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Sustainable Babil: Steps towards Achieving Comprehensive Environmental Development

Nada Abdul-Ameer Mubarak[1*] Rawaa Abd Munaf Alshalah[1] Mahmood Rezooqy Hamid Janjun[2]

[1]*Department of Architecture, College of Engineering, University of Babylon, Hillah, Iraq*

[2]*Department of Design of Fine Arts, Al Mustqbal University, Hillah, Iraq*

[*1]eng.nada.abdameer@uobabylon.edu.iq [1]eng.rawaaabd.alshalah@uobabylon.edu.iq

[2] eng.mhmood.rezooky@uobabylon.edu.iq

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Abstract

This study sheds light on the environmental reality of Babylon Governorate, specifically Hillah. It aims to identify the practical steps necessary to achieve sustainable development. Babylon suffers from numerous environmental challenges resulting from poor waste management, unplanned urban expansion, air and water pollution, and a lack of environmental awareness among its citizens. The current study seeks to provide sustainable solutions to improve the environmental situation in the study area. To achieve its aims, it analyses the current status of the city and conducted a questionnaire to determine citizens' awareness of environmental problems, their participation in environmental activities, and their satisfaction in regard to the environmental services in the city. The study found the principles of sustainability are not applied in the city. And it revealed low level of environmental awareness of sustainability, low participation in environmental activities, and poor satisfaction with the municipal services. Based on the findings, the study proposes certain recommendations to enhance sustainability.

Keywords: Babylon/Hillah, Sustainability, Sustainable development, Urban design.

1. Introduction

The importance of urban design for cities is well known, and researchers have addressed its importance in different ways and in accordance with specific urban design standards. This study addresses the urban development of cities in general, and the city of Hillah in particular, given the city's diverse environmental and design problems. The researchers attempt to identify these problems and propose solutions and alternatives. They conducted an analytical field study aimed at bringing the city of Hillah to the desired level of sustainability and urbanization, enabling urban design to fulfill its intended function. The importance of the research stems from the importance of the urban environment, urban design elements, and its impact on the city and its various public squares [1, 2]. The current study also examines the urban design of the city under study, taking into account the principles of sustainability, including energy conservation, to meet the requirements of the urban environment. Accordingly, the study focuses on analyzing the current situation of Hillah city, as well as identifying the elements of its urban design, while applying the principles of sustainability in general.

Urban design is one of the most important sciences concerned with the environment [3]. It combines various disciplines - natural, social, and engineering - to study existing urban growth problems in cities and how to address them according to a future vision by developing strategies for implementation [4].

1.1.Research Problem

The research problem lies in the deterioration of the urban environment of Babylon Governorate, particularly the city of Hillah. This problem is characterized by urban distortions. It also addresses how to define the city's landmarks, preserve its identity, and develop the city within a framework of sustainable development, which has become a major concern for researchers and designers. It is believed that sustainable solutions appropriate to the city's conditions may be a key factor in improving the overall environmental situation [5].

1.2.Questions of the Study

The current study tries to answer the following questions:

- What are the environmental challenges affecting the city of Hillah in Babylon Governorate?
- How can environmental sustainability be improved in Babylon Governorate?
- What is the level of general awareness among the residents of Hilla?
- What is the extent of their community participation in environmental activities?
- Are the citizens satisfied with the municipal services in the city?

1.3.Aims of the Study

The main aims of the current study include the following:

- Analyzing the current environmental situation and identifying the main environmental problems in the city.
- Providing sustainable solutions that help achieving sustainable development in a way that improves the environment in Hillah and is consistent with sustainable development standards.
- Exploring the level of public awareness and community participation in environmental issues.
- Determining the participation of the citizens of Babylon in environmental social activities.
- Finding out whether the citizens of Babylon are satisfied with the services presented by the municipality or not.

2. Theoretical Aspect

2.1.Sustainability

The word sustainability has Latin roots, meaning "to hold up". It is the optimal use of available resources and capabilities, whether human, material, or natural, in a balanced and environmentally effective manner to ensure sustainability without compromising the gains of

future generations [6]. It is the development of many aspects simultaneously, requiring attention not only to the economic aspect, but also to other aspects, including social, environmental, and cultural aspects. Some scholars describe sustainable living in the twenty-first century as a shift to renewable energy, reuse, or recycling the economy, with diversified transportation systems. Sustainability is considered an attempt to provide the best quality of life for humans and the natural environment, both now and in the future.

2.2.Environmental Sustainable Development

During the last decade of the last century and the beginning of the third millennium, the world witnessed a significant increase in the rates and levels of pollution and global warming [7], which coincided with numerous calls to adopt new architectural and urban trends in their forms, such as sustainable architecture and green architecture. Sustainable development can be summarized as the ability to achieve and sustain development by maximizing the use of natural resources, reducing operating and maintenance costs, and providing a healthy local environment [8].

Environmentally sustainable development is a fundamental concept stemming from the urgent need to preserve the environment while societies continue to grow economically and socially. According to the Brundtland Commission Report (1987), sustainable development is the development that meets the needs of the present without compromising the ability of future generations to meet their own needs. This development is based on three main dimensions: the environmental dimension (which includes the protection of environments), the economic dimension (which focuses on achieving sustainable economic growth that preserves the environment), and the social dimension (which aims to achieve equality among individuals, especially in access to services) [9].

2.3.Environmental Challenges in Babylon

The Babylon Governorate, represented by the city of Hillah, is currently facing various environmental problems that threaten its ecological balance and the quality of the life of its residents. Some of the most pressing challenges include [10]:

- Water Pollution: Water pollution is one of the most significant environmental concerns in Babylon. The Euphrates River, which flows through the city, is a primary source of water for consumption and irrigation. However, water quality has deteriorated significantly due to industrial activities, agricultural runoff, and inadequate wastewater treatment systems. According to studies, the Euphrates River has witnessed an increase in chemical pollutant levels, directly impacting the health of residents [11]. This problem is exacerbated by the lack of modern infrastructure for proper wastewater treatment and management, which leads to the contamination of surface and groundwater sources [12].
- Poor Waste Management: Waste management is another major challenge in Babylon. Rapid urbanization and population growth have led to increased waste production, yet the city's waste management infrastructure remains inadequate. Reports indicate that waste is often not collected on time, and there are insufficient waste bins in public places, leading to illegal waste dumping and accumulation in open areas [13]. In some parts of the city, waste management services are fragmented, contributing to widespread littering in streets and

waterways. These weak waste management systems contribute to increased pollution, affecting air and water quality, and exacerbating health problems among the city's residents.

- Air Pollution: Air pollution in Babylon is another major problem caused by increased vehicle emissions, industrial activities, and waste burning. The lack of effective air quality monitoring systems means that the extent of air pollution is not accurately measured, but the presence of visible smog in urban areas indicates the severity of the problem [14]. Toxic fumes from vehicles, factories, and improper waste disposal lead to respiratory diseases, particularly affecting vulnerable populations such as children and the elderly.
- Loss of Green Spaces: Urban expansion and land use changes in Babylon have also led to the loss of green spaces, which are essential for maintaining ecological balance and providing recreational areas for the community. The shrinking green spaces not only reduce the aesthetic and recreational value of the city, but also limit its ability to regulate air temperature and absorb carbon dioxide, contributing to climate change. A recent study conducted by the Iraqi Ministry of Environment revealed that the area of green spaces in urban areas has decreased by 35% over the past two decades [15].

2.4.Urban Sustainability and Public Participation

- Achieving urban sustainability in Babylon requires employing a number of steps that should be taken by the municipality. But it should be accompanied by active citizen participation. Public participation is an essential component of any successful environmental development plan. According to the United Nations (2020), smart cities cannot be achieved without community participation and engagement. Public participation in environmental decision-making processes fosters a sense of ownership and responsibility among citizens. This is because residents are aware of the environmental challenges facing their city and are given the tools to participate in finding solutions, they are more likely to engage in sustainable practices [16, 17].
- A study by [18] indicates that although many Babylonians are aware of environmental issues, such as pollution and waste, their participation in solving these problems is limited. This lack of participation can be attributed to a lack of public education on environmental issues, a lack of community initiatives, and the absence of accessible platforms for public engagement.

2.5.Urban Design

Urban design is the science that deals with the relationship between open urban spaces and their surrounding components, which complement the urban space [2]. Urban design has certain characteristics that play a significant role in developing the urban environment of cities, each with its own impact, depending on the nature of the place and the culture of its inhabitants. These characteristics include:

- Taking into account the social and cultural aspects of the urban environment,
- How to deal with the natural characteristics and various phenomena in the urban area,
- In addition to developing methods for addressing problems in urban areas as an interconnected whole with all its components, natural elements, and land uses.

Urban studies depend on several dimensions of urban design, such as studying the blocks surrounding the urban space (length, width, height), the time dimension, and the sense of the urban space, as shown in Fig. 1.

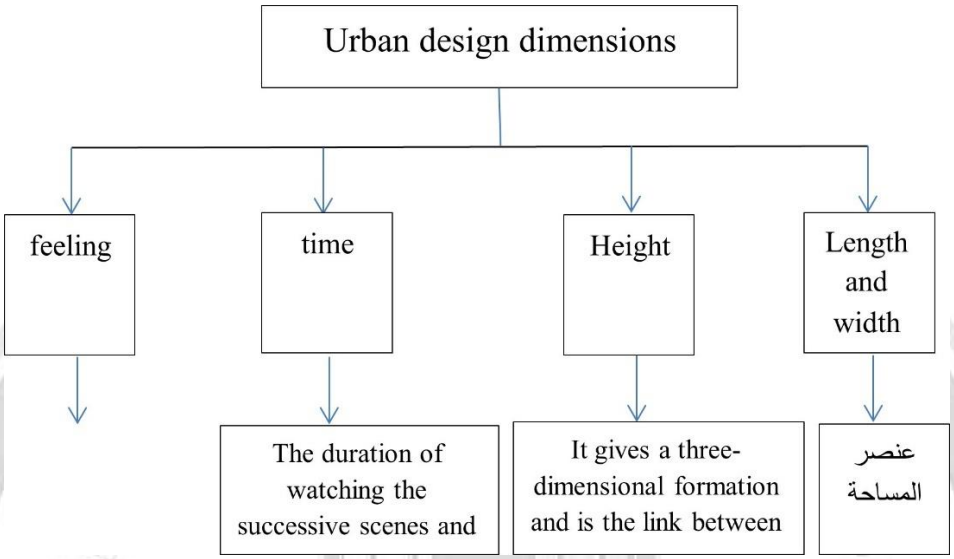

Fig. 1. Dimensions of urban design [19].

2.6.Sustainable Urban Design

Sustainable urban design represents a revolution in how we think about the design, construction, and operation of buildings and cities spontaneously [20]. This is achieved by the following:

- Coordinating open spaces, natural landscapes, and the surrounding environment through:
- Rationalizing energy consumption and providing the best quality natural and artificial lighting
- Preserving natural materials and resources and improving the quality of the indoor environment
- Protecting internal and external water sources

The ultimate goal is to use the approach of old buildings in a logical structure with the best modern techniques (RFQ: Requester for Architecture Qualifications); there are three basic requirements for sustainability that are considered the main pillars of this term, through which its function is completed, see Fig. 2.

These are:

- The environmental aspect: This requires taking into account the climatic and environmental conditions of the study area.
- The social aspect: This requires studying and understanding the traditions and customs of the study community.

- The economic aspect: It requires the creation of vital economic activities that increase employment opportunities for residents.

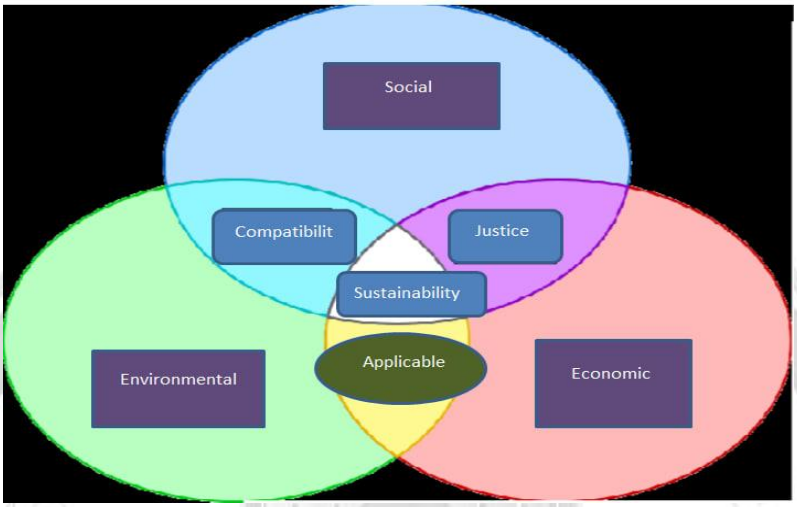

Fig. 2. The sustainable requirement in urban design [17].

The advocates of sustainable urban design are betting on the many benefits and advantages of this trend, including the integration of green design methods and smart technologies. This not only reduces energy consumption and environmental impact, but also reduces construction and maintenance costs, creates a pleasant and comfortable building environment, improves the health of users, increases their productivity rates, and enhances the project's value. It is a method with economic and psychological returns. It is also known as sensitive design, characterized by the design's suitability to the ecosystem and cultural context, its appropriate response to the environment, flexible use of space, minimizing the use of resources, and the use of renewable building materials to the greatest extent possible. Future expansion and adaptation to use are also possible with minimal waste [21].

3. Practical Part

3.1.Methodology

The practical part of this study was divided into two parts: The first part provides a description of the city of Hillah describing its current status. The second part is a questionnaire administered to the city's residents to determine their awareness of environmental requirements, their community participation, and their satisfaction with the services provided.

3.2.Description of the City of Hillah

Hilla is located approximately 100 km south of the capital, Baghdad, and 64 km northeast of Kufa [14]. The city of Hillah represents the administrative center of the Babylonian Governorate and is located in the middle of its administrative units [22]. The city center has maintained its importance for many years. It enjoys economic activity. Its proximity to Baghdad provided a market for its products, which further developed the commercial aspect.

3.3.Field Study of the Center of Babylon Governorate (Hilla Center) Converts

The study covers Hilla the center of Babylon (Figs. 3 and 4).

Fig. 3. The governorate of Babylon (urban planning department/Babylon).

Fig. 4. Basic design of Hillah city (urban planning department/Babylon).

3.4.Study of the Current Situation of the Babylon Governorate Center

City centers are the most important urban elements, reflecting many aspects at the economic, social, cultural, and political levels. We find confusion in the traffic flow on the streets and insufficient attention is paid to them. Unfortunately, we note that some of our cities suffer from significant neglect, which negatively impacts the overall cityscape, leaving an uncivilized character, as shown in Fig. 5.

Fig. 5. The confused traffic flow in Hilla [23].

3.5.Description of the Current Situation on Four Levels

The description of the city of Hilla is going to be presented in accordance to the following four levels:

- On the main streets.
- On the sidewalks and pedestrian walkways
- On the parking lot level
- On the streets' furniture elements

The details are given below for each level:

- On the main streets: they suffer from significant neglect, lack of care, and a failure to provide all the necessary planning and other amenities, see Fig. 6.
- On the sidewalks and pedestrian walkways: They have not performed their function properly due to a lack of maintenance, development, or meeting the needs of pedestrians. There are no service elements for people with special needs, such as signs and directions (Fig. 7).

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Fig. 6. Pictures showing the neglecting of the streets (the researchers).

Fig. 7. The status of the sidewalks and pedestrian walkways (the researchers).

- On the parking lot level: The area generally lacks parking spaces, especially in front of the main markets (malls), which affects the urban appearance of the city and causes severe congestion (see Fig. 8).

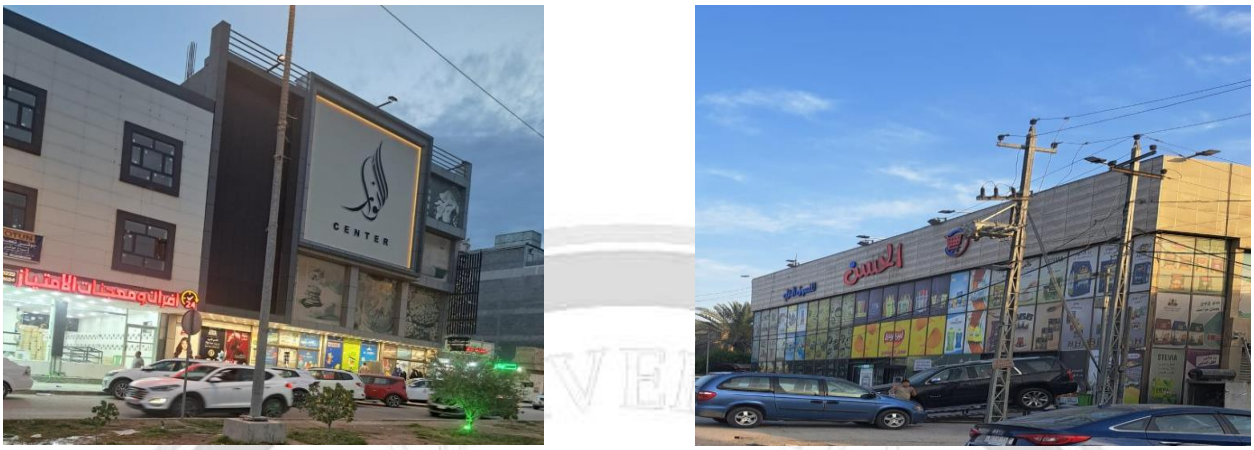

Fig. 8. No suitable parking spaces.

- On the streets' furniture level: The most important furniture elements are:

a. Seats: They are a primary means of comfort for people, especially the elderly, as they provide a place where people can sit and meditate. Currently, they are absent in the majority of the main streets of the city; some rare seats are noted and they are not suitable in regard to being comfortable and in regard their position (see Figs. 9 and 10).

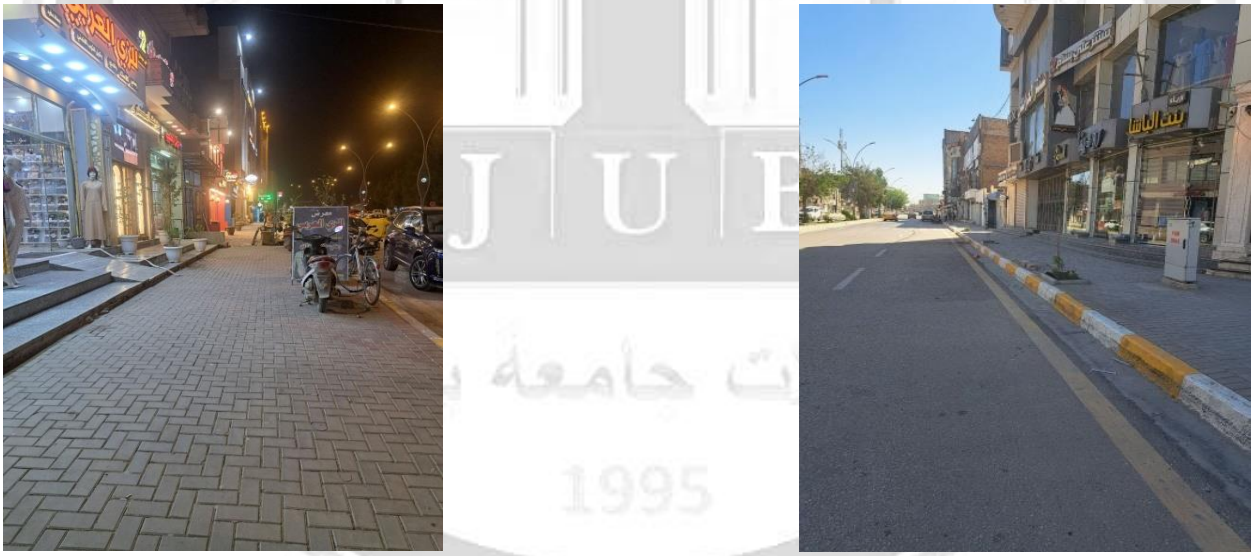

Fig. 9. Lack of seats.

Fig. 10. Presence of seat but uncomfortable and unsuitable placing.

b. Umbrellas: Umbrellas are an important element for providing comfort and protection from weather factors such as sun and rain, as the study sample lacks them. A total absence of umbrellas in the city is noted (see Fig. 11).

Fig. 11. Absence of umbrellas.

c. Trash cans: The absence of trash cans surely leads to the spread of garbage. There are some of them here and there but they are not enough and not followed up, moreover the majority of them are put by the shops' owners, see Fig. 12.

Fig. 12. Insufficient waste bins.

d. Trees and plants: They are an essential element in urban design. They contribute to air renewal and improve its quality. Furthermore, the appearance of plants provides psychological comfort. However, we find them neglected, and some areas lack them. Even if it is present, it is in a very small percentage that does not match what is required and is completely insufficient (see Fig. 13).

Fig. 13. Very small green spaces.

e. Lighting: Conventional and well-known lampposts consume significant amounts of electricity, which can affect the city's energy consumption, especially in the summer (Fig. 14).

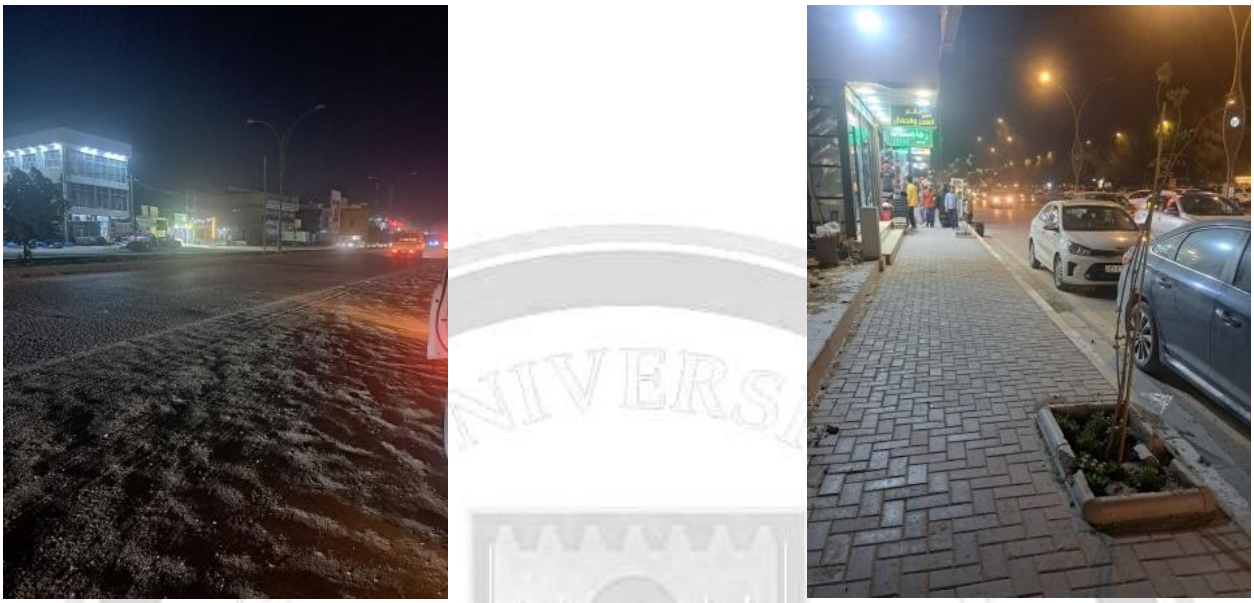

Fig. 14. The lighting shortage (the researcher).

3.6.Identifying the Local Awareness, Satisfaction and Participation

To identify the levels of environmental awareness of the citizens of Babylon, their participation in environmental social activities, and their satisfaction about the services provided by the local government, a questionnaire was designed by the researchers. The questionnaire was built in a form to cover the three areas under investigation. The questionnaire is divided into three sections in accordance with three key areas:

- Environmental Awareness (items 1-4)
- Participation in Environmental Activities (items 5-7)
- Satisfaction with Environmental Services (items 8-12)

Then, and in order to examine the test validity and reliability, it was given to a jury of 5 architects who are university teachers, all are experts in urban design. Then the sight changes suggested by the jury members were done before distributing it to the respondents. The researchers managed to collect responses from a total number of 200 people of the residence of Babylon.

3.7.Data Analyses

As stated before, the questionnaire consists of three parts, so the analyses were done for each part as shown in the details below:

- Awareness of sustainable environments: After analyzing the responses for the first part of the questionnaire which is devoted to examine the citizens' awareness of the sustainable environments, it is found a majority of the participants expressed that they are unaware of the concept of sustainable environment as shown in Table 1.

Table 1. Respondents' awareness of sustainable environments.

The items	Percentage of the agreement responses
I have a good knowledge about the concept of environmental sustainable development	35%
I have a good idea about the main environmental problems affecting my city	63%
I often read about environmental issues in the media	28%
I am familiar with the environmental policies in my city	22%

As shown in Table 1, this part of the questionnaire consists of four items. The percentage of agreement for three items is less than 50% (namely 35%, 28% and 22%); it exceeded 50% only for the item that asks about their knowledge of the main environmental problems in their city which was 63%. This clearly means that the citizens have no good knowledge about the concept of sustainability and its application in urban circumstances.

- Participation in environmental social activities: In regard to the second part of the questionnaire, that tackles the respondents' participation in environmental activities (like for example planting, cleaning, etc.), the results show that they do not have good participation in such kind of activities, (12% and 18%). The percentage was 45% which is also not satisfactory at all, see Table 2.

Table 2. Participation in environmental activities.

The items	Percentage of the agreement responses
I participate in any environmental activities in my city (like cleaning-up, tree planting	12%
I think that community-based environmental initiatives are effective in improving environmental conditions in my city.	45%
There are enough chances for citizens to engage in environmental initiatives in my city	18%

- Satisfaction in regard to environmental services: Finally, the third part of the questionnaire deals with the citizens' satisfaction regarding the environmental services presented by the local governorate. As with the two previous parts of the questionnaire the percentage of agreement was very low, 30% for waste collection services, 25% for two items of the questionnaire, namely the availability of waste bins and the quality of healthy air. In regard to the quality of drinking water, the percentage of the participants who were satisfied was only 15%. Finally, asking about the efforts done by the local governorate to increase the green space, the percentage was 20%. This means that the participants do not see that the local governorate is doing enough in this regard, see Table 3.

Table 3. Satisfaction with the environmental services.

The items	Percentage of the agreement responses
Waste collection services in my city are really good and sufficient.	30%
The waste bins are sufficiently available in my city	25%
The quality of drinking water is very good in my city	15%
The local governorate is doing enough to promote green spaces.	20%
The air quality is very good and healthy	25%

4. Results and Discussion of the Study

The study results highlight several key findings:

- Low environmental awareness among residents regarding sustainable development and key environmental issues in Babylon.
- Limited public participation in environmental activities, despite a clear desire to participate when the opportunity arises.
- Dissatisfaction with municipal services, particularly in the areas of waste management, drinking water quality, and green spaces.

In Table 4, a comparison between the current situation and the concept of sustainable urban design is presented in accordance to the four levels discussed above.

Table 4. A comparison between the current status and the sustainable urban design.

	Level	Current status	Sustainable urban design
1	The main street	Great neglect, lack of care, and lack of providing all the necessary planning and other matters	Great care and attention to it and providing everything it needs in terms of planning and other things
2	Sidewalks and pedestrian walkways	It is not maintained or developed, and there are no service elements for people with special needs, such as signs and directions.	Sidewalks and walkways are taken care of by maintaining and developing them, meeting the needs of pedestrians, and providing services for people with special needs, such as signs and directions.
3	Parking	The area generally lacks parking spaces, especially in front of the main markets (malls).	Providing parking spaces, especially in front of the main markets (malls), in a manner that befits the urban appearance of the city, and in a way that achieves the requirements of sustainable development.
4	Street Furniture		- Providing seating that meets sustainability and energy efficiency requirements, while providing comfort and convenience. - Providing umbrellas that can be used for energy generation, such as solar cells. - Using solar-powered trash bins that sort waste to facilitate recycling. - Providing diverse areas with trees and plants. - Providing energy-efficient lighting units with renewable energy installations.

From the above comparison, it is clear that the study area suffers from a great neglect in providing an urban environment suitable for human life, a failure to meet the requirements of the urban environment, and a great waste of energy, thus not meeting the needs of sustainable development.

5. Conclusions

Through the analysis conducted in this research, several key conclusions were reached regarding the environmental situation in Hilla City, the center of Babylon. These conclusions can be summarized as follows:

- Lack of environmental awareness among residents: Despite some environmental awareness among community members, a large percentage of residents are not fully aware of how their daily behaviors impact the environment, such as pollution or resource waste. This highlights the need for sustainable environmental awareness programs in the community.

- Environmental pollution: Pollution resulting from traffic and the presence of many small factories is considered one of the most prominent environmental problems. This pollution contributes to the deterioration of air quality and significantly impacts the health of residents.
- Waste management: Despite some efforts in waste management, there is a lack of effective strategies for organizing its collection, leading to the accumulation of waste in the streets and public places. This reflects an urgent need to improve waste management systems in the region.
- Lack of green spaces: Hilla city suffers from a lack of green spaces, which could contribute to improving air quality and providing a healthy environment for residents. Adding green spaces could be a major step toward improving the environment.

6. Recommendations

Based on the results obtained in the current study, the following recommendations are proposed:

- Great attention and care should be given to providing all necessary amendments such as providing appropriate lighting, furnishings, etc.
- Attention is to be paid to sidewalks through maintenance and development, meeting the needs of pedestrians, and providing services for people like seats, appropriate sidewalks, lighting, etc.
- Parking spaces must be provided, especially in front of major markets (malls), in a manner appropriate to the city's urban appearance and fulfilling the requirements of sustainable development.
- Providing protection from weather elements such as sun and rain, they can also be used to generate energy. For example, using solar cells provides protection, comfort, and helps reduce energy consumption, in addition to their aesthetic function.
- Using solar-powered trash cans to sort waste, facilitating recycling and adding an aesthetic touch instead of pollution.
- Providing diverse areas with trees and plants by encouraging shops to place anvils in front of them to help refresh the air and add an aesthetic touch.
- Providing economical lighting units with installations that rely on renewable energy, including solar energy, by using electricity poles, which provide electricity to provide both energy-saving and aesthetic elements.

Conflict of Interest

The authors declare no conflict of interest.

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بابل المستدامة: خطوات نحو تحقيق التنمية البيئية الشاملة

[1] ندى عبد الامير كريم [1]رواء عبد مناف الشلاه [2] محمود رزوقي حامد جنجون

١قسم الهندسة المعمارية، كلية الهندسة، جامعة بابل، الحلة، العراق

2قسم تصميم الفنون الجميلة، جامعة المستقبل، الحلة، العراق

[*1]eng.nada.abdameer@uobabylon.edu.iq [1]eng.rawaaabd.alshalah@uobabylon.edu.iq

[2] eng.mhmood.rezooky@uobabylon.edu.iq

الخلاصة

تُلقي هذه الدراسة الضوء على الواقع البيئي لمحافظة بابل، وتحديدًا الحلة. وتهدف إلى تحديد الخطوات العملية اللازمة لتحقيق التنمية المستدامة. تعاني بابل من تحديات بيئية عديدة ناجمة عن سوء إدارة النفايات، والتوسع العمراني غير المخطط له، وتلوث الهواء والماء، وضعف الوعي البيئي لدى سكانها. تسعى الدراسة الحالية إلى تقديم حلول مستدامة لتحسين الوضع البيئي في منطقة الدراسة. ولتحقيق أهدافها، قامت بتحليل الوضع الراهن للمدينة، وأجرت استبيانًا لتحديد وعي المواطنين بالمشاكل البيئية، ومشاركتهم في الأنشطة البيئية، ورضاهم عن الخدمات البيئية في المدينة. وقد توصلت الدراسة إلى عدم تطبيق مبادئ الاستدامة في المدينة، وكشفت عن انخفاض مستوى الوعي البيئي بالاستدامة، وانخفاض المشاركة في الأنشطة البيئية، وضعف الرضا عن الخدمات البلدية. وبناءً على النتائج، تقترح الدراسة بعض التوصيات لتعزيز الاستدامة.

الكلمات الدالة:- بابل/الحلة، الاستدامة، التنمية المستدامة، التصميم الحضري.