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Towards Sustainable Urban Spaces: Evaluating Applied Architecture in The City of Baghdad

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Abstract

Urban spaces are essential components of cities, as they provide environments for interaction among individuals and contribute to social development. These spaces reflect the values, customs, traditions, and cultures of their communities. In today's world, sustainability has become a crucial aspect of architectural design and urban planning. This paper aims to establish a framework for evaluating architectural concepts applied in urban spaces. The research identifies the need to highlight architectural ideas that enhance the sustainability of urban spaces. The study is divided into two parts: the first part defines urban space, categorizes its types, and summarizes the most important sustainability criteria relevant to these spaces. The second part applies the identified criteria and indicators to three types of urban spaces in Baghdad: one that represents the traditional context, another that reflects a modern context, and a third associated with a public building. The research concludes that urban spaces can achieve sustainability when they incorporate effective architectural ideas that are either directly or indirectly related to sustainability factors. Notably, urban spaces grounded in the traditional context of Baghdad exhibit the most characteristics conducive to sustainability.

Keywords: Urban design, sustainable urban environments, Best design, Sustainability Indicators, The city of Baghdad.

1. Introduction

Interest in urban spaces has been evident since the early eighteenth century, as they are recognized as vital arenas for social and cultural interactions due to their public and accessible nature. Urban spaces have garnered significant attention and are closely linked to the characteristics of their communities. For instance, the ancient Greek and Roman arenas exemplify the social cohesion and vibrant life of their inhabitants.

Previous studies have explored various definitions of urban spaces. One notable definition comes from Jane Jacobs, who described them as outdoor areas that ensure free access for all individuals. Jacobs emphasized that several factors contribute to the success of these spaces, including the diversity of activities they offer, which helps make them attractive centers for community interaction while providing comfort and opportunities for relaxation [1]. Jürgen Habermas defined public space as “a physical space in which the urban space is expressed as a space that achieves urban democracy that guarantees social interaction and joint work for members of society.” Historically, urban spaces have served as platforms for political expression and communication, enabling various forms of social participation [2].

Other theorists have defined urban spaces based on historical, cultural, and physical elements. Matthew Carmona, for instance, emphasized the significance of understanding and designing urban spaces in accordance with the unique cultural characteristics of each area [3]. Creating an effective architectural project requires consideration of key quality-of-life factors, such as sustainability, resources, and building materials [4]. Tykanova (2012) noted that the characteristics of communities play a significant role in shaping urban spaces, as highlighted by the Center for German and European Studies. Additionally, technological applications help create a sustainable urban environment, making cities more sustainable overall [6]. Recent studies have examined how urban spaces contribute to urban development and the creation of sustainable cities. These spaces promote well-being, social interaction, and cohesion, ultimately enhancing quality of life by offering green areas, parks, recreational facilities, and other amenities. There is a clear connection between sustainability and urban spaces, as they play a vital role in creating healthy and safe environments, making cities more livable [7].

This research focuses on the concept of sustainable urban spaces by evaluating architectural ideas that promote this goal and contribute to the overall sustainability of cities. The overarching objective is to identify and analyze the factors that contribute to the sustainability of urban spaces while exploring architectural concepts that support this aim. Specifically, the research aims to develop a comprehensive evaluation framework for urban spaces in Baghdad, assessing various aspects of sustainability, including environmental, social, and economic factors. Additionally, it will consider strategic planning and management of these spaces, community participation, quality of life, and urban resilience, all in pursuit of creating more sustainable urban environments.

2. Research Methodology

The paper consists of two parts: the first includes the literature review of urban space and sustainable development criteria, aiming to build an assessment framework of measurable indicators. The other part includes the practical application of the framework on three types of urban spaces in the city of Baghdad:

1. An urban space within the traditional context of Baghdad.

2. An urban space within a modern context

3. an urban space within a public building. To compare the sustainable architectural ideas within three different urban contexts.

This study presenting case study (Three Types of Urban Spaces in the city of Baghdad). Analyzing and comparing the case study spaces clarifies the various applications of sustainable architectural ideas within diverse urban contexts, while also providing recommendations for future designs, as shown in “Figure 1.”

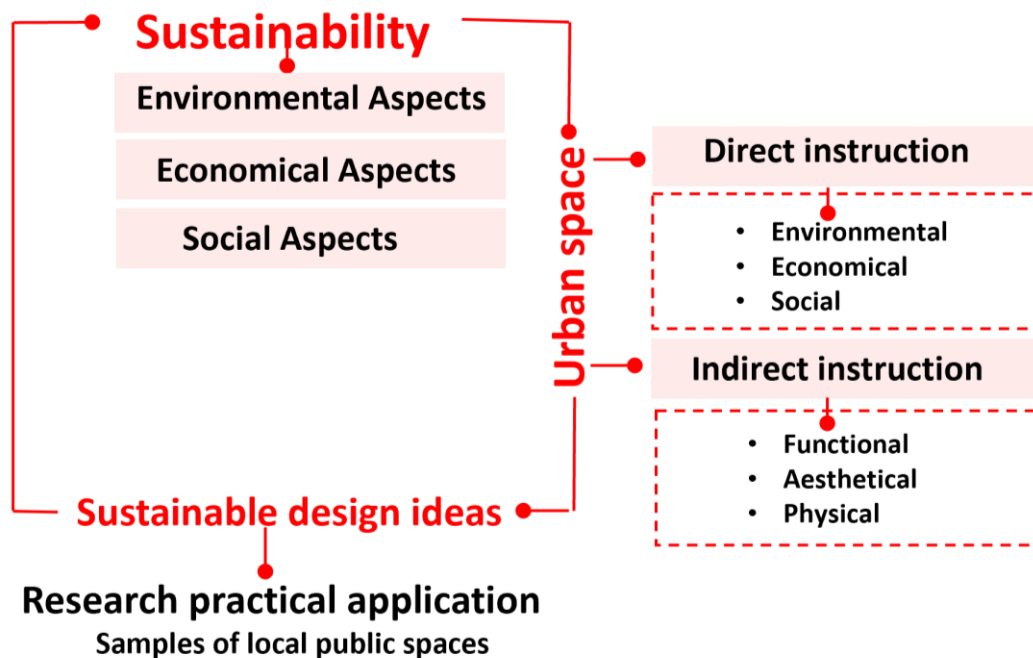


Figure 1. The research methodology.

3. Literature review

The evaluation of sustainability in Urban Design has been studied in different scopes, scales, and levels. Some studies have relied upon the sustainability assessment indicators of LEED, BREEAM, etc. that apply to a wider range and larger scale which is not specific to the urban space. Such as the studies of [8], and [9] have come out with a new evaluation framework named (SUCCEED) that comes from (Sustainable Composite Cities Environmental Evolution and Design Tool), which contains indicators to evaluate the neighborhood level. Besides [10] which has come out with two additional aspects of sustainability: Institutional and Cultural, in addition to the main three aspects (Environmental, Economic, and Social).

In the study referenced as [11], the authors have concentrated on the regions with unique ecological characteristics to develop an evaluation system using a coupling method. This method integrates indicators of Sustainable Urban Development with those of Urban Spatial Development and applies them at a regional level, which extends beyond the scope of the current research. However, the most critical indicators of urban space relate to its spatial characteristics.

Other studies were concerned with sustainable design, either the principles [12] or the instructions [13]. The initial research presented various design concepts focused on sustainability, as well as the different

components of urban environments, including buildings, spaces, neighborhoods, and settlements, along with their connections to stakeholders. In contrast, the other research proposed both direct guidelines (encompassing environmental, social, and economic factors) and indirect guidelines (covering functional, aesthetic, and physical aspects) to promote sustainability in urban spaces. However, neither the indicators mentioned nor the guidelines provided were sufficiently detailed to effectively assess existing urban areas. The [14].

Several studies discuss a single detail or idea of urban space design and its relation to sustainability, such as [15], which describes an initiative of recycling that is called (Creative Sustainability) as a collaborative work between different stakeholders and an industrial company, the aim of it is to recycle paper cups and plastic bottles into useful architectural elements like a door, a partition, street furniture, or a decorative element in public spaces. The research indicates that this initiative is effective in reducing waste and repurposing it beneficially. Additionally, in line with the study referenced in [16], which focuses on achieving social sustainability in urban space design, it explores how the dimensions of a space relate to its volume and the design of surrounding facades. This study aims to examine the effects of these factors on the suitability of the space for social activities and its perceptual qualities.

As shown in the previous studies, there is no study that has given comprehensive sustainability indicators for evaluating the design of urban space, so this research aims to present a comprehensive framework of design indicators to achieve a sustainable urban space, and then apply these indicators to many urban spaces in the city of Baghdad to evaluate them. See Table 1.

Table 1. The Extracted Indicators from Literature Review.

No.	Previous Literatures	Main Issue of Study (Study's Scale)	Extracted Indicators
1	Carmona M (2009)	Sustainable Design	Sustainable Design Ideas
2	Jaechol Kim (2017)	Urban Space's details of Sustainability	Social Sustainability Urban space's proportions The design of surrounding facades
3	Matthew Cohen (2017)	Sustainable Development	Evaluation Indicators for the scale of cities and large regions
4	Mohsen Sanei, et, al. (2017)	Sustainable Design of Urban Space	Direct instructions (Environmental, Social, and Economic) Indirect instructions (Functional, Aesthetic, and physical)
5	Harsimran Kaur, and Pushplata Garg (2019)	Sustainable Development	Assessment indicators that are derived from LEED, BREEAM, etc.
6	Job Momoh, et. al., (2020)		Assessment indicators that are derived from LEED, BREAM, etc.
7	Xiaohui Yu, et. al., (2020)		Sustainable Urban Development, and Urban Spatial Development

8	Albertus Galih Prawata (2020)	Urban Space's details of Sustainability	Creative Sustainability Initiative (Recycling)
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4. Urban Space and Sustainability

Urban spaces consist of both physical and functional components that interact with cultural influences to create areas for social interaction, communication, and sustainability [17]. In this context, urban spaces contribute to urban development by facilitating construction in line with city planning initiatives and adhering to legal frameworks that protect the public interest [18].

In recent decades, many cities have focused on public spaces as a central element of urban development, guided by the key sustainable development goal for 2016-2030: Goal 11, which aims to "Build inclusive, safe, resilient, and sustainable cities and human settlements." Public spaces promote participatory approaches and enable effective planning and landscape design that enhance ecosystems, maintain health and quality of life, ensure access for all individuals, and foster opportunities for expression, political gathering, and civic empowerment through participation and interaction [17].

Designs incorporating technological tools should emphasize the relationship between humans and nature, highlighting their interaction in creating sustainable urban spaces. [19].

The creation, protection, management, and enjoyment of urban spaces offer excellent opportunities for everyone to get involved. This involvement helps transform individual interests into collaborative practices and fosters sustainable economic and urban development, particularly through investments in streets and infrastructure. Urban spaces play a vital role in enhancing productivity while also serving as key elements in climate change mitigation and adaptation strategies. They help absorb carbon from the atmosphere, act as sustainable drainage systems, reduce solar heat, provide cooling corridors, and serve as windbreaks. As a result, public spaces can achieve environmental sustainability [20].

Urban design encompasses numerous theories and academic studies, which categorize it in various ways. Some of the key categories include "urban design areas," "the power of urban design," "integrated models in urbanism," "urban cultures and approaches to city building," "good design models," and "urban design patterns." Among these, the three most prominent concepts are neo-urbanism, post-urbanization, and sustainable urbanization. Each of these perspectives contributes to the creation of healthy, livable spaces characterized by diversity, familiarity, and interaction. [18].

With the growing emphasis on sustainability in urban environments, interest in sustainable design has significantly increased within the field of architecture. This surge is driven by a sense of social responsibility and a commitment to public values aimed at ensuring sustainable development. This interest manifests in the form of principles, guidelines, and evaluations of architectural concepts as they relate to urban spaces and their integration within the city [10,21], as shown in figure 2.

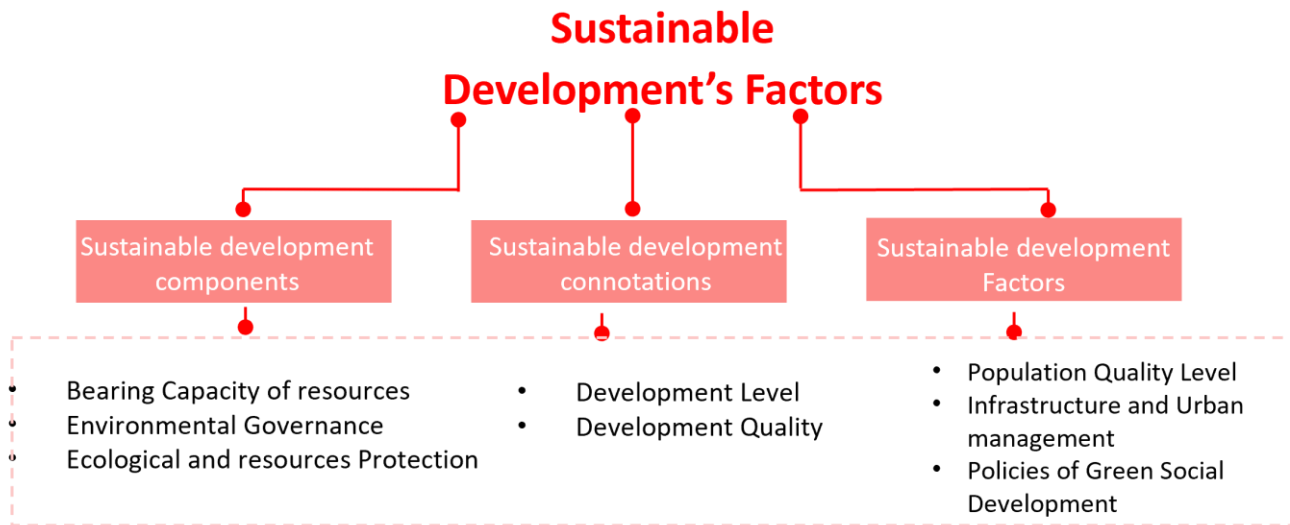


Figure 2. The Extracted Sustainable Development's Factors in urban space.

5. Urban Sustainability Factors: Architectural Concepts in Urban Spaces

The concept of sustainable development encompasses economic, environmental, social, and cultural dimensions. The economic aspect focuses on the welfare of individuals, including services, consumption, and the production of goods. The environmental aspect emphasizes preserving the local environment. Meanwhile, the social and cultural aspect pertains to the quality of human life and the harmony derived from social and cultural diversity.[22]

This understanding of sustainability evolved during the 2002 World Summit on Sustainable Development (WSSD) and the Johannesburg Declaration, which aimed to promote a balanced development of the environment, society, and economy. The objective of sustainable design is to minimize negative impacts on the environment while enhancing the relationship between humans and the natural world. Consequently, sustainable design principles have been applied across various fields, including urban design [23]. The current study focuses on the sustainability of urban space focusing on emphasizing indicators specifically related to these areas rather than buildings or the entire city

The first dimension is environmental sustainability. This involves increasing the efficiency of land use in natural terrains, reducing pollution, conserving energy, establishing parks and green spaces, and securing open areas [22]. This indicator contributes to creating a comfortable environment and an effective circulation system that promotes natural ventilation and recycling. To ensure a long-term positive impact of urban development on the environment, it is essential to recognize the importance of environmental indicators, as they represent the primary sources of air, water, and soil. Additionally, effective management of existing natural resources is crucial for the revitalization and preservation of the natural environment through the recycling of those resources [21]

The second dimension is Social Sustainability. It focuses on preserving and revitalizing societal norms, values, customs, and traditions, as well as protecting historical buildings and sites. The goal is to achieve a strong cultural and local identity, alongside ensuring safety and accessibility [24]. Creating urban spaces fosters community interaction; therefore, establishing these spaces should not be temporary but rather adaptable for future use [25]. Additionally, social sustainability encompasses how buildings relate

to their surroundings, emphasizing the design and planning of mobility, ease of movement, and comfort for individuals navigating these environments.[26]

Third Dimension is Economic Sustainability. This indicator aims to reduce development costs and promote economic growth by securing urban infrastructure and utilities while enhancing quality of life [23]. Achieving this involves establishing a balanced relationship between effective growth, development, and improvements in productivity [27]. Interest in economic sustainability has grown in response to the recognition that environmental resources are limited and must meet the needs and desires of both current and future generations. To maintain urban and regional development, it is essential to coordinate resource usage and direct investment toward technological development.[25]

In addition to these dimensions, contemporary studies have proposed incorporating another category of indicators that indirectly influences the sustainability of urban space design, complementing the direct indicators [28], as shown in Figure 3.

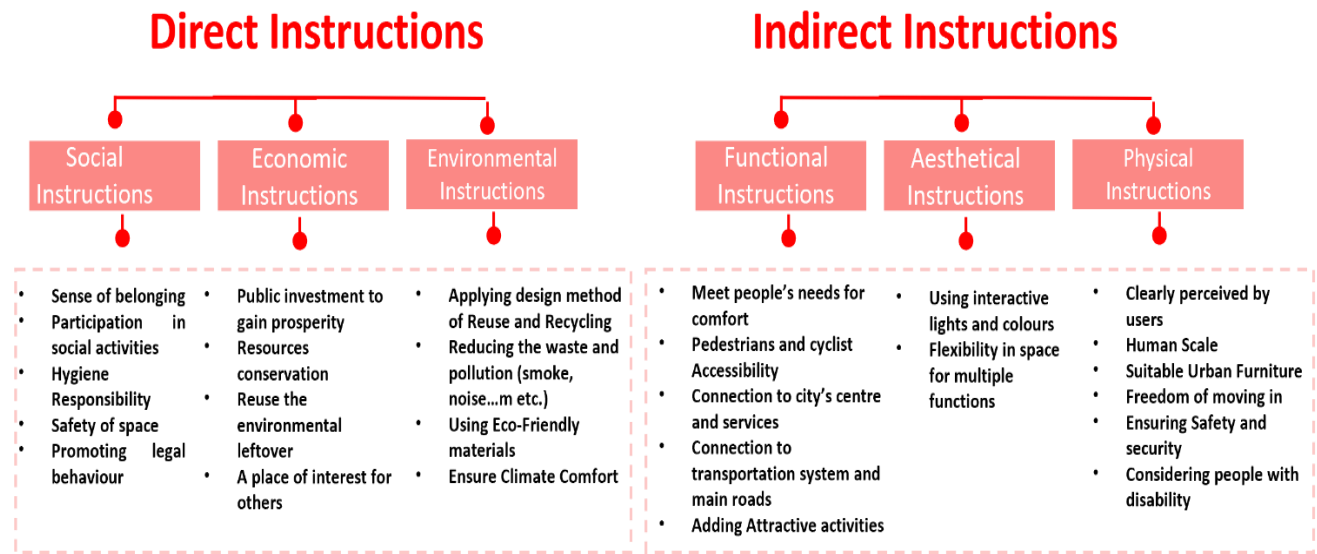


Figure 3. The Extracted Direct and Indirect Indicators to sustainable design of Urban Space.

The current view of urban spaces has been changed, and looking at them is not limited to the physical aspects of an urban space only, but also through close interactions with the various elements that make these spaces sustainable. Sustainability is achieved only through the interaction of social, economic, and environmental aspects [29] with the physical, spatial, and psychological characteristics of urban space that makes it successful according to the viewpoint of multiple theorists and urban designers [30]. As shown in Figure 4 the current study has extracted the recommended characteristics of designing an urban space.

In this context, studying urban spaces include the study of all the tangible and intangible elements towards achieving sustainable cities [31]. Therefore, the research necessitated analyzing the architectural ideas for designing sustainable spaces in Figure 4, in relation to the recommended aspects of designing an urban space in Table 2. The recommended Spatial Characteristics of urban spaces are classified

according to the mentioned (direct and indirect) factors of sustainability to build the evaluation framework that is going to be applied to the selected urban spaces (case study) and propose issues that must be taken into account in the design of these spaces to achieve urban sustainability. As shown in Table 3.

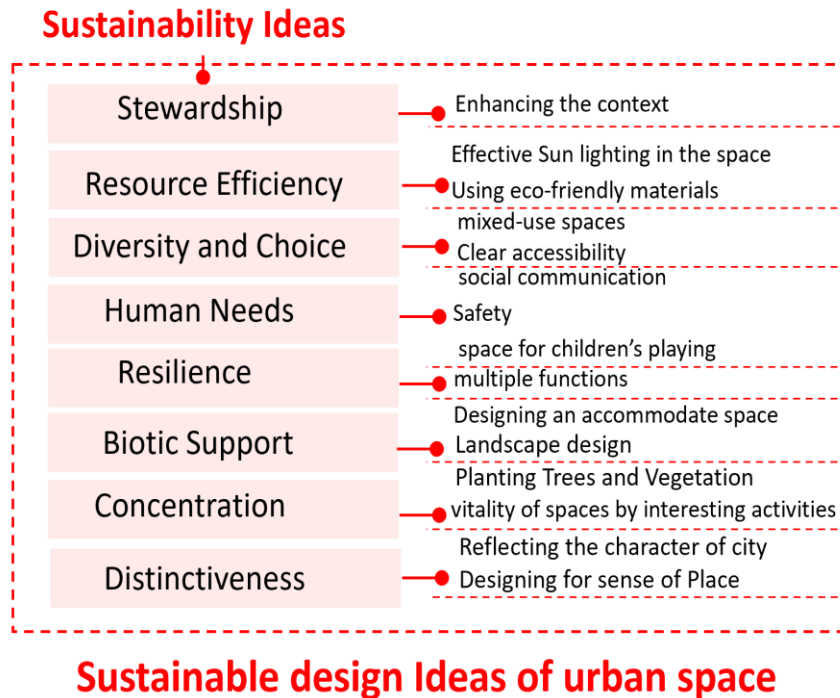


Figure 4. The Extracted Sustainable design concepts of urban space [Authors].

Table 3. The Extracted from The Theoretical Framework for evaluating sustainability in the urban spaces.

Sustainability Dimensions		Main Indicators	Secondary Indicators
Direct Factors	Social Factors	Sense of belonging	Historical Consistency
			Historical Value
		Participation in social activities	
		Hygiene Responsibility	
		Safety of space	
	Promoting legal behavior		
	Environmental Factors	Ensure Climate Comfort and Landscape	Shadow casting object
			Natural ventilation
			Vegetation and green area
			Water management systems
Give Priority to Public Transportation			
Reduce speed and restrict their circulation			
Indirect Factors	Functional Factors	Meet people’s needs for comfort	
		Pedestrians and cyclists’ accessibility	
		Connection to city’s centre and services	
		Connection to transportation system and main roads	

		Connection with other urban spaces	
		Relationship with Environment and Context	
		Adding Attractive activities (Mixed-Use)	Identity
			Religious
			Commercial
			Recreational
			Place Making
	Aesthetic Factors	Using interactive lights and colours	
		Flexibility in space for multiple functions	
		Human Senses	Visual Connection
			Hearing and smelling
		Psycho-emotional Load	Suitable Sculptures that are in harmony to the design
			Natural Elements as a part of design composition
			Surrounding Facades' Design
	Physical Factors	Clearly perceived by users	Clear Shape
			Well-designed Composition
			Enclosed Space
		Size Parameters	Human Scale
			Not wider than 14-18m
			Not Longer than 21m
			Not less than the building's height or more than twice of it.
		Centrality and Directivity	Length to width ratio 1:2, 2:3
		Height Ratio (surroundings)	1:6, 1:3 width to height or 5 times less than diameter
		Suitable Urban Furniture for all in design and distribution	
		Freedom of moving in different directions as desired	
		Ensuring Safety and Preventing Crime	
		Considering people with disability	

In a similar vein, reference [32] focuses on green walls as a sustainable architectural solution within the three dimensions of sustainability (environmental, economic, and social) at the urban level. The research establishes a theoretical framework, and the indicators are derived from previous studies and expert opinions. The weights of these indicators are determined using the Delphi methodology (expert opinions). Reference [33] proposes a theoretical framework for evaluating buildings and spaces, comprised of three main axes: sustainability, inclusivity, and aesthetics. This framework is used to evaluate buildings before and after construction and relies on expert opinions to determine the sub-indicators and their weights. Similarly, reference [34] evaluates water elements (quantitatively) in urban spaces from two perspectives: an environmental (ecological) perspective and a physical (formal) perspective. Twenty-one experts participate in defining the indicators and determining their weights. The application uses the Super Decisions software. References [35] and [36] also employ the Analytical Hierarchy Process (AHP), with the former using it to evaluate sustainability in three architectural projects in Riyadh. Previous studies were used to build a theoretical framework for measurement, through a survey of experts and the determination of weights according to the TOPSIS and AHP techniques. The second relied on building a model to measure aesthetic characteristics in environmental

design treatments, through a survey of experts and designers, and the adoption of Delphi and AHP techniques, without application to case studies.

7. Case Studies

The selected case studies for this paper are three urban spaces in the city of Baghdad (The capital of Iraq). They are selected according to their nature, privacy and accessibility, function, and their location in the city, and these examples were analyzed according to the final indicators, as follows:

7.1. A Public Urban Space in Al-Rasheed Street for traditional (an urban courtyard within a public institutional building- Al-Qishla building)

The urban space of Al Qishla has been selected due to its distinctive role as a public space within a densely populated traditional context. Located in the historical region of Al-Rusafa (Jadeed Hassan Pasha), it is proximate to significant landmarks such as the Al-Qishla building and Al-Mutanabbi Street. This space is bordered by the dilapidated facades of the Old Baghdad Governorate Building, which was initially constructed in the third decade of the 20th century by the Ottomans. [37]. The Qishla was established in Baghdad in 1831, within the Saray complex. The upper floor and the clock tower were added to it, and it witnessed multiple functional transformations. It was used as a headquarters for British officers and housed a number of government institutions before being converted into a museum. It is now a heritage and cultural landmark open to the public and tourist activities, especially the courtyard surrounding the clock tower [38]. The central urban space embodies the concept of a "meeting place" to stimulate communication and community interaction. This project contributes to preserving historical heritage while also promoting sustainable urban development, with a strong emphasis on respecting local customs and social relationships. By maintaining the original architectural elements and incorporating new uses, the project achieves a harmonious balance between preservation and innovation, setting a precedent for future urban regeneration efforts [37].

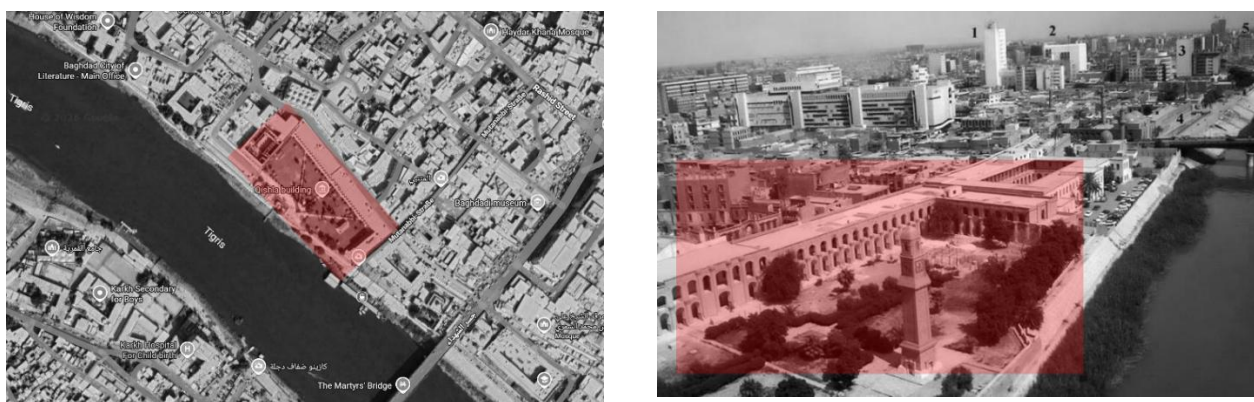


Figure5.Shows the site plan and the perspective of the Al-Qishla building [38].

7.2. A public urban Space in the Modern Context (The Save Iraq Culture Monument)

This Urban Space lies in Almansour district, near the square of (Alfaris Alarabi) and (Alzawra'a Park). It contains the monument of Save Iraqi Culture, which was designed by the famous sculptor and Artist Mohammed Ghani Hikmet in 2010. The monument has great value to the Iraqi people because of its highly symbolic meaning. It is a cylindrical broken stone as a representation of the Iraqi's historical stamp (Iraqi's Culture), supported by a man with five hands, as a representation to Iraqi society's multiple components, to prevent it from falling down. The cylindrical stone has Sumerian letters forming a sentence (The writing had begun from here). The monument is centered in a semi-rectangular garden (145m*200m), (within a circle of 36 meters in diameter), surrounded by square-shaped platform (69m*69 m) [39,40]. As shown in Figure 6.



Figure6.Shows the site plan and the perspective of the Save Iraq Culture Monument

7.3. A Semi-Public Urban Space Inside a Public Building (The Plaza of Babylon Mall)

This urban space lies in front of a 6-storey commercial building (Babylon Mall) in Almansour district. The outdoor space associated with the mall functions as an extension of these commercial and recreational activities, supporting pedestrian movement, gathering, and social interaction. Additional physical characteristics of the outdoor space, including its spatial dimensions, landscape elements, seating areas, fountain, and other site-specific features, were documented through field observation and site survey. The space has a central groundwater fountain, facing the mall's main entrance façade, which contains symbols and motifs of Babylonian culture. The space has a large show screen and a children's train [41]. As shown in Figure 7.



Figure7.Shows the site plan and the perspective of The Plaza of Babylon Mall

8. Findings and analysis

A survey questionnaire was put together based on the measurable indicators coming from the theoretical framework, then it was coded and shown to a panel of experts. After that, 60 questionnaires were sent out, and only 40 of them came back fully completed and usable for analysis. We compared the three urban spaces, and in other words, we checked which ones turned out to be the most sustainable. The results were analyzed as follows:

Table 4: shows the basic variables that will be measured in the practical study. [Authors]

No.	Questionnaire	Code
1	The space is linked to its historical context.	X1
2	The space possesses historical value.	X2
3	The space encourages participation in social activities.	X3
4	Feel safe in the space.	X4
5	The space encourages adherence to proper behavior.	X5
6	The space can be utilized to increase economic resources.	X6
7	The space incorporates water conservation.	X7
8	The space incorporates energy conservation.	X8
9	The space incorporates material reuse.	X9
10	The space incorporates recycling ideas.	X10
11	The space is an attraction for people.	X11
12	The design of the space reduces environmental pollution.	X12
13	The space provides shaded areas.	X13
14	The space provides natural ventilation.	X14
15	The space includes green spaces and plantings.	X15
16	The space includes water features.	X16
17	Waste collection is controlled within the space.	X17
18	The space is accessible by public transportation.	X18
19	The space contributes to reducing car speeds on surrounding streets and regulates traffic flow.	X19
20	The space includes comfortable and suitable seating areas.	X20
21	The spaces include suitable walking paths.	X21
22	The space can accommodate a suitable number of people without feeling overcrowded.	X22
23	The space is accessible by walking.	X23
24	The space is connected to the city center and its main services.	X24
25	The space is connected to the city's main streets.	X25
26	The space is connected to neighboring spaces within the area.	X26
27	A new activity can be added to the space.	X27
28	The space includes appropriate lighting and colors	X28
29	The space can accommodate multiple activities.	X29
30	I feel comfortable when looking at the components of the space.	X30
31	I feel comfortable when listening to the sounds around me in the space.	X31
32	I feel comfortable when exposed to the scents in the space.	X32

33	The space includes appropriate architectural and sculptural elements.	X33
34	The space includes natural elements from the surrounding context.	X34
35	The space is surrounded by a wall or fence.	X35
36	The space has a regular shape (rectangular, circular, square).	X36
37	The space is enclosed and not open in all directions.	X37
38	The design and shape of the space are suitable for me.	X38
39	The space is accessible to people with disabilities.	X39
40	I can move freely in the space in all directions	X40

The survey results showed that Al-Qishla Historic Building had the highest percentage of agreement in relation to the urban space and its historical context, followed by the Save Iraq Culture Monument, while the lowest score was for Babylon Mall Plaza. As shown in Figure 8. The survey results showed that Al-Qishla Historic Building had the highest percentage of agreement in relation to the urban space and its historical context, followed by the Save Iraq Culture Monument, while the lowest score was for Babylon Mall Plaza. As shown in Figure 9.

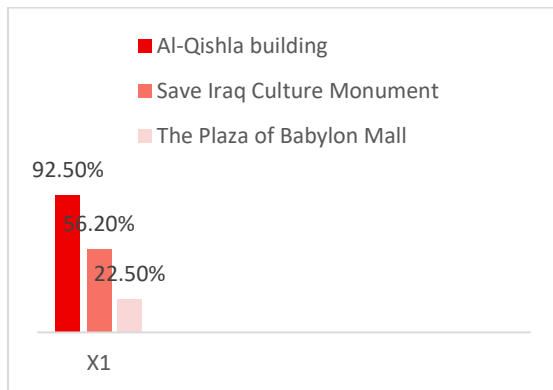


Figure 8. shows the results for variable X1.

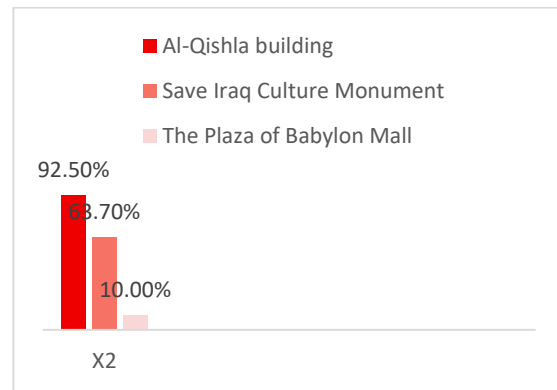


Figure 9. shows the results for variable X2.

Figure 10 gives the results of the survey show that the highest percentage of agreement to encourage participation in social activities was for Babylon Mall Plaza, followed by Al-Qishla Historic Building, and the Save Iraq Culture Monument came last. X4: The results of the survey revealed that the percentage of the users' sense of safety inside the plaza was the highest in Babylon Mall Plaza, then Al-Qishla Historic Building, and last The Save Iraq Culture Monument as shown in Figure 11.

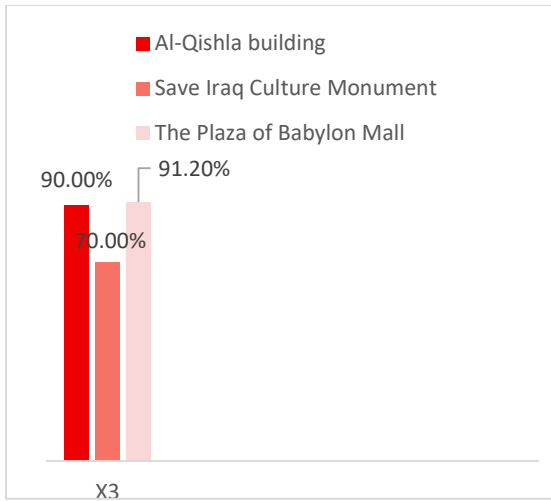


Figure 10. shows the results for variable X3.

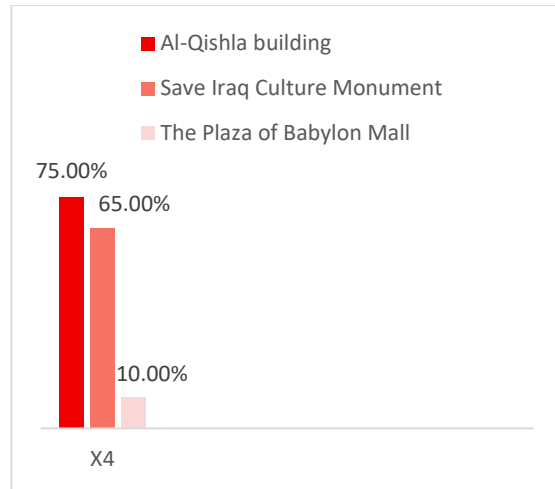


Figure 11. shows the results for variable X4.

X5: The survey results show that Babylon Mall Plaza has the highest percentage of agreement in encouraging the appropriate public behavior, followed by Al-Qishla Historic Building, while the Save Iraq Culture Monument has the lowest percentage. As shown in Figure 12. X6: The results of the survey showed that the highest percentage of agreement on the possibility of the space to improve economic resources was for Al-Qishla Historic Building followed by Babylon Mall Plaza, while the lowest score was for The Save Iraq Culture Monument as shown in Figure 13.

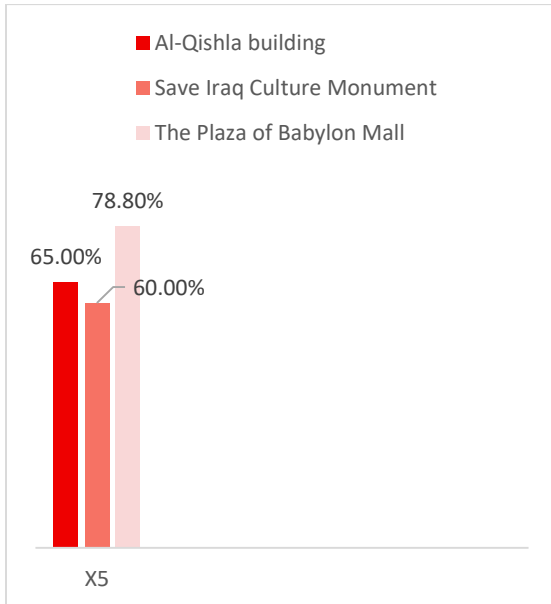


Figure 12. shows the results for variable X5.

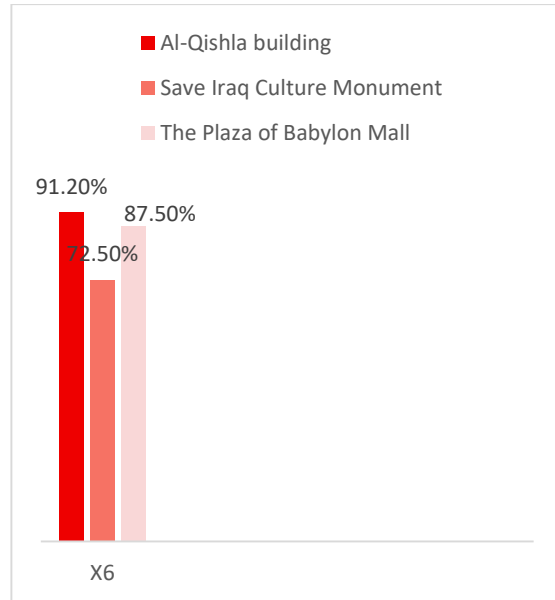


Figure 13. shows the results for variable X6.

X7: The results of the survey show that Al-Qishla Historic Building had the highest percentage of agreement on water resource conservation, followed by Babylon Mall Plaza, while the lowest score was recorded for The Save Iraq Culture Monument as shown in Figure 14. X8: The survey results indicate that the Al-Qishla Historic Building had the highest percentage of agreement on energy conservation,

followed by Babylon Mall Plaza, while The Save Iraq Culture Monument was in the last position as shown in Figure 15.

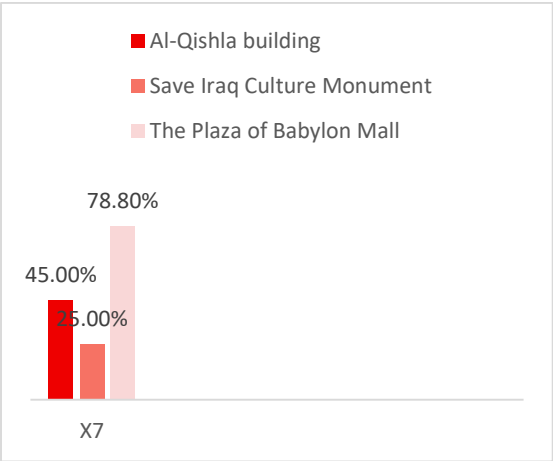


Figure 14. shows the results for variable X7.

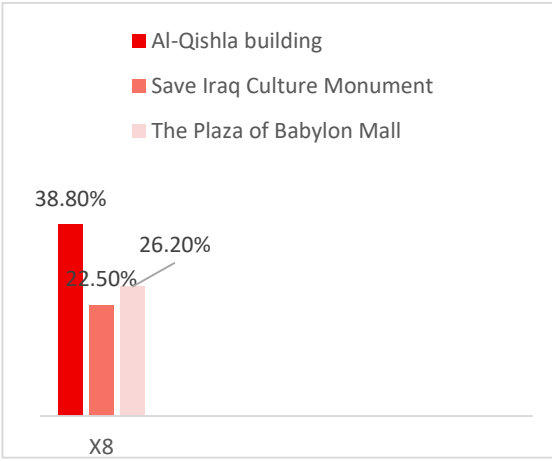


Figure 15. shows the results for variable X8.

X9: The survey findings indicate that Al-Qishla Historic Building obtained the highest percentage of agreement on reusing materials, while The Save Iraq Culture Monument got the lowest, followed by Babylon Mall Plaza. As shown in Figure 16.X10: Survey results indicated that the most successful project in terms of the percentage agreement for the implementation of recycling strategies was Al-Qishla Historic Building followed by Babylon Mall Plaza, and The Save Iraq Culture Monument with similar percentages as shown in Figure 17.

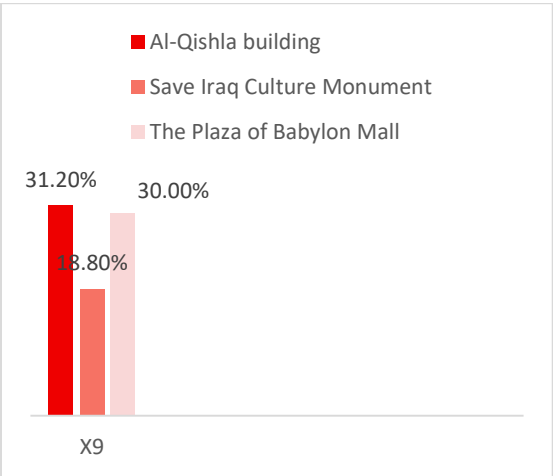


Figure 16. shows the results for variable X9.

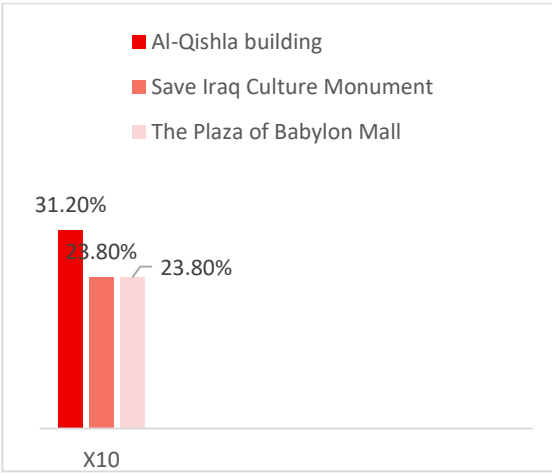


Figure 17. shows the results for variable X10.

X11: The survey results showed that Al-Qishla Historic Building has the highest percentage of agreement as an attractive destination for visitors, while Babylon Mall Plaza and The Save Iraq Culture Monument got the same scores ss shown in Figure 18. X12: The results of the questionnaire show that the Al-Qishla Historic Building obtained the highest percentage of agreement in terms of reducing environmental pollution, then The Save Iraq Culture Monument, while the Babylon Mall Plaza obtained the lowest score as shown in Figure 19.

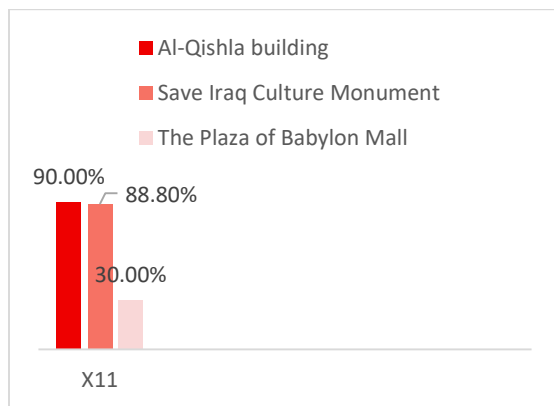


Figure 18. shows the results for variable X11.

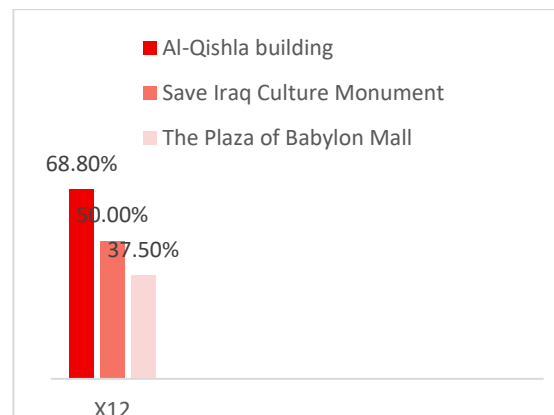


Figure 19. shows the results for variable X12.

X13: The survey results show that Al-Qishla Historic Building obtained the highest percentage of agreement in providing shaded areas, followed by Babylon Mall Plaza. Meanwhile, The Save Iraq Culture Monument has received the lowest score. As shown in Figure 20. X14: The results of the survey showed that Al-Qishla Historic Building and The Save Iraq Culture Monument had the equal highest percentage of agreement on the provision of natural ventilation, followed by Babylon Mall Plaza as shown in Figure 21.

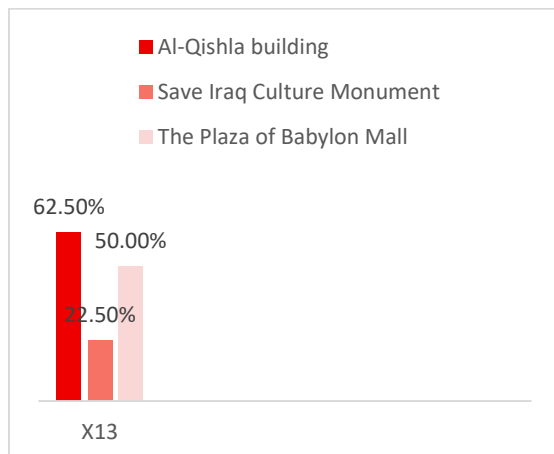


Figure 20. shows the results for variable X13.

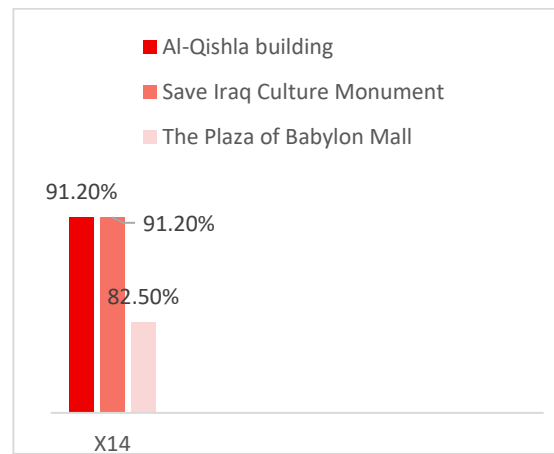


Figure 21. shows the results for variable X14.

X15: According to the survey results, the Al-Qishla Historic Building recorded the highest percentage of agreement on the provision of green areas and vegetation, followed by The Save Iraq Culture Monument while the Babylon Mall Plaza recorded the lowest. As shown in Figure 22. X16: The survey results show that the highest agreement on the addition of water features was obtained in (Babylon Mall Plaza) followed by (Al-Qishla Historic Building) and the lowest agreement was obtained in (The Save Iraq Culture Monument) as shown in Figure 23.

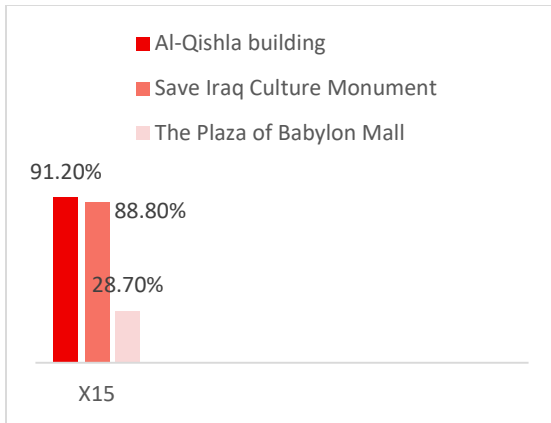


Figure 22. shows the results for variable X15.

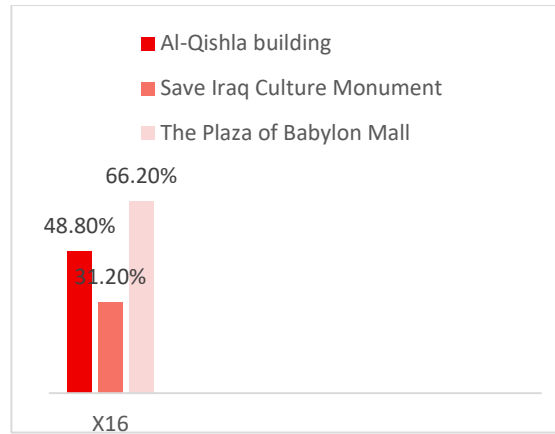


Figure 23. shows the results for variable X16.

X17: The survey results indicate that the highest agreement on effective waste collection and management was registered in Babylon Mall Plaza, followed by Al-Qishla Historic Building, and the lowest score was obtained in The Save Iraq Culture Monument. As shown in Figure 24. X18. The results of the survey indicated that The Save Iraq Culture Monument ranked first with the highest percentage of agreement about the accessibility by public transport, followed by Babylon Mall Plaza, whereas Al-Qishla Historic Building ranked last as shown in Figure 25.

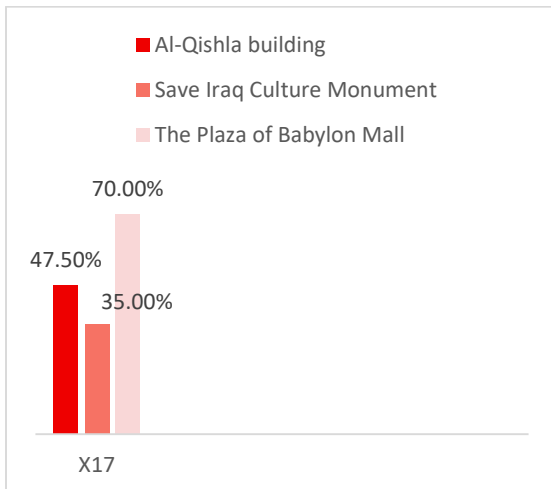


Figure 24. shows the results for variable X17.

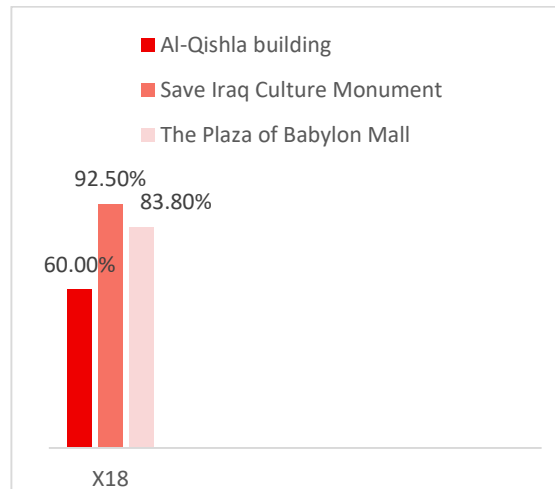


Figure 25. shows the results for variable X18.

X19: The survey results showed that the Al-Qishla Historic Building has the highest percentage of agreement to reduce the speed of vehicles and regulate traffic around the space, followed by Babylon Mall Plaza, while The Save Iraq Culture Monument has the lowest percentage. As shown in Figure 26. X20: Survey results showed that Al-Qishla Historic Building and Babylon Mall Plaza had equal and highest percentages of agreement about providing comfortable seating areas, followed by The Save Iraq Culture Monument as shown in Figure 27.

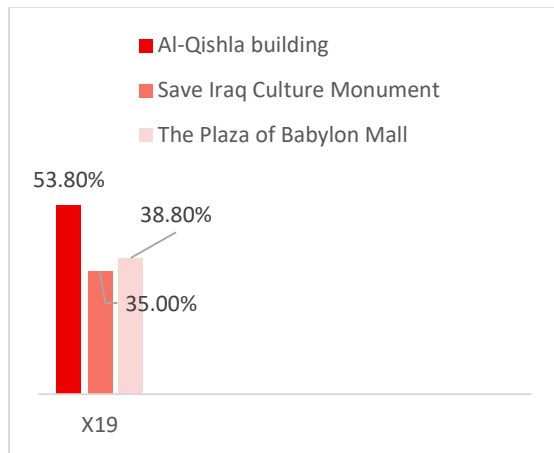


Figure 26. shows the results for variable X19.

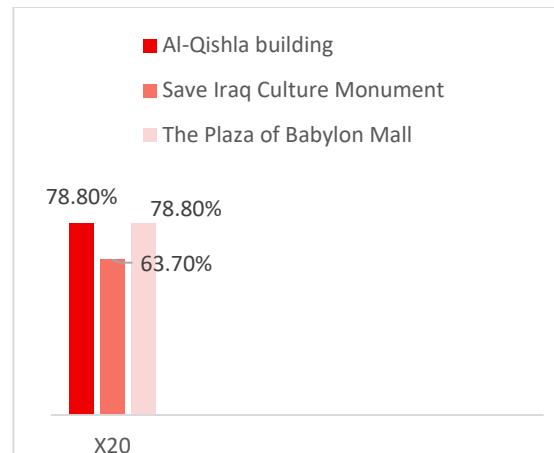


Figure 27. shows the results for variable X20.

X21: Results of the survey show that Al-Qishla Historic Building got the highest percentage of agreement in providing adequate pedestrian spaces, followed by The Save Iraq Culture Monument, while Babylon Mall Plaza got the lowest score. As shown in Figure 28. X22: The survey result shows that the highest percentage of agreement about the Al-Qishla Historic Building is in accommodating an appropriate number of users without crowding, followed by The Save Iraq Culture Monument, and Babylon Mall Plaza came last as shown in Figure 29.

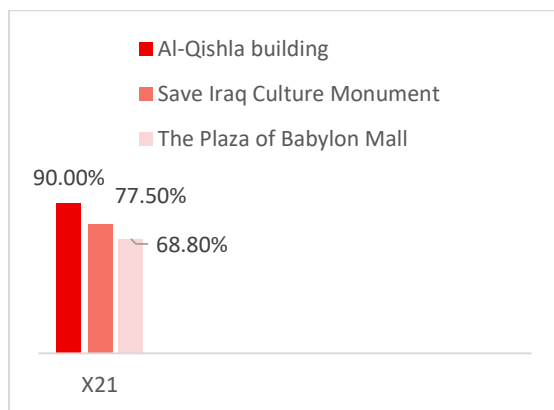


Figure 28. shows the results for variable X21.

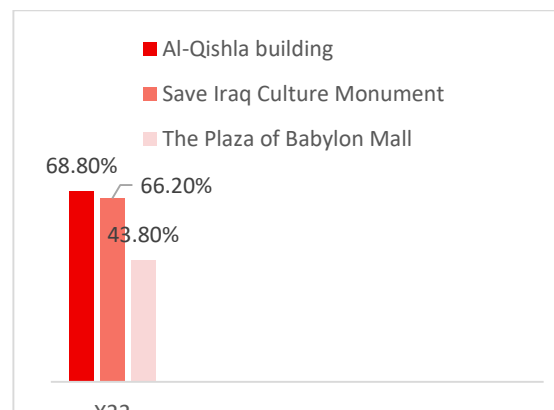


Figure 29. shows the results for variable X22.

X23: The survey results show that Al-Qishla Historic Building got the highest agreement percentage in walkability, followed by The Save Iraq Culture Monument, while Babylon Mall Plaza got the lowest score as shown in Figure 30. X24: The survey results show that the highest agreement percentage on the association to the city center and major services was scored by The Save Iraq Culture Monument, followed by Al-Qishla Historic Building, while the lowest was scored by Babylon Mall Plaza as shown in Figure 31.

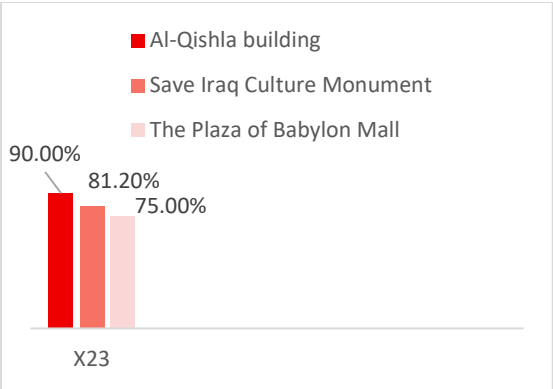


Figure 30. shows the results for variable X23.

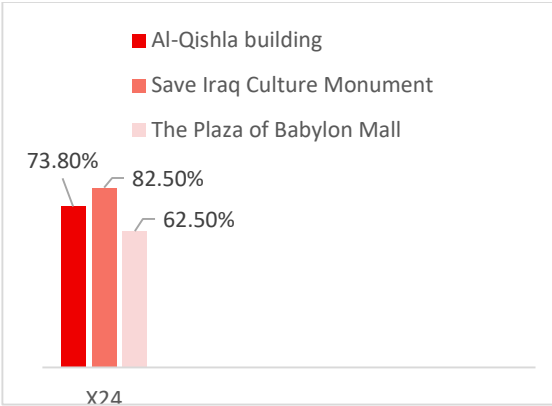


Figure 31. shows the results for variable X24.

X25: The survey results showed that the highest percentage of agreement about the connection of the square to the main streets of the city was for The Save Iraq Culture Monument, followed by Babylon Mall Plaza, while Al-Qishla Historic Building had the lowest score as shown in Figure 32. X26: The results of the survey indicate that The Save Iraq Culture Monument achieved the highest percentage of agreement in its integration with the surrounding urban spaces, followed by Al-Qishla Historic Building, while Babylon Mall Plaza got the lowest score as shown in Figure 33.

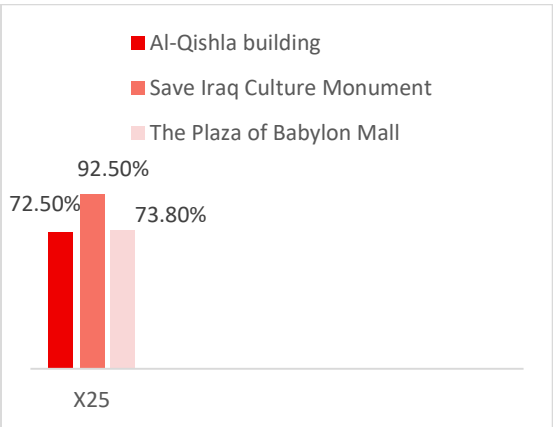


Figure 32. shows the results for variable X25.

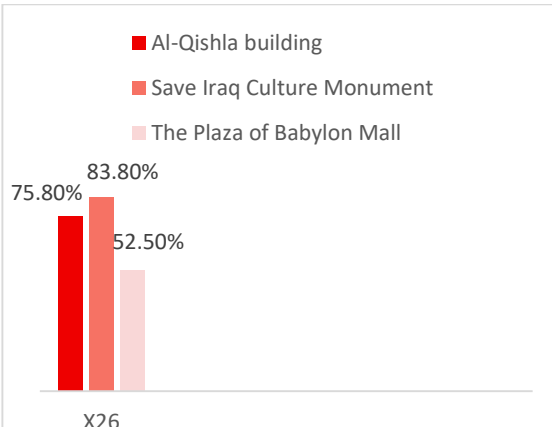


Figure 33. shows the results for variable X26.

X27. According to the survey results, the highest percentage of agreement to accommodate new activities was in Al-Qishla Historic Building, followed by Babylon Mall Plaza, and The Save Iraq Culture Monument ranked last as shown in Figure 34. X28: The survey results revealed that the highest percentage of agreement on appropriate lighting and color schemes was for Babylon Mall Plaza; while The Save Iraq Culture Monument received the second highest score; and Al-Qishla Historic Building received the lowest score. As shown in Figure 35.

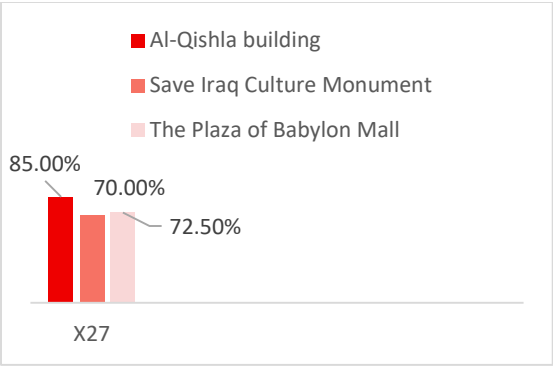


Figure 34. shows the results for variable X27.

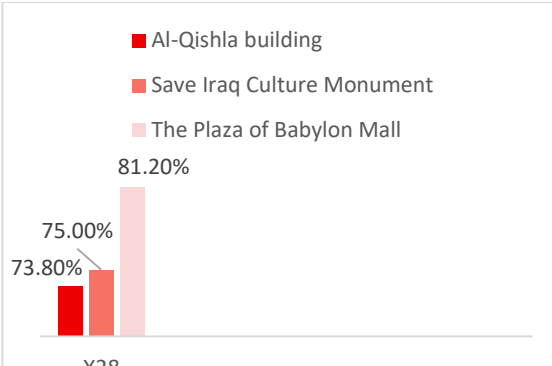


Figure 35. shows the results for variable X28.

X29: The results of the survey show that the highest percentage of agreement in terms of the ability to accommodate multiple activities is in Al-Qishla Historic Building, followed by Babylon Mall Plaza, and The Save Iraq Culture Monument comes last as shown in Figure 36. X30: From the survey results, it is evident that Al-Qishla Historic Building has the highest percentage of agreement in visual comfort when looking at the space and its components, then The Save Iraq Culture Monument. However, Babylon Mall Plaza has got the lowest score as shown in Figure 37.

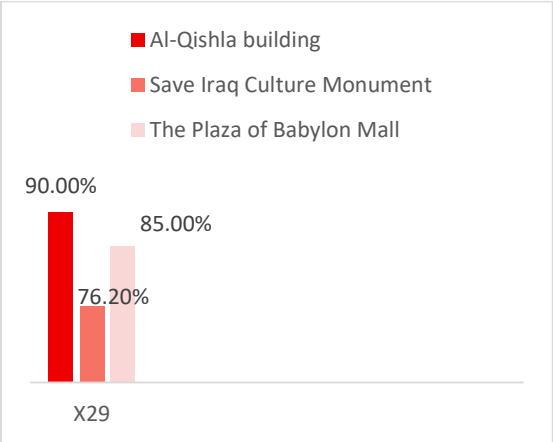


Figure 36. shows the results for variable X29.

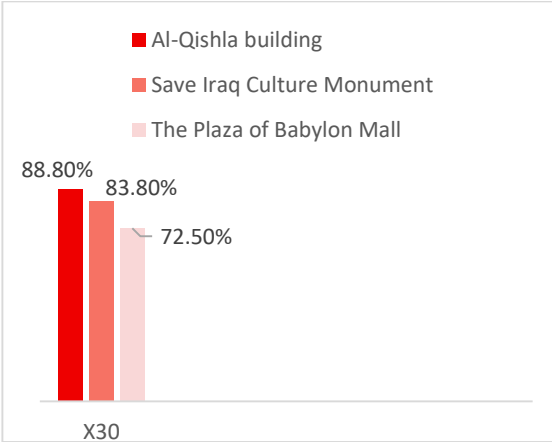


Figure 37. shows the results for variable X30.

X31: The results of the questionnaire showed that Al-Qishla Historic Building had the highest agreement percentage for acoustic comfort, followed by Babylon Mall Plaza, while the lowest score was for The Save Iraq Culture Monument as shown in Figure 38. X32: The results of the survey show that the Al-Qishla Historic Building is the highest in the percentage of agreement about the olfactory comfort in the space, followed by Babylon Mall Plaza, while The Save Iraq Culture Monument was the last as shown in Figure 39.

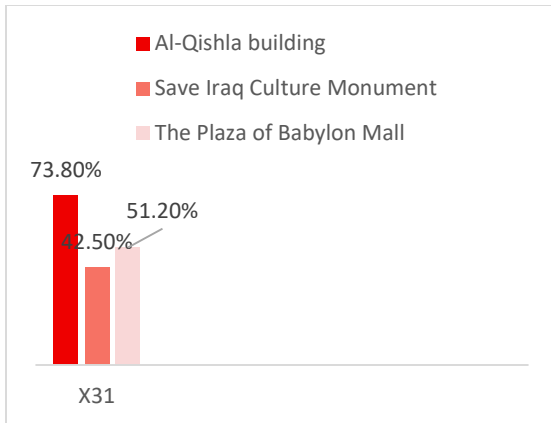


Figure 38. shows the results for variable X31.

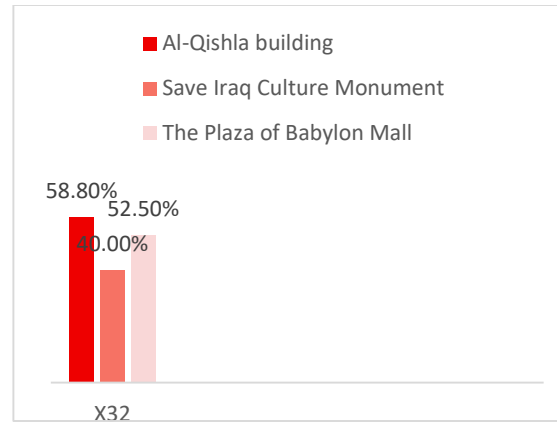


Figure 39. shows the results for variable X32.

X33: The survey results showed that the highest percentage of agreement on including suitable architectural and sculptural elements was for The Save Iraq Culture Monument, followed by Al-Qishla Historic Building, while Babylon Mall Plaza got the lowest score. As shown in Figure 40. X34: The results of the survey showed that Al-Qishla Historic Building obtained the highest percentage of agreement for the inclusion of natural elements from the surrounding context, followed by The Save Iraq Culture Monument, while Babylon Mall Plaza obtained the lowest percentage as shown in Figure 41.

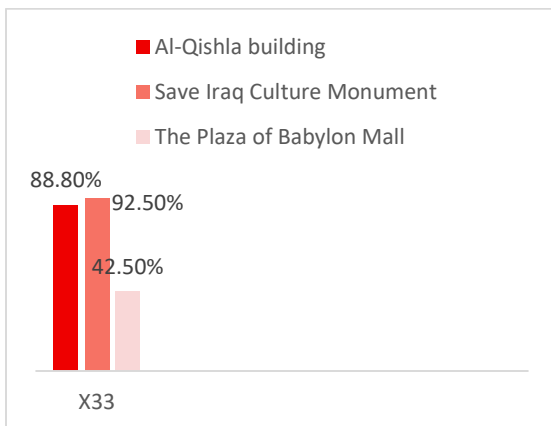


Figure 40. shows the results for variable X33.

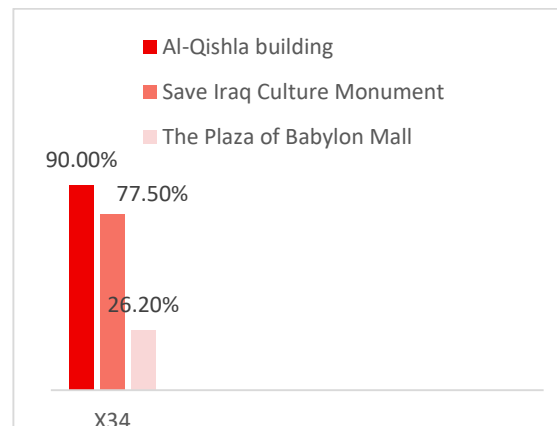


Figure 41. shows the results for variable X34.

X35: The results of the survey indicate that Babylon Mall Plaza has the highest percentage of agreement on being surrounded by a wall or fence, followed by Al-Qishla Historic Building, whereas the lowest score was for The Save Iraq Culture Monument. As shown in Figure 42. X36: The results of the survey show that the highest was Babylon Mall Plaza in terms of agreeing to have a regular geometric form, followed by Al-Qishla Historic Building, while The Save Iraq Culture Monument came last. As shown in Figure 43.

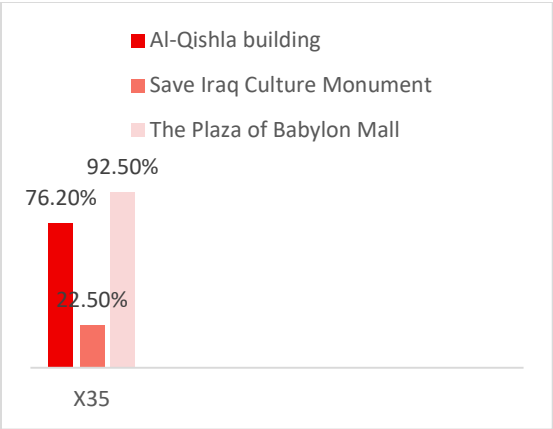


Figure 42. shows the results for variable X35.

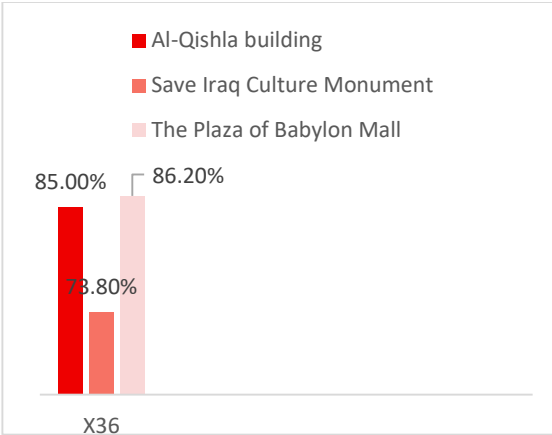


Figure 43. shows the results for variable X36.

X37: The survey results indicate that Babylon Mall Plaza achieved the highest percentage of agreement on the fact that the space is enclosed rather than open from all sides, followed by Al-Qishla Historic Building, while The Save Iraq Culture Monument was the least. As shown in Figure 44. X38: The survey results showed that The Save Iraq Culture Monument had the highest percentage of agreement on the suitability of the spatial form followed by Al-Qishla Historic Building while the lowest ranking was for Babylon Mall Plaza. As shown in Figure 45.

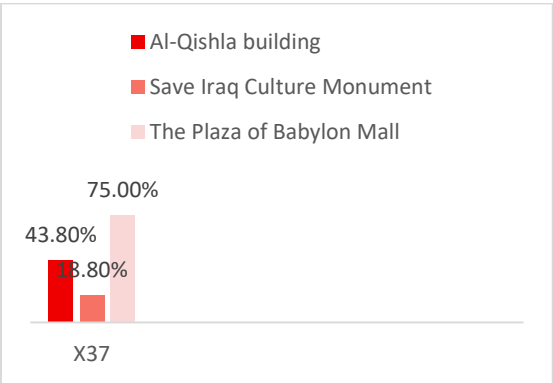


Figure 44. shows the results for variable X37.

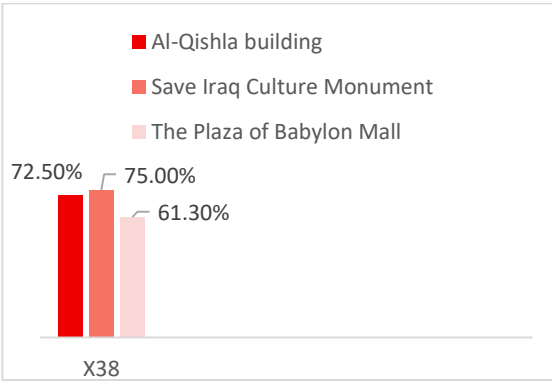


Figure 45. shows the results for variable X38.

X39: The survey results show that the accessibility for people with disabilities was highest in Babylon Mall Plaza, followed by Al-Qishla Historic Building, whereas The Save Iraq Culture Monument scored the lowest. As shown in Figure 46. X40: The survey results show that The Save Iraq Culture Monument scored the highest percentage of agreement regarding the freedom of movement in all directions, followed by Al-Qishla Historic Building, while Babylon Mall Plaza scored the lowest. As shown in Figure 47.

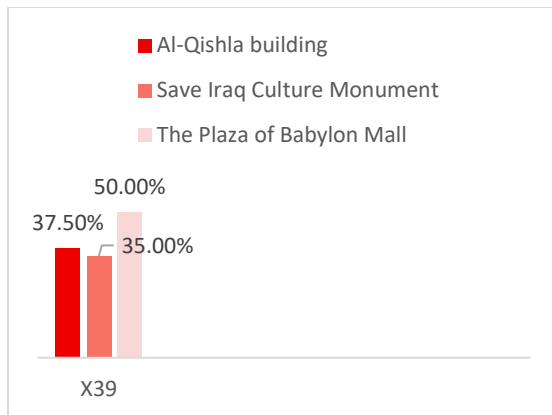


Figure 46. shows the results for variable X39.

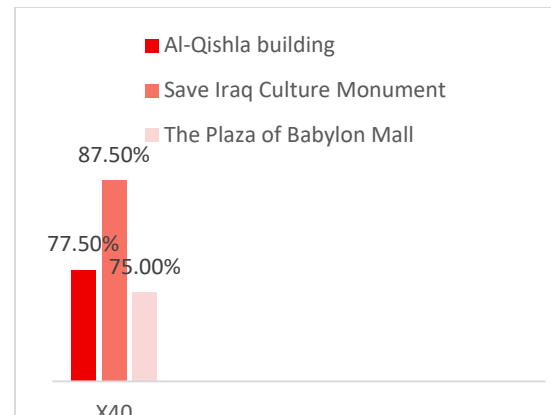


Figure 47. shows the results for variable X40.

9. Discussion

The analysis of selected urban locations with sustainability ratings, which includes both direct and indirect evaluation parameters, indicates that traditional urban settings exhibit higher levels of sustainability compared to modern urban spaces. Traditional environments consistently outperform modern metropolitan locations in various aspects, including social, economic, environmental, and historical factors, as well as measures of community involvement.

Social Factors: Traditional urban environments demonstrate the highest levels of social sustainability due to their historical value, strong cultural identity, and human-centered design. These elements promote social interaction, community participation, and cultural activities. In contrast, modern urban settings tend to exhibit weaker social sustainability, likely because of their open, less-defined layouts and high traffic volumes, which limit opportunities for social engagement.

Economic Factors: Traditional urban settings show superior economic sustainability through adaptive reuse, efficient resource utilization, and the ability to attract both residents and tourists, all of which support local economic activity. In comparison, modern urban areas often require additional commercial and economic services to ensure their long-term viability.

Environmental Factors: Traditional urban areas tend to have more greenery, utilize eco-friendly materials, and promote walking and public transportation, leading to better environmental outcomes. By contrast, contemporary metropolitan areas often lack key features associated with sustainable urban settings, particularly green infrastructure and environmentally friendly transportation options.

Functional and Aesthetic Factors: The Babylon Mall Plaza stands out for its functional and aesthetic attributes, which are considered indirect indicators of sustainability. As a mixed-use development combining commercial, recreational, artisanal, and community functions, its adaptability, visual appeal, and variety of activities enhance its attractiveness and encourage long-term public use.

Physical Factors: Traditional urban spaces and the Babylon Mall Plaza achieved relatively high scores in physical sustainability by maintaining sufficient spatial order, providing historical context, encouraging social interaction, and fostering a strong sense of safety and security.

Overall Implications: While factors such as economic vitality, environmental quality, functional efficiency, and aesthetic value are essential for enhancing urban sustainability and improving the quality

of life for users, the findings highlight the significant role that historical and cultural characteristics play in social and cultural sustainability. As a result, the Babylon Mall Plaza and traditional urban areas serve as valuable examples of urban environments that effectively incorporate various aspects of sustainability.

10. Conclusions and Recommendations

The sustainability of urban spaces relies on the integration of architectural concepts that address social, economic, environmental, and historical aspects. Based on the evaluation of three urban areas in Baghdad, this study offers the following recommendations for enhancing sustainable urban development:

-Environmental and Economic Aspects of Design: Urban sustainability should be promoted through the use of eco-friendly materials, energy-efficient technologies, resource conservation practices, natural ventilation, and recycling initiatives. These principles have been effectively demonstrated in traditional urban settings, underscoring their importance for long-term environmental and economic sustainability, Social Issues: Sustainable urban spaces should foster social sustainability by encouraging interaction, cohesion, and community participation among residents. It is also essential to preserve local character, customs, traditions, and cultural and historical symbols, Historical Sustainability: Preserving historical and cultural assets strengthens place identity, continuity, and a sense of belonging. The analysis of the Al-Qishla urban space highlights the importance of incorporating heritage conservation into urban design as a crucial component of sustainable city development, Accessibility and Sustainable Mobility: Effective public transportation systems and well-designed street networks enhance accessibility, promote walkability, and reduce reliance on private vehicles. Urban planners should prioritize sustainable transport infrastructure as a vital element of urban sustainability, Flexible and High-Quality Urban Design: A flexible urban design that incorporates mixed-use functions improves adaptability, vitality, and long-term usability. Additionally, visual quality, spatial arrangement, and psychological comfort significantly influence the appeal, functionality, perceived safety, and overall success of public spaces. Case Study Implications: The comparative research demonstrated that traditional urban areas serve as an excellent model for sustainable urban design. This is due to their successful integration of heritage values, environmental quality, and community involvement. In contrast, modern urban areas require improvements in urban morphology, spatial design, and the incorporation of sustainable architectural elements. The Babylon Mall Plaza exemplifies how mixed-use complexes that combine commercial, recreational, social, and environmental activities can significantly contribute to urban sustainability.

Overall Recommendation: The findings suggest that sustainable urban environments can be achieved by incorporating architectural concepts that balance environmental, economic, social, and historical considerations into a comprehensive design approach. It is essential to prioritize the preservation of historical identity while also enhancing flexibility, accessibility, environmental performance, and community engagement. Therefore, urban designers and planners must focus on creating adaptive, inclusive, and versatile public spaces that respond to changing societal needs, improve quality of life, and contribute to the development of resilient and sustainable cities.

11. Study limitations and applicability of the findings

The study recommends that future research apply the assessment framework to various urban areas in different regions and validate their sustainability using larger sample sizes. This approach will enhance the generalizability of the results and contribute to a more comprehensive framework for assessing the sustainability of urban spaces.

Declaration of generative AI and AI-assisted technologies in the writing process

-None

Disclosures

The authors have no conflicts of interest to declare in relation to this manuscript.

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نحو استدامة الفضاءات الحضرية: تقييم الافكار المعمارية التطبيقية

الخلاصة: تعد المساحات الحضرية من اهم مكونات المدن حيث تمثل بيئة تفاعلية لافرادها وتنشئتهم الاجتماعية بالبعادها وعاداتها وقيم وثقافة تلك المجتمعات ،لقد اصبح مفهوم الاستدامة في يومنا الحالي جزءا لا يتجزأ من كل مفاهيم المعمارية ، لذا يسعى البحث الى وضع اطار تقييمي للافكار المعمارية المطبقة في المساحات الحضرية لحل مشكلة البحث المتمثلة في الحاجة الى توضيح للافكار المعمارية التي تجعل تلك المساحات الحضرية اكثر استدامة وذلك من خلال جزأين : الاول يتناول مفهوم المساحة الحضرية: تعريفها، انواعها، وتصنيفها واستخلاص اهم معايير الاستدامة فيها، بينما يتناول الجزء الثاني تطبيق المعايير والمؤشرات المستخلصة على ثلاثة انواع من مساحات حضرية في مدينة بغداد وهي :مساحة حضرية ضمن سياق تقليدي ومساحة حضرية ضمن سياق حديث ومساحة حضرية ضمن مبنى عام ،ويستنتج البحث ان المساحة الحضرية يمكن ان تكون مستدامة عندما تتضمن افكارا معمارية فعالة ترتبط بشكل مباشر او غير مباشر بعوامل الاستدامة وان المساحات الحضرية ضمن السياق التقليدي هي الانسب لتكون مساحة حضرية مستدامة.

الكلمات المفتاحية: التصميم الحضري البيئات الحضرية المستدامة، التصميم الجيد، الاستدامة،مدينة بغداد،التصميم الحضري.