context and the type of development in a given region (Sharifi & Murayama, 2013). In this research, the assessment of adaptive reuse projects is made following an evaluation grade, by referring to a set of criteria obtained from the literature journals which are the following.

Form

The reuse of the historic building respects its authenticity without compromising the original appearance. The intervention takes into account existing materials and techniques, which may limit the choice of the new function. Sustainable adaptation ensures that there are no impacts on the heritage value of these legacies, thus ensuring their preservation for future generation.

Function

The function depends on the new requirements; it allows the enhancement of the existing structure, and the transmission of this legacy to the present time. Reuse is an adaptation of the new use to the conditions of the historic building.

Society

Societies that understand what the most appropriate future for their heritage is are those that effectively plan for the future of future generations. Reuse has long-term benefits and offers communities a sense of belonging by exploiting historical buildings into useful structures. Reuse contributes to the quality of life and sustainability of communities.

Environment

The adaptive reuse of historic buildings has many advantages that support its sustainability. It makes it possible to integrate them into the new requirements of the city; it participates significantly in urban regeneration.

Economy

The adaptive reuse of historic buildings provides considerable financial savings. It is used to avoid demolitions and rebuilding. In addition, the reuse project becomes a driving force for the city's economy; it brings benefits and becomes a self-financier, particularly for maintenance and improvement operations.

Governance

It would be the criterion that unites the three pillars of sustainable development. A key dimension of an intelligent development approach, it provides the essential link and cohesion to the development process. The city's managers and elected officials manage as actors any decision to reuse.

Presentation of the case study

City and events

At the moment, when nothing else marks the history of a city, which finds itself mummified without any reason to exist, it must be the subject of a programming of "events" likely to upset the state of decadence (Garnier, 2002). The promotion of cultural and event dimensions through urban projects is a milestone in the policies of improving the city's image. It is a question of taking into account the hobbies, the culture and the various manifestations in an overall project. An event takes place in the city, charged with dynamics radiating very well its cultural asset. Generally, cultural capitals are organized so as to allow the cities to approve their cultures for a well determined period. The resuscitation strategies of abandoned cities are translated into concrete projects essentially revolving around the valorization and redevelopment of degraded neighborhoods, the old centers in decline being a fertile ground for renewal operations and urban attractiveness.

An example is Tlemcen city signed by ISESCO (The Islamic Educational, Scientific and Cultural Organization) as the capital of Islamic culture in 2011. Tlemcen won the title thanks to the large percentage of Arab-Islamic heritage that it shelters. The advent of the event "Tlemcen, Capital of the Islamic Culture, 2011" has increased the resources of local heritage stakeholders. Many works have been launched to prepare for the event. It should be noted that Tlemcen's old town restoration and renovation works were launched in 2009. In this context, the alleys and "derbs" benefited from the development and reinforcement of lighting networks as well as the renovation of facades. Peremptorily, the historic center of Tlemcen was erected as a protected area governed by Executive Decree No. 09-403, which at the same time delimited the perimeter.

The restoration and rehabilitation projects of Tlemcen's cultural heritage consist of urban interventions. They particularly affect the buildings in priority, some walls segments, as well as the public build. The entire program is subdivided into 99 projects or intervention sites spread across the ancient city of Tlemcen, as well as through the surrounding area involving the important heritage elements.

In sum, the event "Tlemcen, Capital of the Islamic Culture, 2011" wanted to transform the old city into a cultural center by encouraging tourism and craft activities and by offering some tourist circuits. In addition, it has made it possible to highlight a good number of historical monuments, some of which still retain their primary functions at a time when others have become obsolete: a fact that has led to new destinations for them. Almost all of these are currently devolved to the function of a museum, which will continue more over time. The following table shows all of these monuments-museums in Tlemcen city (Fig. 1).

It should be noted that the emblematic monuments inherent to the territory of Tlemcen, located mainly in the old historic center of the city, are in this case promoted to tourist historic sites par excellence. As Marçais mentions in his book "The Arab Monuments of Tlemcen" (Marçais, 1903), these constructions derive from different historical periods crossing the region (Zyanide, Merinide, French). These monuments refer to a varied typology with regard to mosques, medersa, royal palace and town hall (Table 1). The reconversion of these monuments is a recent decision that was born thanks to the event "Tlemcen, Capital of the Islamic Culture". Hence, the investment of operations such as restoration, and rehabilitation for the development of this built heritage.

Fig. 1. *The monuments converted into museums in Tlemcen. Source: author.*

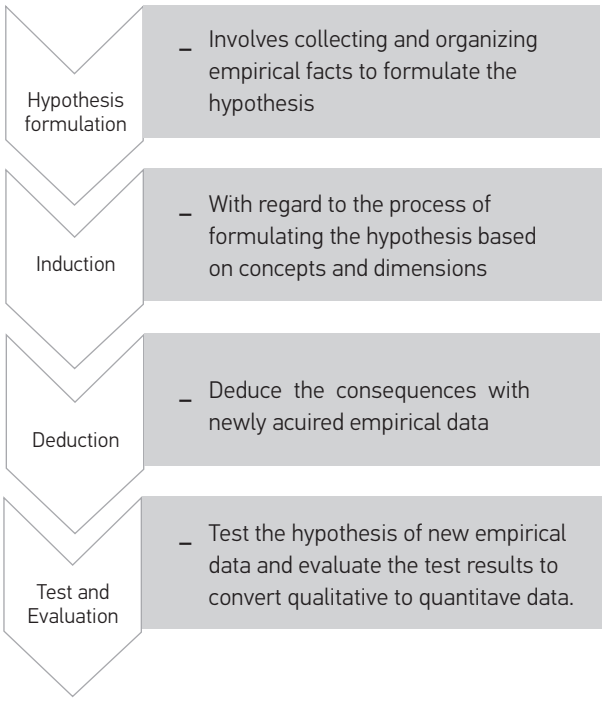
Table 1. *Monuments reconverted to museums in Tlemcen. Source: author.*

Monuments	M1	M2	M3	M4	M5	M6
Primary function of monuments	Koranic school (Medersa) French-Muslim	French Town Hall (previously Medersa tachfinya)	Mosque Sidi Belahcen	Zianid Royal Palace of El Mechouer	Koranic school (Medersa) Sidi Boumedienne	Mosque of El Mechouer
Period of construction	French period 1951	French period 1873	Zianid period 1296	Zianid period 1248	Mirinid period 1347	Zianid period 1317
Type of intervention	Renovated Reconverted	Renovated Reconverted	Renovated Restored Reconverted	Res Reconverted	Renovated Reconverted	Restored Reconverted
Function after reconversion	Tlemcen Museum	Museum of Art and History	Islamic Calligraphy Museum	Museum of Traditional Costume	Adrar Manuscript Annex Museum	Museum of Islamic Rites
Temporality of the new function	Museum since the capital event of the Islamic culture 2011					

Methods

This research work is based on the empirical method (Fig. 2), allowing direct investigations to be carried out in the field in order to verify the previously defined hypothesis.

Fig. 2. *Evolutionary scheme of the adopted method.*



The analysis of the data obtained was mainly based on a constant interaction between the interview and the evaluation grid. First, the interview is an investigation tool designed to answer indirect questions, something that is rarely found elsewhere (Taylor & Bogdan, 1998). However, 80 semi-directive interviews were conducted with three samples of the population: heritage specialists, managers and ordinary citizens (the sample selected is the nonprobability quota sample). The semi-directive interview was organized in the order of the concepts and dimensions previously defined in the literature review. It began with key questions, reframing the speeches of interviewees with other secondary questions as they went along to point out the purpose of the interview (Angers, 1997). As for the indicators, they are constructed from the data obtained from the interview, the comments are grouped into categories and then justified theoretically; they are part of the same universe of meaning, and practically are comparable in terms of numerical values (Angers, 1997). These indicators have definitions that refer to the comments obtained from the interviewees' words as follows.

Then, the evaluation of the data obtained is based on the quantitative reading resulting from the meeting of a list of criteria to be reviewed and an assessment scale. The list of criteria is based on all the indicators obtained from the

Table 2. *Definitions of sustainability indicators. Source: authors.*

Indicators	Definitions
1.1 Social connections	These are the collective exchanges and debates of the city's inhabitants in the service of citizen initiatives.
1.2 Social solidarity	This is the aspect of social cohesion, where the composition contains a set of duties and rights that satisfy the entire individual.
1.3 Cultural identity	It is the living memory of the region in all times that can be read through the landscape and the cultural heritage.
1.4 Social impact	Refers to all the consequences of an act on the company. This notion is linked to the generalization of interest. It can be used to guide the strategic choices of the city's component structures.
1.5 Social knowledge	Indicates the interest of the society posted towards its city and its heritage, in such a way that it participates in reviving the witness of its identity (architectural heritage in the first place).
2.1 Economic coherence	Presents itself in the compatibility of the economy with the planning schemes of the territory in order to support the economic development of the territory.
2.2 Economic dynamics	Allows the creation of new growth markets that aim to revitalize the territory and fight against economic decline.
2.3 Financial equilibrium	This can be summarized in the formula of counterbalance between the investment costs and operating costs.
2.4 Financial impact	It is when the results of a project succeed in exceeding the local financial impact to reach the regional and territorial ones.
3.1 Environmental impact	It represents the consequences that result from a project and directly affect its environment; an impact can be illustrated as industrial pollution and waste, noise pollution, etc.
3.2 Environmental management	Presents the rate of integration of environmental issues into a project design in order to achieve environmentally sound management.
3.3 Project integration	Allows the project to integrate into its urban environment. It becomes an essential element and meets the city's current requirements and needs.
4.1 Government management	Presents the decision to become a city through the management of implemented projects whose team is multidisciplinary in its composition.
4.2 Concertation and stakeholder participation	Decisions concerning city planning and development require the participation of all those concerned in the city, including society in the first place.
4.3 Limits and modalities of management	They revolve around the respect of technical and legal rules when making decisions on a project within the city.
4.4 Evaluation, supervision	It is the set of evaluations and interviews carried out repeatedly at each phase of the project in order to verify the accuracy and smooth running of the pre-established program.
4.5 Respect for human values	Means the context of transparency and loyalty that government management can offer when planning and carrying out a project.
5.1 Compatibility	The additions used must be compatible with the original ones in terms of mechanics, chemistry and physics.
5.2 Reversibility	This implies that what has been done can at the same time offer the possibility of going back and being done again without damaging the cultural property.
5.3 Minimal intervention	The need for each intervention must be justified to add as little as possible.
5.4 Readability	Indicates the balance between aesthetic and historical value during the intervention process.
5.5 Authenticity	Maintaining the original elements without having modified them or damaged their primary character.
5.6 Differentiation	The added elements must be distinguished from the original ones
6.1 Implementing the form	It is ensured when the new function is assigned to the monument and enhances the existing form.
6.2 Scalability/ innovation	When the existing form has an evolving and innovative character thanks to the new function.
6.3 Usefulness of space	Allows the new function to exploit the different spaces of the old structure.
6.4 Adaptability	Indicates that the new installed function adapts to the existing spatial conditions of the monument without major changes.
6.5 Respond the current requirements	Assured when the choice of the new use provides a solution to the needs and requirements of the city.

maintenance performed. While the assessment scale makes it possible to estimate the state of the criterion, it is organized in the order: not taken into account (0), poorly taken into account (1), moderately taken into account (2), fairly well taken into account (3), well taken into account (4), and very well taken into account (5). Finally, all the assessments are converted into numerical values ranging from 0 to 5 in the same predefined order, the results of which are presented at the end in sustainability profiles using the Microsoft Office coding system (Score of dimension = the average of the component indicators). The following table is a summary of the assessments obtained from the previously defined criteria, each broken down into a set of indicators (Table 3).

Table 3. Comparative evaluation of monuments converted into a museum.

Sustainability criteria	M1	M2	M3	M4	M5	M6
1. Social implication	0.8	2.4	2.2	1.4	0.8	1.2
1.1 Social connections	0	2	2	1	0	1
1.2 Social solidarity	0	2	2	1	1	1
1.3 Cultural identity	2	4	4	3	2	2
1.4 Social impact	1	3	2	1	0	1
1.5 Social knowledge	1	1	1	1	1	1
2. Economic rentability	1.75	3.5	3.5	3.5	1.5	2.5
2.1 Economic coherence	2	4	4	4	2	3
2.2 Economic dynamics	2	4	4	4	2	2
2.3 Financial equilibrium	1	3	3	3	1	2
2.4 Financial impact	2	3	3	3	1	3
3. Environmental integrity	2	3.33	3.66	3	2	2.66
3.1 Environmental impact	2	3	4	4	2	3
3.2 Environmental management	1	3	3	2	1	2
3.3 Project integration	3	4	4	3	2	3
4. Governance	0.8	1.8	1.6	1	0.8	1
4.1 Government management	1	2	1	2	1	2
4.2 Concertation and stakeholder participation	0	1	1	0	0	0
4.3 Limits and modalities of management	1	2	2	1	1	1
4.4 Evaluation, supervision	1	2	1	1	1	1
4.5 Respect for human values	1	2	3	1	1	1
5. Monument's form	3.5	2.66	3.66	1	3.33	2.83
5.1 Compatibility	4	4	5	0	3	4
5.2 Reversibility	5	4	4	1	3	3
5.3 Minimal intervention	4	2	3	2	3	2
5.4 Readability	4	2	4	1	3	3
5.5 Authenticity	3	3	4	2	2	3
5.6 Differentiation	1	1	2	1	2	2
6. Monument's function	3.6	4	3.8	2	2	3
6.1 Implementing the form	4	5	4	2	3	3
6.2 Scalability/innovation	5	4	3	2	1	3
6.3 Usefulness of space	3	3	4	1	1	2
6.4 Adaptability	2	4	4	2	2	4
6.5 Respond the current requirements	4	4	4	3	3	3

Results and Discussion

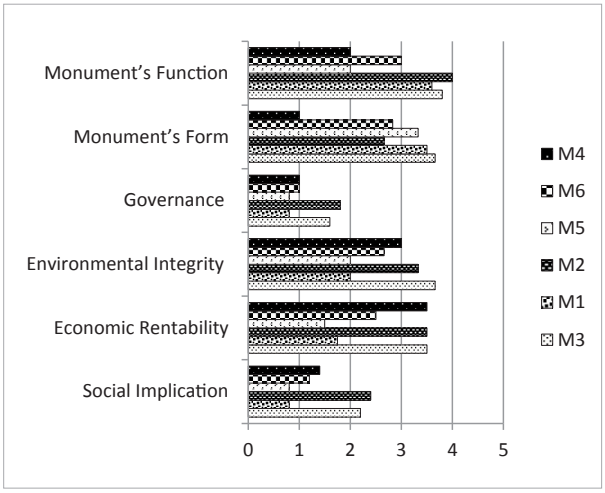
An estimate of the overall sustainability criteria was determined for each monument converted to a museum. The series of graphs obtained allowed us to trace the durability profiles, thanks to the coding system via Microsoft Excel. Then, the latter were compared to explore the sustainability of historic monuments following adaptive reuse. The criteria that constitute constant sustainability in all reconverted monuments are equivocal to the formal-functional aspect (formal enhancement, responses to new requirements), economic (economic coherence) and environmental (project integration). Following the qualitative assessments of the scores of sustainability, almost all of the responses from the semi-directive interview converge to say that "the sustainability of the adaptive reuse project varies from one building to another depending on the specific characteristics of each building".

Moreover, the comparative evaluation carried out thanks to the interviews made it possible to situate the positioning of the adaptive reuse project in the process of sustainability. They even provided the value of sustainable development criteria in the project implementation, in the need to perpetuate the historic building in its environment. The assessments collected from the interviewees allowed tracing the sustainability profiles in the adaptive reuse process of each of the six monuments studied, including the Ex French Town Hall and the Ex Mosque Sidi Belahcen, which have the highest criteria rates.

The results indicate that the function of the monument is the most convincing criterion in all the monuments converted into museums specifically for the ex French Town Hall (score 4) and the ex Mosque Sidi Belahcen (score 3.8) (Fig. 3). Due to the interactive relationship between the new use and the existing structure, the monument shape criterion gains a considerable rate. An example is the ex Mosque Sidi Belahcen (with the score of the highest rate 3.66) (Fig. 3), a monument that has not experienced any spatial mutation despite the change of the original function. A heritage expert interviewed admits that "the monument that is always used can be valued, then the one that has lost its initial function can be rehabilitated, but a monument that

Fig. 3

Profile of the sustainability dimensions of monuments converted into museums



can be reused can only be sought a new role in the urban environment." This explains the need to revive the obsolete monument, the success rate of which depends on the effectiveness of the function installed within the monument. As in the cases studied, the museum function proves its particularity in that it can provide the site with new life without having made major changes to the primary character of the monument. Obviously, this is done in order to have a better integration of the monument within its environment (environmental integration). As one former manager, now living in the old city, insists, "the monument is a living element in the urban city; it gradually integrates into its environment, which presents a space in progressive movement." This aspect of the monument belonging to its environment means that the new function assigned is chosen in a need to respond to urban evolution, taking into account not only the monument's location in relation to the new centers, but also its impact on the desire to restore the attractiveness of historic sites. Indeed, the location of the converted monument influences its sustainability.

Thus, with the new function of the monument, we are given the opportunity to effectively achieve "economic

profitability", which is one of the most successful criteria, specifically in the three monuments the ex French Town Hall (score 3.5), the ex Mosque Sidi Belahcen (score 3.5) and the ex Palace of El Mechouer (score 3.5), situated in the heart of the ancient city of Tlemcen (Fig. 3). The economy has an aspect that was strongly discussed by the interviewees, for example, one architect said: "A heritage does not mummify itself, it is a powerful economic source, a small stone properly developed can attract thousands of people to come and visit the place and it automatically brings benefits to the whole country."

The economic gain obtained from converted monuments refers to the nature of the service offered by the place the museum function of which makes it possible to have the old structure delivered as an exhibition piece calling on the curious to rediscover the monument (mosques, town hall, palaces, medersas, etc.) of the past in the present era. Especially since almost all the converted monuments are located in the heart of the old city, it helps to fight against economic decline and encourages the creation of new job markets.

In spite of this, the government management has deficits which generate an imbalance in the pyramid of the actors compared with the future of the monuments (even the two cases of the same typology ex Medersa Sidi Boumedienne (score 0.8) and ex Medersa Franco-Muslim (score 0.8 score) (Fig. 3). For example, a heritage specialist made the following comment: "The enhancement of the built heritage is a responsibility of the public authorities, they must take care of it before the operation, during and after its completion, something that is not even done by the small gestures of the accessibility and light assurance routes." Similarly, a tourist guide and legal expert insisting on the importance of categorizing the missions of managers said: "The organizations responsible for heritage protection are defined according to an administrative hierarchy in which one depends on the other, nothing when you ask yourself the question whether their organizations perfectly fulfill their role; unfortunately, we are faced with the factor that prevents their union and which is the lack of organization and coordination of tasks."

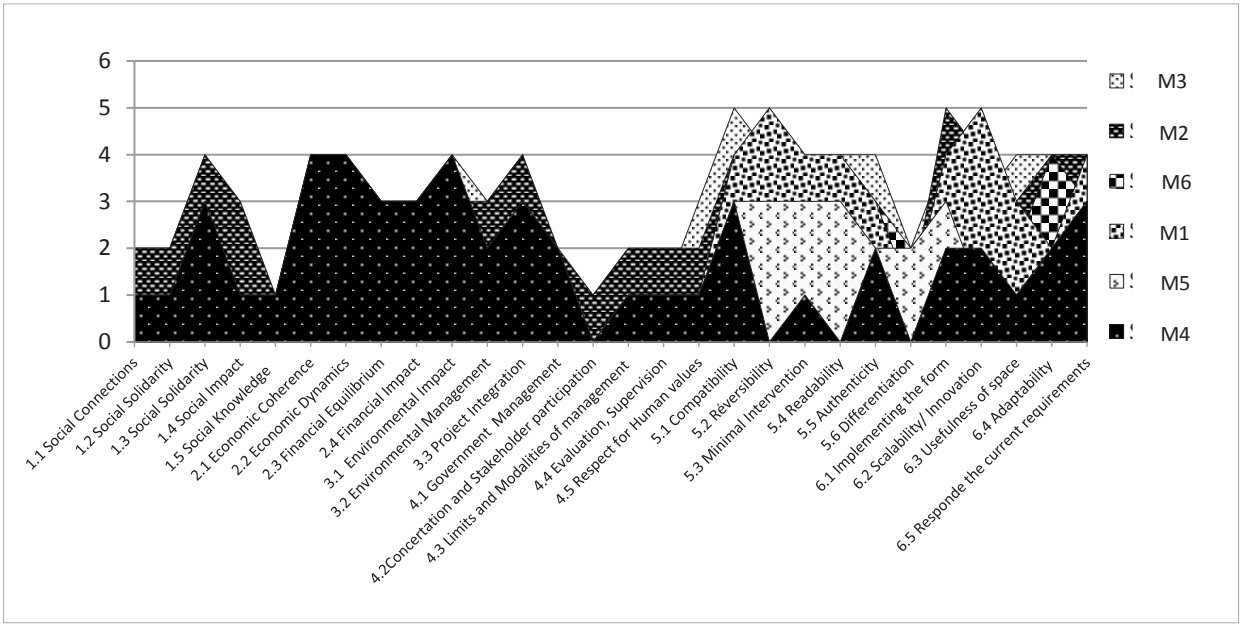
In the same way, the sustainable profile knows its fall at the level of the criterion of the society where almost all the monuments do not present an iterative alchemy with the patrimonial space users, in spite of the role that it plays in the development of the cultural identity of the region. For example, an archaeologist specializing in heritage stated: "We all know that heritage belongs to all people, it is the living memory of their history and presents their identity, yet the protection of architectural heritage is at the origin of the citizens' direct contact with the monument. According to me it's a matter of popular conscience."

The city is constantly growing; the people are increasingly abandoning the old center and becoming attached to the new poles, which explains the rupture between popular consciousness and architectural heritage. Indeed, society builds unconsciousness towards its heritage, which sends it back to the decadence of its identity. The people are used to the old typology of buildings; they have no ambition to participate in the revival of the old centers through the conversion of these monuments. Similarly, managers do not find it in their interest to involve the company in the decision on such an act. Hence, the disagreement between the two.

Therefore, the results obtained following the dimensional assessment made it possible to declare that durability is closely linked to the characteristics of the converted monuments. However, in order to discover the gaps and drivers of an adaptive reuse project, the sustainability dimensions are divided into indicators evaluating the six monuments converted into museums in the city of Tlemcen (Fig. 4).

Due to the complementarities that are created between the existing form and the new function, the formal and functional sustainability indicators acquire similar scores in all monuments. The compatibility is successful (from score 3 to 4) in almost all offering a correct adaptability of the function (from score 2 to 4), except at the level of the ex Royal Palace (score 0) where the function does not seem to conform to the existing place (M5, score 2) despite the success that it has experienced after his conversion (Fig. 4). The intervention on the building is a priori adequate (from score 2 to 4); it seems to respect the authenticity of the historic building (from score 2 to 4) by offering an affordable reversibility to the primary character (from

Fig. 4. *Profile of the sustainability indicators of monuments converted into museums.*



score 3 to 5) (Fig. 4). As a result, the building's form is emphasized (from score 2 to 5) to meet the new requirements (from score 3 to 4) (Fig. 4).

Adaptive reuse can therefore revive the city's profitability. The monument becomes a generator of economic dynamics (score 4); it creates an economic coherence (score 2 to 4) where the converted monument becomes self-financing and considerably exceeds the local financial impact to join the regional and territorial. This automatically generates an impact on the environment (from score 2 to 4), which is satisfactory in all cases of monuments converted to Tlemcen. This is the case for the integration of the project into its environment (from score 2 to 4) (Fig. 4). However, the two former Medersa reconverted are not really successful on the economic and environmental aspects, and the new function does not manage to effectively revive the place through the new use. In addition, there are many obstacles to the social component (score 1.2) (Fig. 3). Society is often marginalized (score 1) in decisions about the ownership of assets, which has a significantly social impact (from score 0 to 3) on the historic building's sustainability.

The buildings, however, continue to reflect cultural identity (from score 2 to 4) (Fig. 4). All these obstacles are part of the management system, which results principally from the anarchy in the conduct of the project management process. It must necessarily pass through all the multidisciplinary actors, each of whom contributes to the efficacy of the city's future decision (from score 1 to 2) (Fig. 4). Therefore, it is necessary to mention the confusion between the missions of the actors, which questions the sustainability of the city and negatively influences the sustainability management of historical buildings (object of this research).

Indeed, the results of the evaluation of the indicators confirm those obtained following the evaluation of the dimensions. The form and the function refer to the nature of the new function installed, whereas the formal changes made are obvious according to the typology of the original function and the time of construction of the monument. However, the economic and environmental contribution is initially based on the geographical and economic situation of the converted monuments in such a way that the new function gives access to the city's new sustainable development strategies.

The social aspect depends on the way in which the monument is delivered not only in its territory but also in coordination with the authentic nature of the place while participating in this desire to revive the identity

of the people, obviously, while agreeing on the hierarchy of the pyramid of decision-making actors in such a sustainable conversion project.

However, sustainability does not hold the same status in all monuments; it changes from one type to another, which allows us to notice a convergence of characteristics for some and a divergence for others. The comparative evaluation made it possible to review the characteristics that favor the sustainability of the converted monuments in the city of Tlemcen. The results are as follows (Table 4).

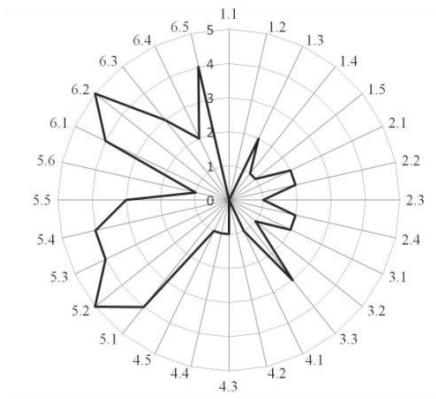
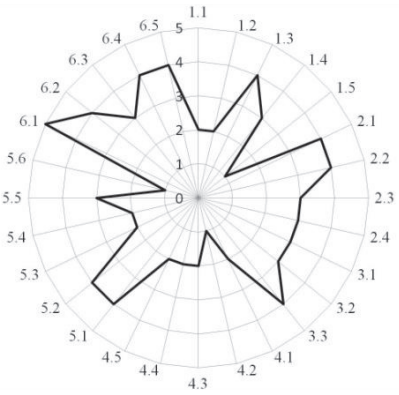
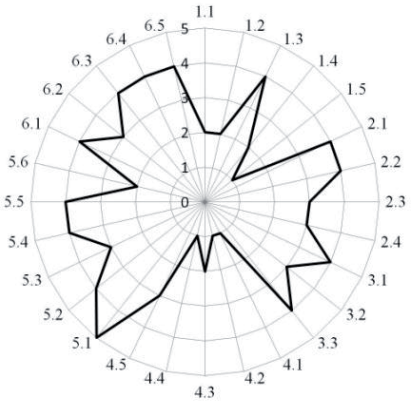
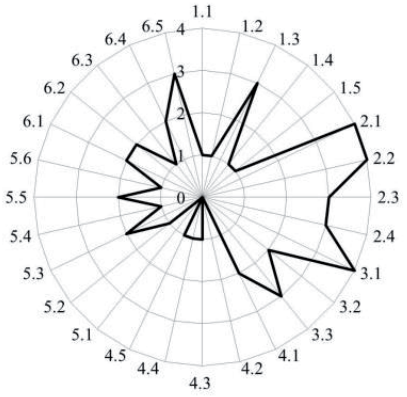
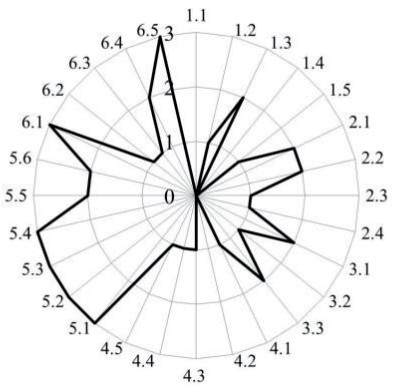
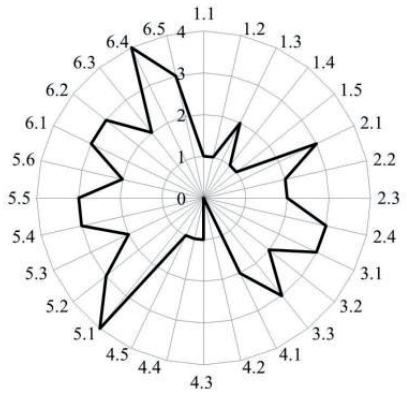
The ex Sidi Belahcen Mosque and the ex French Town Hall present the two most successful museums (Fig. 4, Table 4). The first by its primary function as being a place of worship very frequented, and the second as being a place of popular service, attract the crowd and encourage the social link (score 2). The flow of visitors has been growing since the conversion of monuments on the occasion of the year "Tlemcen, Capital of the Islamic Culture". The adaptive reuse of the two monuments effectively contributes to revitalizing cultural identity (score 4) despite the marginalization of society (score 1) when making such decisions. However, the two museums revive the economic component, of which score 4 is recorded for economic coherence and score 4 for economic dynamics. The economic rise has surpassed the building itself to reach the city, due to the strategic location of the mosque as well as the town hall within the ancient city. As a result, they demonstrate successful reintegration into the environment (score 4) (Table 4). Nevertheless, the process of reuse of the monument meets the new requirements (score 4). The adaptability of the new use was carried out (score 4) without compromising its authenticity (score 3 to 4 score) (Table 4). However, the mosque has not undergone any formal transfer since the reconversion; it is a museum piece in itself, unlike the town hall which has been renovated by adding a set of facilities facilitating its exploitation as a museum. In addition, the new use is the main element of the reuse process, with the shape enhancement score 4 to 5, resulting from the compatibility of form and function (score 4 to 5) (Table 4). So, the two most successful examples share the same location, which is a fundamental criterion to be taken into consideration when deciding to convert historical monuments into museums. Moreover, these two museums have not undergone any formal changes, which explains the success of the museum function in preserving the authenticity of the building.

Thus, the ex Mosque of El Mechouer, despite the multitude of formal and functional changes was still a place of worship until 2011, when it was transformed into a museum of Islamic Rites. The scores of the sustainability criteria (Fig. 3) form a balance between the strands of society (score 1.2), the environment (score 2.66), the economy (score 2.5) and the aspects of the function (score 3) with the existing historic building (score 2.83) (Table 4).

However, the Ee Royal Palace Zianide located near the mosque within El Mechouer has a deficit (Fig. 4) towards the homogeneity of the old structure (score 1) with the new function installed (score 2) where the compatibility between the two is zero (score 0) (Fig. 4). However, the reconverted monument effectively contributes to the sustainability of society (score 1.4) of the economy (score 3.5) and the urban environment (score 3) (Table 4). Due to its unique composition in the territory, it is a place that is highly visited nationally and internationally. The attractive element here is the monument itself, since the new function is only one way to revitalize the palace once again. Indeed, the typology of the original function must be taken into account when reconverting the monument in order to create an interactive enhancement between the building and the new function. In addition, the former royal palace, the ex Mosque of El Mechouer and the ex Sidi Belahcen Mosque date back to the same period of construction, thus explaining the value of the buildings in the planning of the current city.

On the other hand, the two monuments of the same typology, ex Medersa French-Muslim next to the old city and the ex medersa Sidi Boumedienne, on the outskirts of the city have considerable scores of sustainability at the interaction of the new function (M1, score 3.6 and M5, score 2) with the old structure (M1, score 3.5 and M5, score 3.33), but do not provide a large social contribution (score 0.8), economic (score 1.5) and environmental (score 2) (Table 4). This imbalance refers to the effectiveness of the function itself, which did not result in joining the useful to the

Table 4. *Sustainability profiles of monuments*

M1: City (Ex Medersa French-Muslim)	M2: Museum of Art and History (Ex Medersa French-Muslim)
	
M3: Islamic Calligraphy Museum (Ex Sidi Belahcen Mosque)	**M4: Museum of Traditional Costume (Zianid Royal Palace of El Mechouer)**
	
M5: Adrar Manuscript Annex Museum (Ex Medersa Sidi Boumedienne)	**M6: Museum of Islamic Rites (Ex Mosque of El Mechouer)**
	

pleasant; the monument is manifested as an independent element of the city and does not contribute by any contribution to its functioning.

In the case of the medersas, the conversion into a museum in the city of Tlemcen has no value if it does not introduce the monument into economic productivity, integration into its environment and a satisfactory response to the needs of society.

Conclusions

Adaptive reuse is the most appropriate concept that can bring the obsolete or abandoned historic buildings back to life. It ensures their sustainability, taking into account all the criteria necessary for the reuse decision-making process. Nevertheless, following a comparative evaluation of the monuments converted into museums in the city of Tlemcen, the results obtained show that the score of sustainability varies from one monument to another according to the characteristics of each one, with regard to its location within the city, the time of its construction, its original functional typology, as well as the different formal changes and functions it has undergone.

The sustainability criteria and characteristics of the monuments are interactive. First, the common museum function between all the converted monuments offered the opportunity to revitalize the historic building without compromising its authenticity. The economic and environmental aspects are influenced first by the choice of the new function, the location of the monument and its primary construction period. In addition, the issue of social ignorance remains closely linked to urban sprawl, which has meant that the centers of interest are no longer the same as in the past, with almost all the monuments located in the heart of the former city of Tlemcen. Thus, the decision-making body, which in turn loses its hierarchy of tasks, finds no interest in involving society in such a decision with regard to monuments as symbols of identity.

However, monuments that share the same scores of sustainability criteria converge towards identical characteristics, whose fundamental characteristics to be taken into account when reusing monuments in museums are the location and the formal changes that the historic building has undergone. This is the case of the ex Sidi Belahcen Mosque and the ex French Town Hall, which present two most successful examples of sustainable conversion. However, the typology of the original function also has an important characteristic; it must be taken into account in order to ensure better coordination between the old form and the new function. Such is the case of the ex Royal Zianide Palace. Monuments that are satisfied with formal-functional coordination do not present successful examples, since the sustainability of the latter is only achieved if they also cover socio-economic and environmental aspects. This is the case of the two monuments of the same typology; the Ex Medersa French-Muslim and the Ex Medersa Sidi Boumedienne.

Finally, the question of the sustainability of converted monuments is not a standard one; it does not only depend on the planning of the process according to the profile of sustainability criteria, but rather varies from one case to another according to its characteristics. This calls for a broader scope of study when deciding on the adaptive reuse of historic monuments.

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