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## The Role Of Addition In Leftover Places In The Sustainability Of Historical Buildings

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# The Role Of Addition In Leftover Places In The Sustainability Of Historical Buildings

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**Abstract.** Leftover places are one of the phenomena faced by the built environment, which is subject to continuous renewal and development. These leftover are returned as empty spaces, sometimes positively exploited as green areas, and sometimes negative, to appear neglected. These leftover are distributed in different parts of the built environment. As for buildings, they are distributed around them - forward, backward, or lower, and sometimes above or between two buildings. Interference with these places appears as additions or as an expansion of existing buildings. The previous knowledge dealt with the nature of these additions from different aspects, especially in the historical buildings in terms of controls and determinants, but the need appears to clarify the effect of adding on these buildings and the sustainability of their functional and formal performance, so the research problem stipulated the "need to explore the role of the addition within the leftover places of historical buildings in its functional and formal sustainability". The research methodology was based on three phases: the first is to build a conceptual framework on the concept of sustainability and its dimensions, the concept of sustainable preservation of historical buildings, its policies and levels, and its relation to the concept of leftover places, their types, objectives, and characteristics. Secondly, building a theoretical framework, which is the first step in solving the research problem, which addresses the concept of addition, its justifications, and types, as well as the policies and criteria for adding to historical buildings, and thirdly, conducting an applied study on selected samples from historical buildings, "local and global", which were exposed to addition interventions, which were divided into two groups according to the functional and site diversity, finally, analyze the results and determine the conclusions. The most important findings of the research are despite the existence of a conflict between changing needs and between values and intellectual and architectural meanings of historical buildings, but this conflict represents the starting point for contemporary additions that achieve sustainability by embracing the past with all its values, the present with all its appearance and the future with all its manifestations.

## 1. Introduction

The addition is one of the concepts that have increased in its importance after the eighteenth century, which was considered as a kind of interference in the old buildings when it does not meet the required needs, whether in the formal, functional or service level, and despite the numerous studies on the concept of addition, it didn't mention the role of additions within the leftover places in achieving sustainability of historical buildings, and this is the focus of this research.

The concept of Sustainability addresses in general and its relationship to the historical buildings through the concept of sustainable conservation. The policies of sustainable conservation overlapped with the concept of leftover places on many levels. This idea was shown in many previous studies.



## 2. The concept of sustainability :

*2.1 Linguistically, sustainability* word was originally derived from the word (Sustainer) It means supporting and longevity [1].

*Sustainability idiomatically*, It is aimed for the adopting of a new style and a sense of responsibility towards the available resources, Sustainability is a process of development and continuous renewable aims to improve life in the present to the future without neglecting the past data .Alsalaq (2014)[2].

The concept of sustainability is one of the modern concepts that appeared in the eighties of the last century in Europe, and the concept is often linked to **sustainable development** ,which is defined as the rational exploitation of various natural resources to achieve development of all kinds without harming the environmental systems, and preserving the rights of future generations to meet their economic and vital needs .Abdul Rahman (2008)[3].

### *2.2 Dimensions of sustainable development*

In general, there are three basic dimensions of sustainability, Recently has been added a fourth dimension which is a cultural dimension, which is the most important:

- The environmental dimension :which is concerned with achieving the ecological balance and preserving the environment (natural or constructed) to the extent that does not threaten the interest of future generations, and is done through (providing opportunities for recycling materials - taking advantage of natural renewable energies that are not polluting the environment .Ibrahim(2017)[4].
- The social dimension :It It is deal providing basic needs for individuals, achieving social justice, providing housing, education, health and safety in addition to respecting cultural and social diversity .Ismail(2011)[5].
- The economic dimension :It is concerned with achieving economic development, increasing productivity and achieving efficient economic performance, this could be done through (encouraging employment and internal investment - contributing to attracting tourists - helping to create a favorable image of a place - adding value to the property and thus increasing the tax return to maintain public services) Ismail(2011)[5].
- The cultural dimension :It aims to strengthen the ties of the past with the present while enhancing identity and a sense of place. Al Khalifa(2015) [6].

### *2.3 The sustainable preservation of historic buildings*

It means a protection from destruction, as it is related to the term continuity and thus related to the concept of sustainability, and it is defined as "management that prevents damage and preserves the architectural heritage for future generations.Amin(2004)[7].

We conclude that the preservation is to rehabilitate historic buildings, which is a type of recycling that falls within the framework of sustainability.

### *2.4 Policies for the sustainable preservation of historical building*

As a result of the importance of the concepts of conservation and sustainability,A number of policies have been developed, as follows:

- **Upgrading**:It deals with historical buildings as a cultural heritage, and aims to develop plans to keep the heritage for as long as possible Al-Issawi(2012)[8] ,so this policy is concerned with three levels Al-Zahrani(2012)[9] which are:
  - **Moral Upgrading**: It means the old building development of high value with the increasing awareness of its importance.
  - **Physical Upgrading**: Development of the old structure, while preserving it to suit contemporary requirements.
  - **Social and economic upgrading**: improving the economic and social situation by investing old buildings for new investments. Ibrahim(2017) [4].
- **Reuse**: It is the process of reviving the old building by reviving its original function or creating a new one. Al-Issawi(2012)[8].
- **Rehabilitation**: It is the process of improving the condition of a building that is not usable, which impedes the performance of its function.Habib(2010)[10].

### *2.5 Levels of Sustainability in Historic Buildings*

Many calls emerged in 1970 for preserving historical buildings emerged as a sustainable process by linking them with social, economic, environmental, or cultural benefits, Johnsow(2009)[11]. We Classifying them into seven levels, which varied between functional, formal, cultural, economic, social, environmental, and locational aspects (leftover places) as follows:

- **Functional sustainability:** It is the extension of the building's functional life by developing and improving its function to suit contemporary functional needs, for example ,the Lyon Opera in Paris in 1756 AD, which was rehabilitated as a result of changing engineering, service, and functional needs on the one hand, and changing the scale of the city and the buildings surrounding it from Another aspect. Byard(1998)[12]. Figure (1).
- **Formal and aesthetical Sustainability:** This level deal with Architectural elements and their relationships with the whole building, with all its cultural and symbolic values. For example, the glass dome of the German parliament, Saudi Building Magazine(2000)[13] .Figure (1).



**Figure 1.** Dome shape proposals for designer Norman Foster (on the left) <http://www.archpedia.com> the addition of Lyon Opera and relationship to neighborhoods (on the right) <http://www.jeannotel.com/>

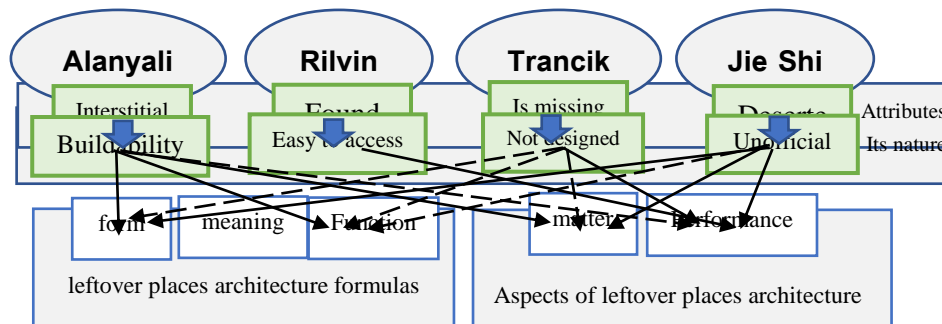
- **Social sustainability:** It has greatly affected the preservation process as being the primary beneficiary, so It can be enhanced by making historical buildings the nucleus of convergence to strengthen the society. Ibrahim(2017) [4].
- **Cultural sustainability :** Where historical buildings are the legacy of the past in all its manifestations, so its sustainability lies in its legacy for future generations, and therefore it is a means to refresh society intellectually and culturally. Al-Allaf(2013) [14].
- **Economic sustainability** It is achieved in two aspects. The first is to increase the return income that has not been spent on a new building, and the second is to invest historical buildings in various investment fields that yield a financial return .Youssef(2014) [15].
- **Environmental sustainability :** Where historical buildings were characterized by having thick walls and thus they reduce thermal insulation when rehabilitating them, on the other hand, the reuse of these buildings will reduce urban sprawl and thus conserve environmental resources. Frey(2007)[16].
- **Sustainability in investing the leftover places:** The previous literature indicated that dealing with the remaining areas, whether within the context of the built environment or the architectural context, would vary between temporary partial additions or permanent additions. These additions may be within the building or in front of it, behind it, beside it, under or on top of it. It could become in the form of expansion or extension of an existing building. So it is possible to extract the type of addition and expansion as one of the methods of investing leftover places within the historic buildings. Al-Allaf(2012) [17].

### 3-The Concept Of Leftover Places:

Many definitions of the Leftover Places concept, It described as the lost space according to Trancik, or Spaces of Uncertainty according to Jie Shi, or the found spaces according to Rilvin, or Interstitial Areas according to Alanyali Trancik noted that these spaces may appear as” unwanted areas that need to redesign and had no positive contribution to users "Trancik(1986)[18]. Jie Shi agreed with him when he said," it is an unused or insignificant or meaningless by a large part of society " Jie Shi(2016)[19]. Rilvin has a different idea when he said "It is a place that is easy to reach, accessible

and has high visibility "Rilvin(2007)[20] .While Alanyali indicating it is " a non-buildable interface which may be designed but not used" Alanyali(2009) [21].

Therefore leftover places appeared in three formats: One, as a form that being not designed, and as something unremarkable, or as a way or method of work that has a functional performance. It uses an informal service that could not provide for the community sometimes. and Figure (2) Shows the extraction method.

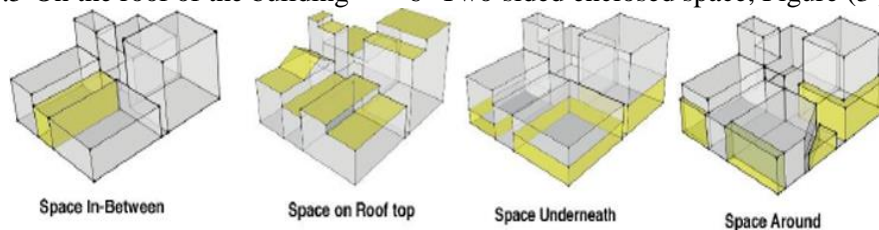


**Figure 2.** Derivations of the concept of leftover places ..Source (The researchers)

### 3.1 Classification of leftover places

They are depending on many things like there location, by there relationship with the urban context, likely to de found located outside the areas of official use as mentioned by Doron "places outside the city management could be effective and productive which located between commercial, recreational and residential areas. or maybe an areas under or above or along highways Doron(2000)[22]. And there is another opinion indicating that the site affects the nature of dealing with these areas, which are reinterpreted by the residents through the temporary or permanent automatic activities as indicated by Khalil That it " may take a position(both ends or medial) and thus affect the types of added activities where formal or informal, and even the official use of them may not restrict laws or restrictions because they usually reflect the choices and desires are limitless for its inhabitants " Khalil(2013) [23]. As for its relationship with the single building , it was divided into six types according to Azhar(2016) [24] they are:

1-An area around on three sides .2-In front of a building. 3-Behind the building .4-Space underneath the building .5-On the roof of the building .6- Two-sided enclosed space, Figure (3) .



**Figure 3.** shows the types of leftover places, Azhar<sup>24</sup>

### 3.2 Goals of leftover places

The most important goals are to achieve sufficiency ,whether economic, social and environmental aspect and that by utilizing leftover places as a green area. Consequently, it generates energy as well as conserving resources or water storage and reducing pollutants, Camaren(2010)[25]. Either goals associated with the type of interventions ,they are often temporary interventions ,low cost and with the least effort possible ,working to improve the viability of living and aesthetic in the local neighborhoods "Camaren(2010) [25].

So leftover places could be as a motive for creativity and innovation, as they invest available resources without depleting them as well as reflecting personal and local identity.

### 3.3 Qualities of the leftover places

They are dependent on virtual qualities of leftover places, For Khalil that it may be "regular or irregular " Khalil(2013)[23] .While for Trancik it is like a specific or loose field, "lacking the edges of the shape removable perception "Trancik(1986)[18]. Doron agreed with this point view as "an area

with open or closed borders, narrow or spacious, internal or external, and it may be public (for the city) or private property owned by someone “Doron(2000) [22].

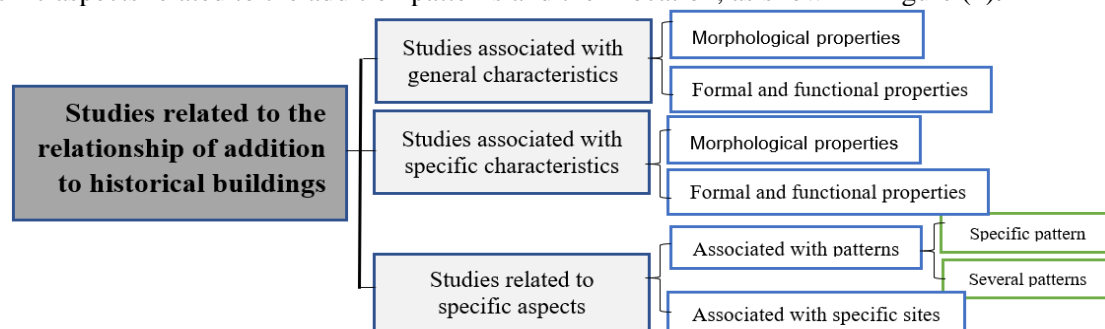
From above, leftover places have three qualities: the first concerns with its appearance, which may lack the definition of the edge, second its shape could be (regular or not, open or closed, public or private), the third is their functional performance.

#### 3.4 The characteristics of the leftover places

The main characteristics of the leftover places and which could summarize all of them is flexibility, where the system back to its original position in case of departing from it through stability and adaptation, this will help to make an integrating the parts with the whole, and open the opportunity of creative solutions Trancik(1986)[18].

#### 4. Addition concept in Previous studies:

The studies that dealt with the concept of addition in historical buildings are varied according to specific aspects related to the addition patterns and their location, as shown in Figure (4).



**Figure 4.** the structure of criticism of previous studies ..Source (The researchers)

4.1 *Studies related to the concept of architectural addition, through general characteristics* ,This studies divided into parts as follows:

-*Studies related to formal characteristics* ,These studies concern with building values of the Old, the language of the past and their translation of the new one in a comprehensive one Torres(2009)[26] . Moreover emphasis on external additions and determining their expressive architectural compatibility with the characteristics of the existing building , Moreover emphasizing on external additions and determining their expressive architectural compatibility with the characteristics of the existing building Hulya(2012)[27].

-*Studies related to functional or formal characteristics*, they emphasized on Additions whether it is a specific part added to a building or an integrated building itself when the addition is a new separate building, Soliman(2018) [28].

(4.2) *Studies related to the concept of architectural addition, through specific characteristics*, This studies divided into parts as follows:

-*Studies on the characteristics of formality* , the researchers stressed the need to avoid distortion of additions to the old building by the control using suitable size, mass, proportions, colors and different textures of materials "Torres(2009)[26].The additions affected the physical properties of the historical building, The problems that faced the designers could be solved by a proper use of additions of architectural elements (size and mass-materials-surface joints and include the number, shape, and size of openings, and linear elements And the curve, and the added and presented shapes, their proportions, rhythm, and arrangement) taking into account their relationship to the human scale"Gulsen(2018)[29] The additive should be smaller and do not overwhelm, and should be less visible from the street side, it is best suited to a new addition in a part back or side of the existing building, and front additions are best avoided as possible in order not to obstruct the view of the original building . While Soliman analyzed a formal architectural vocabulary of additions based on diversity, rhythmic, parasite interference, he concluded that the appearance is the highest factor of acceptance among participants so that there are buildings that have been adopted underground addition to maintaining Soliman(2018)[28].

-*Studies related to the functional and formal characteristics*, these studies concerns with studying the historical values of the building. Hulya pointed out, "That the design added must be started with the analysis of the basic physical aspects Like the environment, location, and mass (building height, width and depth) and architectural details, as well as define the architectural, cultural and contextual criteria for historical buildings" Hulya(2012)[27]. Also define the characteristic of differentiated compatible with the new intervention in a historical environment that mentioned Anne(2012)[30].

From the above, we draw the vocabulary of "the balance between differentiation and compatibility, uniqueness", as characteristics of the addition that are based on imparting a spirit of change in harmony with the old building.

*4.3 Studies related to the concept of architectural addition, through specific aspects*, this is related to the addition pattern, one or several patterns as follows:

- *Studies related to a specific pattern*, some of the studies indicate that through the rehabilitation process of the historic buildings it could dominate the old host so that the addition is reflected in a complementary manner within it Anne(2012) [30].

- *Studies related to several patterns*, Point out to the possibility of using contemporary style addition to avoid distortion Torres(2009) [26]. Using added the same patterns, colors and materials for the old building, or understanding of the original style well to see the new vision, or use contrasting patterns".

Another opinion indicates the pattern of "sustainable addition", "which contributes to inheriting the cultural, intellectual and social meanings of historical buildings and transferring them to future generations, as explained by Gulsen(2018)[29]" That there is no particular formula about the type and form of add, so that it can be traditional or contemporary, or a simplified version of the original building". So he suggest four types of additions, compatible, standard, contradictory, and Sustainable addition.

The latter type shows the importance of historical buildings and culture to reflect the thought, history, legacy, the civilization of society for future generations. as well as social, environmental and economic value of income-generating through the adaptation of buildings to the museums or hotels with shops and cafes, thus increasing the value of financial". while some argue that the patterns is determined by the needs use of functional, formal or structural, as mentioned Soliman(2018)[28] Rehabilitation of old buildings to meet current and future needs, to divide patterns additions to: (same as the original use, the reuse is compatible with the original use, new use distinct from original use).

We conclude four patterns to add, they are: (Standard or Harmonious Pattern), which is a direct transcription of the features and has proven to be failing as it gave a false metaphor for the past, (the derived pattern) that is inspired by old vocabulary and abstracts it in a new style, (the contradictory pattern) which is out of the ordinary and maybe welcomed if it is homogeneous, (Sustainable pattern), That brings the past and the present to the future life. Finally, we conclude identifying the research problem, which was drawn from the analysis of previous studies:

- Research Problem: the need to explore the role of the addition within the leftover places of historical buildings in its functional and formal sustainability.
- Research Objective: To explore the compatibility and the ability of additionally within leftover places to sustain historical buildings by analyzing the relationship between function and form.
- Research hypothesis: Addition within the leftover places has a role in achieving historical building sustainability
- Research Methodology: The qualitative research methodology adopted in three steps::
- *First*: Building a theoretical framework about addition concept and its indicators, its role with sustainable preservation of historical buildings, its policies and levels, and its relation to the leftover places, their types, goals and characteristics.
- *Second*: Preparing the practical study, choosing to sample which are tow local and tow global samples, identifying variable measurements.
- *Third*: analyzing the results and drawing conclusions.

## 5. Building Theoretical framework

*5.1 The role of additions and expansion in dealing with the leftover places* .The role of additions and expansion in dealing with the leftover places: this part deal with the nature and characteristics of the additions of historic buildings within the remaining spaces.

*5.2 The nature of addition concept* :it came in several meanings which are (alteration ,improvement , and enlargement) , All of which refer to buildings in a state of continuous growth and development to meet the evolving priorities, as considered by some as "A kind of intervention in the old buildings when no longer meet the current needs of the space " Torres(2009)[26].And emerged importance of after the eighteenth century when it started old buildings are of historical value should be preserved for future generations Torres(2009)[26].On the other hand, reference was made to the need to achieve homogeneous optical continuity addition, as presented Brolin "that the addition must provide a kind of homogeneous expression when dealing with the design of the old building without any contradictions except in certain cases" . Brolin(1980)[31].There is another opinion indicates how the additive appears as it introduces a new language through its association with features expressive and intellectual old buildings and As explained by Wood where he presented "the idea of addition by dealing with the duality of the past / present" , Woodman(1993)[32] .

We conclude that the add is a new intervention in buildings, and it came as a justification that the human and buildings in a continuous dynamic with the development of scientific knowledge, practical and technological, can carry added a new formula with an emphasis on maintaining the continuity of the visual and intellectual architectural language of the existing buildings.

*(5.3)Reasons and justifications for adding* :multiple causes between :(functional reasons) and so to improve the use career to adapt to changing requirements ,(aesthetic reasons) required to enrich the built environment with new values ,Damla(2017)[33].(cultural reasons) that reflect an event, date, or heritage of a place ,( technological reasons)indicating that the community is keeping pace with modern technologies ,( economic reasons)because adding a part to a building is less expensive than adding an entire building , Ali(2011)[34].( Legislative reasons)that may be stimulating for creativity when applying the addition in formal ways, or vice versa, so weak buildings appear visually, intellectually and functionally Khalil(2013)[23] .(Natural causes)which may destroy parts of a building and need to be repaired ,Dourish(2006)[35].

*(5.4) Types of additions* : additions classified in many theories and architectural studies about how to preserve the architectural significance of the old buildings Torres(2009)[26]. We will explain three aspects, design pattern, Additions site, additions through the time period, as follows:

- *The design pattern* . The buildings were exposed to material changes over time, which in turn created different design patterns for addition. They were classified Gulsen(2018)[29]to:
  - Paradoxical addition :Contrasting the added part from others ,while avoiding misrepresenting the distinctive features of the neighborhood or the current building.
  - Standard addition :It adopts the same scale, proportions and proportion to the original building with all the details and components ,and is the best and easiest way to avoid the physical change by making The current building and the new addition look like one structure.
  - Matching addition: It is looking for the essence of the original building and re-translate it with a new addition, so it works with abstract elements and reformulate them in a similar way with a slight difference from the original, Figure (5), And agree with him Steven in principle which he categorized into Steven(2007) [36]:
    - Replication: It gives priority of compatibility and reduce the differences
    - An invention of the same style: It adds new elements in a style closely related to the old style, and maintains a sense of continuity in the architectural language ,and how the new building can display the traditional style and provide a strong statement of its own identity without sabotaging the original character .
    - Abstract reference :this seeks to achieve differentiation ,which It is difficult to implement and limited, because the classical language, for example, is difficult to abstract, so it is necessary to divide it into coherent sub-parts.



-The intended opposition: It is deceptive to the context and design by changing its personality with clear contrast, as it sets the distinction at the expense of consensus, and the use of this strategy in order to reduce the values of historical context.



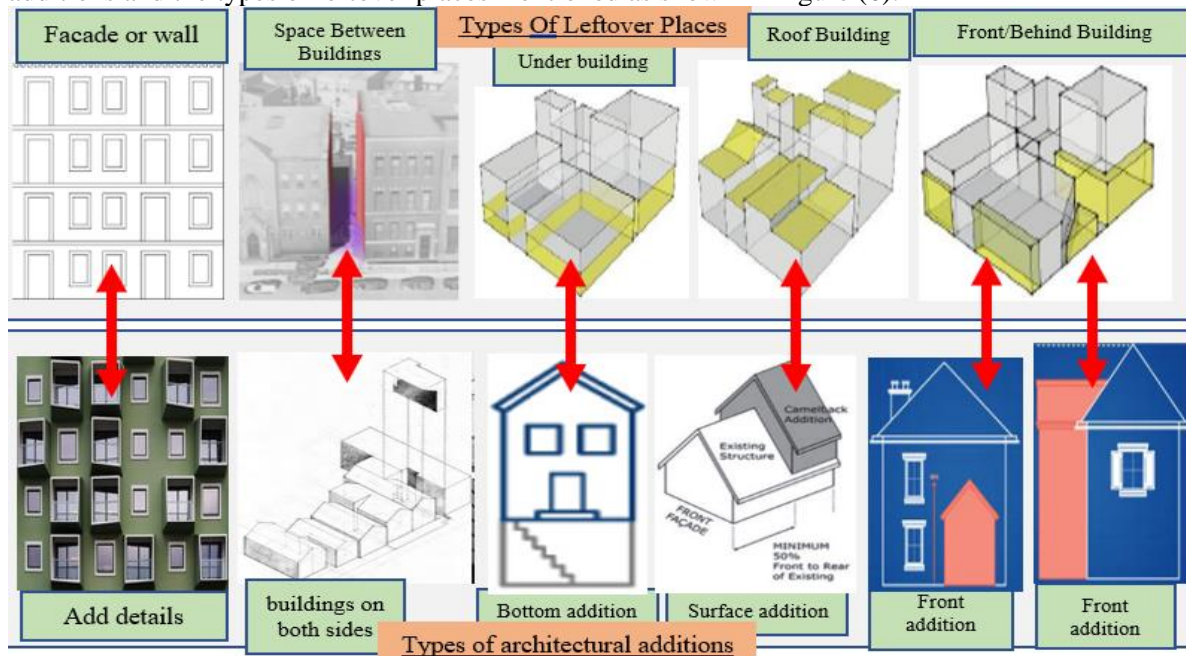
**Figure 5.** Classification of architectural additions.. Gulsen[29]

From the above it is clear by the contrast of the design patterns of the addition, which represent the differences in the relationship of differentiation and compatibility with the old building, there is an approach that indicates the development and modernization of the existing structure financially, and another approach called abstract that translates fundamental concepts into addition to a new formula but not a radical change, and finally the approach of the contradictory style which is the use of contemporary style With new materials, techniques and values without distorting the values that preceded them.

- *Additions site:* The architectural additions have several types depending on their location or the direction in which they will be in relation to the original building .Where divided it Gulsen(2018)[29]

1-Background additions 2-Side additions 3-Bottom additions 4-Compound additions 5-Additions to the roof 6- Additions to the interfaces 7-Additions between two buildings

From the above it is clear that there is a logical correlation between the types of architectural additions and the types of leftover places mentioned as shown in Figure (6).



**Figure 6.** illustrates the relationship between the concepts of addition and Leftover Places, Source (The researchers)

- *The added building, according to the time period,* this part deals with architectural additions to historical buildings, as the following:

-Additions in ancient architecture : One of the examples of additions appeared on the architecture of ancient civilizations, is the initial reconstruction of the Cordoba Mosque and the consequent additions ,Peter. J(2010)[37]. Figure (7 a) in the appendix.

- Additions before the Industrial Revolution : This kind of additions happened in the fifteenth and sixteenth centuries based on copies of most of the old building details, They are embodied by repeated openings and floor subdivisions.,Naeem(2005)[38]. Figure(7 b ) in the appendix.

-Additions after the Industrial Revolution : in the early sixties of the twentieth century, and as a result of increased awareness of the problems of the built environment of modern, such as the inconsistency and confusion and refused to interact with the former, sparked new calls for heritage investment and returned to use it in a new experiments, which were reflected in additions architectural respect the existing construction Brolin(1980)[31] . Figure (7c) .As for recent times, the methods of the additions were changed due to many economic, social, political, and legislative influences. The addition did not care about historical or temporal values. As a result, strange patterns emerged that did not relate to the original building. Ali(2011)[34] . Figure (7d ) in the appendix .

It is clear the necessity of respecting additions to historical architectural values, this could be by relying on direct copying and repetition of elements or details to reflect accuracy, consistency, and organization, yet there is another trend that they tend to be excessive and extravagant a. As for contemporary additions, several of them reflect a kind of intellectual, aesthetic and visual distortion.

*5.5. Determinants of architectural additions to historical buildings from the perspective of international organizations* : International organizations such as UNESCO<sup>1</sup> have indicated how to deal with historical buildings and in particular the additions that might fall under the formula of adaptation, and they can be summarized by<sup>2</sup>:

- The possibility of the introduction of contemporary architecture added to the old buildings without affecting the structural and aesthetic qualities of the latter.

- The originality of historical monuments or building groups must be considered a basic criterion, and any tradition that affects their artistic and architectural value should be avoided.

- Protecting historical significance through the visual distinction between old and new

(5.6) *Criteria for designing new additions to the historic building*: It can be summarized according toByard(1998) [12] :

- Avoid the addition that would hinder the ability to explain the design character of the old building.

- The addition should not harm important architectural features. They must not obscure, damage, destroy or remove the original architectural details and materials from the infrastructure.

- If the addition is small, it must respect the pre-designed structure, but if it is large, it is set away from the main structure and connected to a smaller connecting element, and an addition can be made on the back of the building if that is possible.

- In the event that the building is converted to a new use that is different from the old use, this type of employment is called "adaptive use", for example, the change from housing to trade, and it is preferred to linking the new user to the original to avoid radical changes ,And agree with him Gulsen which referred to "Taking into account the horizontal and vertical dimensions of the new addition because of its impact on the aesthetic values of the old building. The rhythmic adaptation of these additions to the old building is preferred by repeating the original materials, color, ratio, or component" Gulsen(2018)[29] .

It is clear that any addition to the architectural features of the existing building or its adjacent must be respected, so that the compatibility between them is at the level of size, materials, mass, in addition to respecting the existing details, and it is preferable to use rhythmic adjustment with the mechanism of repetition of a percentage or component so that the addition does not dominate the original building and thus cause confusion Optical and aesthetic.

Finally, a theoretical framework was formulated from the above information and labeled as main and Sub concepts of additions of leftover places described in Table (1), which is the first step in solving the research problem, which will be explained in the next steps.

<sup>1</sup> (UNESCO) is an international organization established by the United Nations in 1945.

<sup>2</sup> [http://www.icomos.org/docs/contemporary\\_architecture.html](http://www.icomos.org/docs/contemporary_architecture.html)

## 6- Practical Study

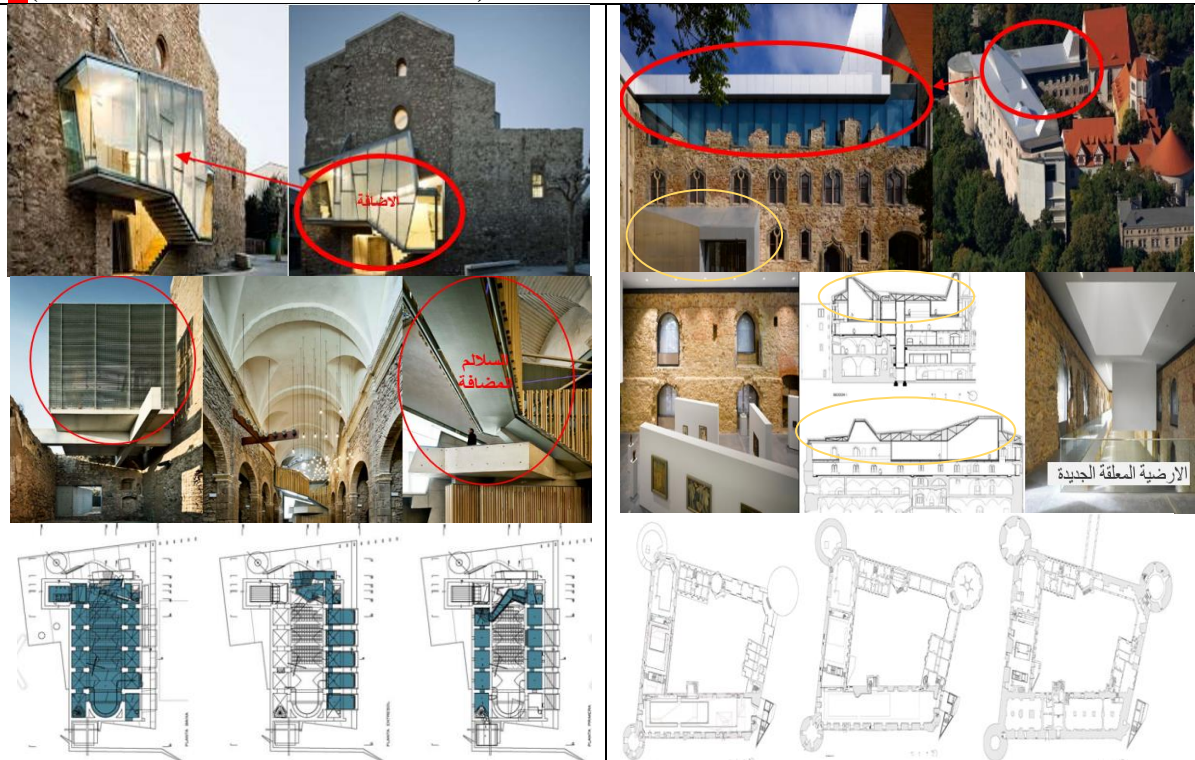
This part of research deal with applying above concepts and indicators on selected samples represented (tow global projects and tow local projects). elected on these samples based on functional and local diversity, it may be adding a part of a building, or adding a separate building to a specific place to highlight its historical importance.

Method of measurement: The measurement method depends on analyzing every sample by the main variables identified in the theoretical framework. A qualitative serial scale consisting of three levels to verify the possible values for each sample, where it takes the value number (1) when it is achieved, And the value of (0.5) when it is achieved somewhat, and the value of (0) when there is no verification, and the single characteristic is calculated by calculating the arithmetic mean of the ungrouped data in equation (1).and since the results will be from (1), so it will be converted to a degree of (100) for ease of reading by the receiver. Table (1) shows the practical framework for the samples chosen after a general description of each of them.

$$M = \frac{\sum d}{n}$$

( $\sum d$ ) is the sum of the degrees of all possible values for a single property  
 (n) is the total number of values for a single property  
 (M) is the average score for a single feature  
 equation (1) source [39]

**Global examples :the sample A(Moritzburg Museum Extension) On the right ,the sample B(The Saint Francis Convent Church) On the left.**



[https://www.archdaily.com/251389/convent-de-sant-francesc/St\\_Francesc-391\\_r2.jpg?next\\_project=no](https://www.archdaily.com/251389/convent-de-sant-francesc/St_Francesc-391_r2.jpg?next_project=no)

**Figure 8.** The Saint Francis Convent Church

The church dating back to the eighteenth century is located in Spain, where it was partially demolished and revitalized in 2011 by adding its goal to preserve the church's cultural heritage and adding new values through respect for size and spatial quality. The old and thus the introduction

<https://www.archdaily.com/132838/moritzburg-museum-extension-nieto-sobejano-arquitectos>

**Figure 9.** Moritzburg Museum Extension

The new addition was built on the ruins of an ancient stone museum dating back to the fifteenth century. The design was based on an architectural idea that includes a new surface depicted as a large folded platform consisting of glass and metal rising and falling to allow

of natural light that was not taken into account in advance, as service rooms and circular stairs were added so that the circular path allowed to see the church as a whole, the addition retained the signs of the deterioration of the building and thus highlighted the old values. Adaptive use, which gives new life by arranging old structures according to modern priorities, so that the church today has become a comprehensive cultural complex with a unique contemporary shape, and there is a future proposal to convert the upper floors into a historical archive. <https://www.archdaily.com/251389/convert-de-sant-francesc>

natural light to enter, and from these platforms, ground connected to represent the new exhibition areas, As for the surface of the addition surface, create one of the unstable forms of the displayed artboards. The first is located in the northern wing to connect the levels that must communicate between them. The second is a modern tower 25 meters high, providing access to new exhibition areas. <https://weburbanist.com/2016/08/08/a-study-in-architectural-contrasts-12-modern-meets-historic-additions/>

Local examples : the sample **C** ( Expansion of the shrine of Imam Ali (peace be upon him) ) on the right, and the sample **D** ( Al-Imam Al-Hussein Quranic Complex ) on the left.



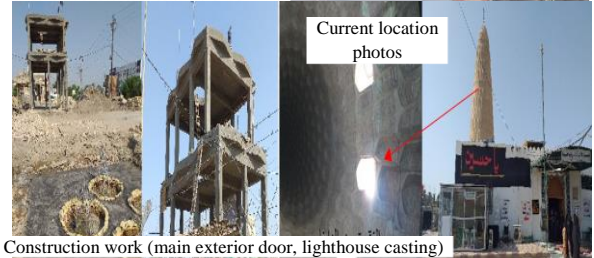
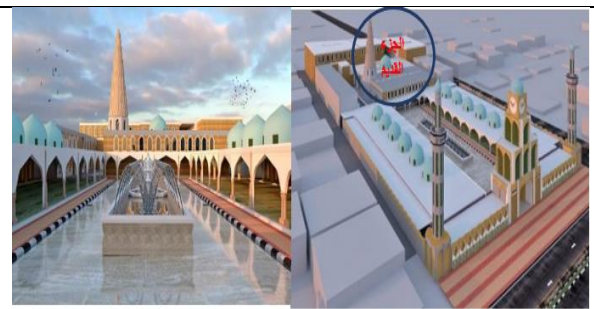
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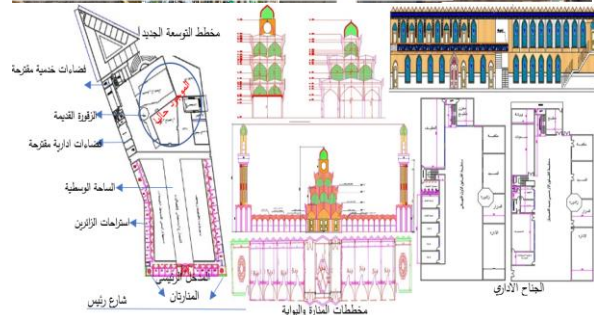
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**Figure 10:** forward compound Hussein Quranic. The building is located in Karbala / Iraq. It contains six buildings (the main building, a building for men, a building for women, and a building for families) and it consists of four floors except for the administration and service buildings, one floor, and also contains a central area and a conference hall. The addition was based on documenting the vocabulary of Islamic architecture with the flavor of local architecture using the (inner courtyard in an innovative way, showing a roof and another exposed, the continuity of the architectural language through repeated arches, especially in the interior halls or external facades, motifs and writings with texts from the Holy Quran, the human scale, unity within diversity), As well as adherence to social and religious standards, which were reflected in total isolation between males and females and at the level of employment and movement. Modern building techniques and methods have also been used with a variety of roofing patterns, with an emphasis on the environmental aspect through the use of glass wool in the walls to increase thermal

insulation. <http://www.nashatat.org/view.php?id=2258>



Construction work (main exterior door, lighthouse casting)



**Figure 11:** expansion of the shrine of Imam Ali, source [40]

It is called (Mard al-Shams) in Babel / Iraq. It consists of a main external entrance leading to the entrance to the maqam where there is an old ziggurat with a prayer hall for men and another for women. In 2019 it was proposed to expand it through additions represented by one prayer floor and two floors for management. It leads to a large square with a fountain surrounded by the spaces of the visitors' rest. With the addition of two minarets named (Al-Hassan and Al-Hussein) at a height of 17 meters. , Abstraction, metaphors of the Noble Qur'an, rhythmic and engineering, human scales, lighthouses and domes<sup>40</sup>.

**Table 1.** Main and Sub concepts of additions of leftover places and there applying on architectural samples .. Source (The researchers)

Main concepts	Sub-concepts	Main indicators	Sub-indicators	values	code					degree from 100
						A	B	C	D	
Architectural Addition Methods	Correlation	Functional correlation	space	General	X <sub>1</sub> 1-1	1	1	1	0.5	<b>87.5</b>
				Almost general	X <sub>1</sub> 1-2	0.5	0.5	0.5	0.5	<b>37.5</b>
				Special	X <sub>1</sub> 1-3	0.5	0.5	0.5	1	<b>62.5</b>
		movement		Major	X <sub>1</sub> 1-4	1	1	1	1	<b>100</b>
				Secondary	X <sub>1</sub> 1-5	0.5	0.5	0.5	1	<b>62.5</b>
		Functional style		Movement with space	X <sub>1</sub> 1-6	1	1	1	1	<b>100</b>
				Space relationship with space	X <sub>1</sub> 1-7	0.5	0.5	0	0	<b>25</b>
				Formal correlation	Optical bonding	Relationships between the elements	X <sub>1</sub> 2-1	0	0.5	1
		Relationship between buildings	X <sub>1</sub> 2-2	0		0	0	1	<b>25</b>	
		Share the form with the function through		Rhythmic	X <sub>1</sub> 2-3	0	0.5	1	1	<b>62.5</b>
				Diversity	X <sub>1</sub> 2-4	1	1	1	1	<b>100</b>
				Unit	X <sub>1</sub> 2-5	0.5	1	1	1	<b>87.5</b>
				Proportions	X <sub>1</sub> 2-6	0.5	0.5	1	1	<b>75</b>
				variance	X <sub>1</sub> 2-7	1	1	0	0.5	<b>62.5</b>
		Homogeneity	X <sub>1</sub> 2-8	0.5	0.5	1	1	<b>75</b>		
Total					<b>15</b>	8.5	9.5	10.5	12.5	
Average degree of verification of 1						0.56	0.63	0.7	0.83	
The average score is 100						<b>57</b>	<b>63</b>	<b>70</b>	<b>83</b>	
Circumstantial					X <sub>2</sub> 1-1	1	1	0	0.5	<b>62.5</b>
Additive										

<b>Architectural Addition Links</b>	Catalyst		Spatial	X <sub>2</sub> 1-2	0.5	0.5	1	1	<b>75</b>	
			Temporal	X <sub>2</sub> 1-3	1	1	1	0.5	<b>87.5</b>	
			Aesthetic	X <sub>2</sub> 1-4	0.5	1	1	1	<b>87.5</b>	
			Legislative	X <sub>2</sub> 1-5	0	0	0.5	0.5	<b>25</b>	
	The Nature Of The Addition	Total	Add an entire building	X <sub>2</sub> 2-1	0	0	1	1	<b>50</b>	
			Add part to a building	X <sub>2</sub> 2-2	1	1	1	0	<b>75</b>	
		partial	Relationships or items	X <sub>2</sub> 2-3	0	0.5	1	1	<b>62.5</b>	
			Materials and colors	X <sub>2</sub> 2-4	1	1	1	1	<b>100</b>	
	Add Location	In front of		X <sub>2</sub> 3-1	0	0	1	0	<b>25</b>	
		behind		X <sub>2</sub> 3-2	0	0	1	0	<b>25</b>	
between		X <sub>2</sub> 3-3	0	0	0	0.5	<b>12.5</b>			
Bottom		X <sub>2</sub> 3-4	0	0	0	1	<b>25</b>			
Overhead		X <sub>2</sub> 3-5	1	0	0.5	0	<b>37.5</b>			
Interface		X <sub>2</sub> 3-6	1	1	1	1	<b>100</b>			
side		X <sub>2</sub> 3-7	1	1	1	0	<b>75</b>			
Pattern Or Type Of Use Added	On the formal level	Reproductive Standard	X <sub>2</sub> 4-1	0	0	1	1	<b>50</b>		
		Symbiotic	X <sub>2</sub> 4-2	0.5	0.5	1	1	<b>75</b>		
		Off-text paradoxical	X <sub>2</sub> 4-3	0.5	1	0	0	<b>37.5</b>		
	At the functional level	Similar to old use	X <sub>2</sub> 4-4	1	0	1	0	<b>50</b>		
		Contradictory to old use	X <sub>2</sub> 4-5	0	1	0	0	<b>25</b>		
Total				<b>21</b>	10	10	15	11		
Average degree of verification of 1					0.48	0.5	0.71	0.52		
The average score is 100				<b>48</b>	<b>50</b>	<b>71</b>	<b>52</b>			
<b>Architectural Addition Characteristics</b>	Suddenly	Transformation	Formal	Quantitative	X <sub>3</sub> 1-1	1	0.5	0.5	<b>75</b>	
			qualitative	X <sub>3</sub> 1-2	0.5	1	0	0.5	<b>50</b>	
			Functional	Quantitative	X <sub>3</sub> 1-3	1	0	0.5	1	<b>62.5</b>
			qualitative	X <sub>3</sub> 1-4	0	1	0	0	<b>25</b>	

				4						
		At the level of form	Traditional form	X <sub>3</sub> 2-1	0	0	1	1	<b>50</b>	
			Innovative form	X <sub>3</sub> 2-2	0.5	1	0.5	0.5	<b>62.5</b>	
The Dynamic Change		At the level of function	Normal function	X <sub>3</sub> 2-3	1	1	1	1	<b>100</b>	
			New design	X <sub>3</sub> 2-4	0.5	0.5	0	1	<b>50</b>	
			New Movement	X <sub>3</sub> 2-5	1	1	0	1	<b>75</b>	
		Total		<b>9</b>	5.5	6	3.5	7		
		Average degree of verification of 1			0.61	0.66	0.38	0.77		
		The average score is 100			<b>61</b>	<b>66</b>	<b>38</b>	<b>77</b>		
Architectural Addition Features	Parasitism	At the service level		X <sub>4</sub> 1-1	0	0	0	0	<b>0</b>	
		At the level of the structural		X <sub>4</sub> 1-2	1	0.5	0	0	<b>37.5</b>	
		At the level of function		X <sub>4</sub> 1-3	0	0.5	0	0	<b>12.5</b>	
		At the level of form		X <sub>4</sub> 1-4	1	0	0	0	<b>25</b>	
	Symbiosis	Addition with context	At the level of the whole		X <sub>4</sub> 2-1	0	0	0	1	<b>25</b>
			Part level		X <sub>4</sub> 2-2	0.5	0	0.5	1	<b>50</b>
		Added to the old building	At the level of function		X <sub>4</sub> 2-3	1	1	1	0	<b>75</b>
			At the level of the structural		X <sub>4</sub> 2-4	1	1	1	0	<b>75</b>
			At the level of form		X <sub>4</sub> 2-5	0.5	0.5	1	0	<b>50</b>
			Total		<b>9</b>	5	3.5	3.5	2	
		Average degree of verification of 1			0.55	0.38	0.38	0.22		
		The average score is 100			<b>55</b>	<b>38</b>	<b>38</b>	<b>22</b>		
Architectural Addition Objectives	Positive Objectives	expediency / Social	Expansion	X <sub>5</sub> 1-1	1	0.5	1	0	<b>62.5</b>	
			Development	X <sub>5</sub> 1-2	1	1	1	1	<b>100</b>	
	Sustainability	Technique	Modern materials and technologies		X <sub>5</sub> 1-3	1	1	1	0.5	<b>87.5</b>
			Cultural		X <sub>5</sub> 1-4	1	1	1	1	<b>100</b>
			Social		X <sub>5</sub> 1-5	1	1	1	0.5	<b>87.5</b>
			Economical		X <sub>5</sub> 1-6	1	0.5	0	0.5	<b>50</b>



	Environmental	X <sub>5</sub> 1-7	1	1	0.5	1	<b>87.5</b>
Negative Objectives	Disruptive	X <sub>5</sub> 2-1	0	0	0	0	<b>0</b>
	Total	<b>8</b>	7	6	5.5	4.5	
	Average degree of verification of 1		0.88	0.75	0.69	0.56	
	The average score is 100		<b>88</b>	<b>75</b>	<b>69</b>	<b>56</b>	

## 7. Results.

### 7.1 Analysis of application results

This part deals with analyzing the statistical results presented in Table (1).

#### 7.1.1 The Concept Of Architectural Addition Methods

The results have shown that sample D has the highest formal and functional correlation while sample A has the lowest one. In detail, it was found that the general spaces in addition and the main movement are the highest and that each reinforces the other, on the formal level it was found that the relationships between the added architectural elements and the old elements achieved a higher rate than the addition relationship with Buildings (partial and not total compatibility). While the form shares with the function, it is found that diversity occupies the first rank, followed by unity and then other characteristics. Figure (12)and(13).

#### 7.1.2 The Concept Of Architectural Addition Links

The results have shown that sample C has the highest degree while sample A achieved the lowest. On the other hand, it was found that terms of the motives for addition related to aesthetic and temporal motives are the most influential, followed by spatial, circumstantial and legislative incentives, respectively. As to its nature, it was found that most of the intervention is by using materials or colors, to be followed by the partial intervention, whether adding a block or elements, while adding a separate building got the lowest percentage. As for the addition pattern, the sympathetic pattern and the use consistent with the old one were the highest. Figure (12)and(13).

#### 7.1.3 The Concept Of Architectural Addition Characteristics

The results have shown that D achieved the highest characteristics of addition but sample C got the lowest score. In detail, this concept depended on two secondary variables, the first of which is “transformation”, which was measured at the functional and formal levels, where it turned out that the quantitative transformation got the highest percentage based on the development or expansion of a particular building. On the other hand, this type of transformation is characterized by “flexibility” which allows to change and innovation. Figure (12)and(13).

#### 7.1.4 The Concept Of Architectural Addition Features

The results have shown, sample A achieved the highest symbiosis property with the old structures, while sample D got the lowest one. That means the symbiotic feature has gained the highest percentage, especially at the functional and structural levels. As for the Parasitic addition, it got the lowest percentage and for all its levels. This is evidence that the additions are designed to restore life to the old building. Figure (12)and(13).

#### 7.1.5 The Concept Of Architectural Addition Objectives

The results have shown that sample A project got the largest value while sample D got the lowest one. In detail, the first rank is the development and improvement of the old building. As for sustainability, it was found that the addition achieved cultural sustainability in historical buildings with a greater percentage than other aspects of sustainability. This is evidence that the addition plays a role in spreading awareness and opening horizons to define the identity of these important buildings and to inherit their values, legacy, and originality over the coming generations. Figure (12)and(13).

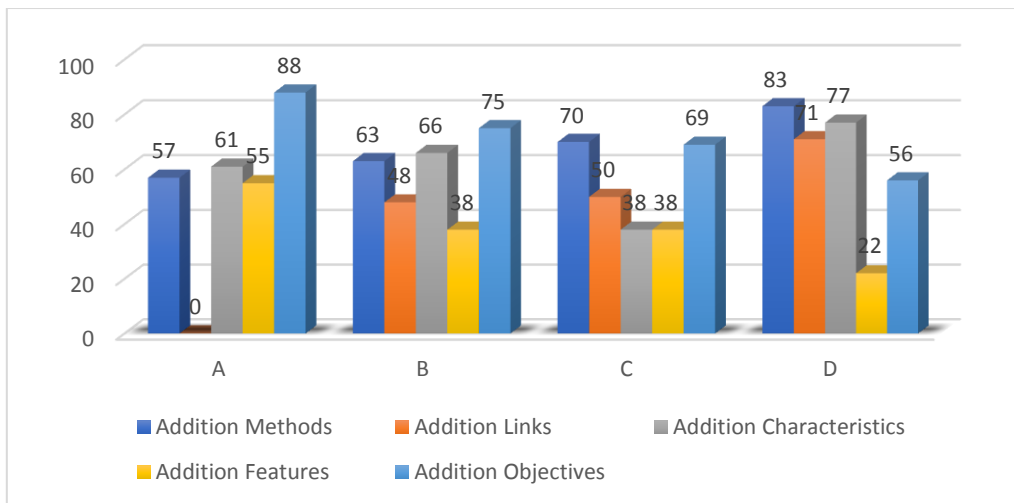


Figure 12. General Application Results ... Source (The researcher)

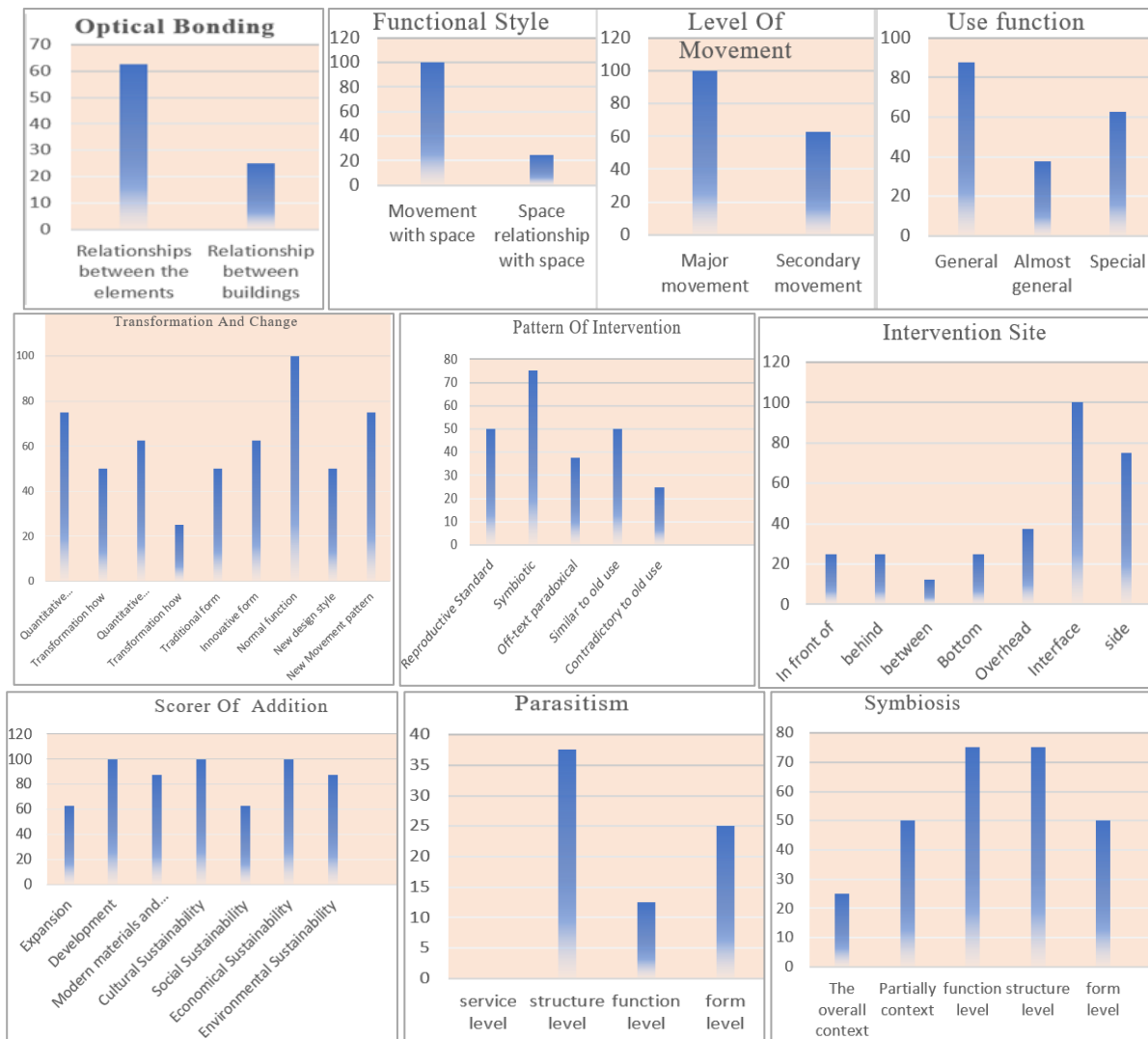


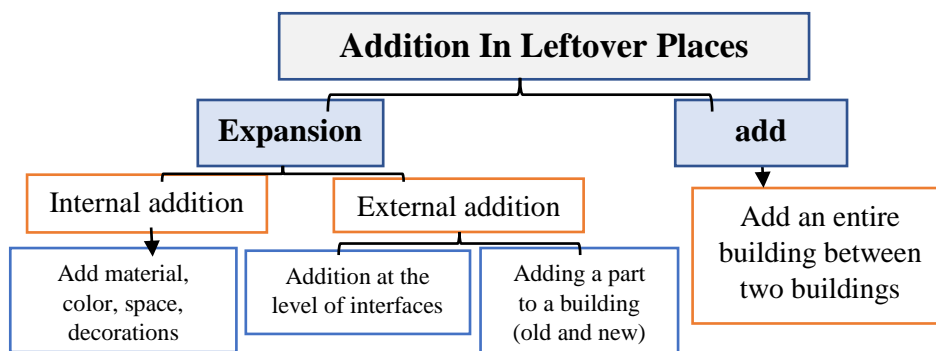
Figure 13. Detailed Application Results ... Source (The researcher)

### 8. Conclusions: The research concludes with the following:

First: The leftover places are every remaining area left for two main reasons: the first, neglected due to weakness and poor planning, social or economic factors, while the second, it is left for the purpose of future expansion. However, the characteristics of these leftover places, which are (flexibility and Exhaustivity) and their shape (Open or closed, regular or not, narrow or roomy) are motives and challenges in front of the designer to create an architecture within it.

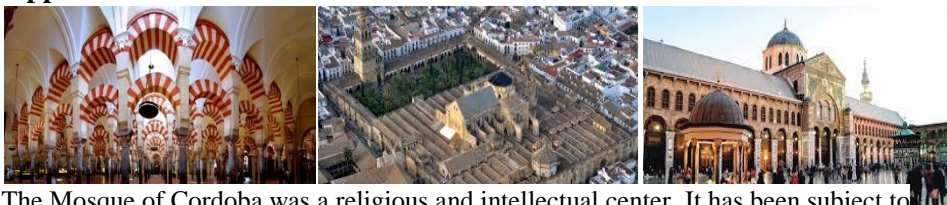
Second: The concept of additionally within the leftover places is a type of intervention or modification that appears in two forms: the first is to add architecture within the leftovers places, and the second is to expand or add a part to the leftover places in the levels of interior and exterior design. Were the types of leftover places, which are (behind, front, under, up, on both sides of the building), are prepared for such additions to combine their types together within one system. Therefore the addition is the intentional intervention to meet an urgent need and express the flexibility of thinking and the dynamics of expression in contemporary architectural products. It has physical properties in its apparent form and performance characteristics, which take two aspects: the first, human performance within, and the second, additional performance within leftover places. The research focused on creating a participatory relationship between the form and function of the additive to sustain the host building. See Figure (14).

Third: Through practical study, it became clear that cultural and intellectual sustainability has the largest share, which is the enhancement, enrichment, and revitalization of the addition within the spatial remnants of historical past values, as they are patterns that must be studied and inherited for future generations because they express the strength and resilience of civilizations in the face of the challenges of time.



**Figure 14:** shows the Leftover Places correlation with the concept of addition, which is the focus of the research ... Source (The researcher)

### Research Appendix:



The Mosque of Cordoba was a religious and intellectual center, It has been subject to addition and expansion four times, but all these works have gone in one direction, which is respect for the personality and style of the mosque.

([http://ishrakat.com/cms/upload/articles/4441\\_600X400articles.jpg](http://ishrakat.com/cms/upload/articles/4441_600X400articles.jpg)) **Figure 7a:**old architectural additions



(Renaissance architecture) St. Peter's Church (Vatican) in Rome for Architects Bramante and Michelangelo, in 1450, then Architect Bernini added two sides to it [https://en.wikipedia.org/wiki/St.\\_Peter%27s\\_Basilica#/media/File:Rome\\_San\\_Pietro.jpg](https://en.wikipedia.org/wiki/St._Peter%27s_Basilica#/media/File:Rome_San_Pietro.jpg) **Figure 7b** :Architectural additions before the Industrial



Addition to the Goteborg court designed by Asplund

<https://encryptedtbn0.gstatic.com/images?q=tbn:ANd9GcRA7SZz8oDkVgkFJcoxz82rUOvs0qJjm1CJzG6RzqU6cXXWF5WI&s>

**Figure 7c**: architectural additions after the Industrial Revolution



Bunker Towers house , (Symbiotic addition)

New materials (bricks, wood, and steel) were used, but they were not coated with dye until they were consistent with the old structure below <https://domob.com/backpack-house-portable-addition-hangs-from-buildings/>

**Figure 7d**: Contemporary architectural additions



The temporary restaurant in Paris(Parasitic addition) .it is a portable restaurant that can be moved to a different location. It was a project by architect Pascal Grasso, the restaurant inside features a dining room that can accommodate up to 12 people and a cooking area. There is also LED lighting between the metal and glass body that makes the restaurant stand out at night. ([https://www.homedit.com/?attachment\\_id=257070](https://www.homedit.com/?attachment_id=257070))

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