



Employing Sustainability Principles for the Revitalization of Commercial Streets in Iraq: A Case Study Approach

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ABSTRACT

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The streets, with their diverse urban spaces, are an important part of the physical composition of the city and a link of architectural and Civilizational Communication Over time, ranging from historical cities to contemporary cities. The streets in Iraq suffer from a lot of neglect at the level of sustainable design. The research aims to clarify the mechanisms of employing sustainability principles in the design and Revitalization of commercial streets in Iraq by taking advantage of international experiences and studies. To achieve the research goal, several steps were taken in four axes. The first axis deals with the concept of streets, their types and what are commercial streets the second axis discusses the reality of theoretical knowledge of business and previous architectural studies that dealt with the topic of Sustainable Streets. The third axis presents the theoretical framework that includes the main and secondary vocabulary measured in the research. The fourth axis is the practical side of the research, represented by the choice of the study model and the final results. The research found in its results that the sample chosen for the study achieved only a few of the principles of sustainability that the research reached in its theoretical framework, and the suffering of the occupants and patrons of the street increased after rehabilitation.

1. INTRODUCTION

Urban design is a multi-system approach, where it solves complex and different urban problems, and it connects architectural sites and transport traffic, communications, social, political, and economic planning aspects. And any urban configuration should contain spaces of all kinds of buildings, roads, traffic paths, squares and parks. The urban road network is distinguished from land roads by a set of characteristics that affect the conditions for its design and construction [1, 2].

Kevin-lynch talked about the visual elements of the mental image, including paths, where they are represented by streets that are used to move both cars and pedestrian walkways, public transport lines or waterways such as canals, rivers or railway lines, so streets are the main element of the mental perception of residents towards their cities [3].

Streets make up a high percentage of the total area of cities, up to about 30% of major cities [4]. Therefore, streets are considered the main factor in the development of cities, vital arteries for the population and physical movement of goods and people, they also lead to places where individuals live and practice many activities, and represent the space between the various urban components. Therefore, urban streets should be designed to accommodate these diverse uses of individuals [5]. And because the commercial streets in Iraq suffer neglect at the level of sustainable design from the economic, social and environmental aspects. The importance of the research came

to find a theoretical framework for the mechanisms of employing the principles of sustainability in the design and development of commercial streets in future projects.

1.1 Street

The street is defined as the part that expresses the content of human existence and the basis of the content of the city, and it is an image of the interaction of human gatherings with the architectural fabric [6].

The street is known as a reflection of the impact of the first human steps on the Earth and the line of his path towards the surrounding environment and the discovery of primitive means and tools for living and survival [7]. With the passage of time, these paths began to be associated with certain signs, such as the topography of the Earth or certain climatic phenomena or its proximity to points of interest, and then differentiated into paths to seek knowledge and science, or to trade and highlight traditions and culture, or to carry out military campaigns and spread the religion and customs of a particular society. The shapes of the streets varied and their dimensions varied with the development of means of transport [8, 9].

1.2 Streets as major urban elements

The first urban element that defined the traditional city is the street, where it connects urban spaces and places. Thus, the

street forms the urban fabric of the city and determines the axes of movement within it [10]. The role of the street is not limited to functional activities in the movement of transport and the formation of the city's infrastructure, but it is a multifunctional space [11]. Throughout the history of cities, the street has provided spaces for social, entertainment and commercial events as places to meet, shop, work and Stroll, so people meet their destinations and connect with their events [12, 13].

The streets can be divided according to their width, that is, to accommodate the number of vehicle lanes, and their location into Main streets and Branch streets connecting the main streets with each other [10].

The streets in the city center are the nerve of life and its economic artery. These streets perform various functions and social and political services related to the urban phase of the city [6].

By focusing on the concept of Environmental Conservation and sustainability, new urban movements and initiatives have called for reviving the role of streets as places for people because streets are the basis for creating sustainable places to live, work and leisure [14].

The concept of a "sustainable city" was introduced in the late eighties, which was first formulated by (Richard Registe), taking into account the city's buildings for a healthy future.

Urban sustainability meets the consensus of changing and emerging needs according to urban, social, environmental and economic principles [15]. The sustainable urban fabric is multi-shaped with the designs and performance of its interconnected streets to achieve accessibility, which supports various benefits through diversity and land uses and leads to the creation of a vibrant community and a safe urban space that provides comfort to its users and attracts commercial and social events to provide basic needs [16, 17].

1.3 Types of streets

Streets are usually classified in terms of shape into: straight, curved, broken, or organic streets, not a clear geometric characteristic that applies to them [18] (Figure 1).

In terms of the relationship of streets with each other, they can form: an orthogonal system, centered around a focal point, radial starting from a central focus, or be a combination of one or more of these interconnections [11, 16].

In terms of their use identity, the streets are classified into residential, recreational, service, and commercial streets of various types [19].

The functional distribution of streets in general is controlled by three factors:

- (1) Rooted social values
- (2) Economically rooted values
- (3) Rooted public values



(a) Mosul city plan mixture between, organic and engineering
<http://www.lib.utexas.edu/mosul>



(b) Washington city plan, Chart type is a mixture of orthogonal and radial
<http://www.boklife.com>

Figure 1. Classification of streets in terms of shape

1.4 Commercial streets

Commercial streets are one of the most active, diverse and attractive public places in urban life. It is a tourist attraction that takes into account in its design all services with a large capacity for the public, and the design often relates to culture, Environmental Protection and humanization.

The location of the Commercial Street, the improvement of the landscape and the expansion of entertainment options are the most important considerations in its planning [20].

1.5 Dimensions of sustainable commercial streets

Sustainability in commercial streets has many dimensions on which it is based: the dimension of the composition (design), the dimension that represents the activity and the environmental dimension, as well as the role of the user as a key participant that integrates among other dimensions and participates in the evaluation of public space [21] (Figure 2).

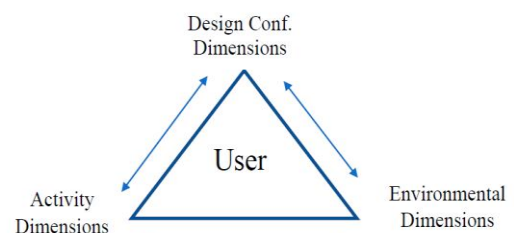


Figure 2. The relationship between the street user and the three dimensions of sustainability

2. PREVIOUS SCIENTIFIC KNOWLEDGE ABOUT SUSTAINABLE STREETS

An assessment of the reality of theoretical knowledge contained in a number of architectural literature and studies that dealt with the topic of Sustainable Streets.

A study addressed the principles of sustainability of the street in the urban city and included [4]:

- (1) Diversity and versatility of the land, through the difference in the shapes and ages of buildings, which creates a diversity of facades, the diversity of transition from one urban space to another in terms of stopping and containment, and the diversity of The Shape of the street from narrow and wide,

straightness and curvature, frequent conversions, and many angles in it. The principle of integration of functions on the street is achieved through the diverse zoning of land uses vertically and horizontally on the street. They have multiple functions and events such as residential, commercial, entertainment, administrative and service, and they are close to each other and adjoin harmoniously and harmoniously.

(2) Correlation, achieved through the clarity of the spatial structure of the urban fabric network. The main streets are connected to each other through subsidiary streets called joints, and the meeting points are called nodes. The associativity depends on the structure, number, continuity and depth of the Branch streets, the structure, density and quality of nodes, the density of the road network. Connectivity contributes to urbanization and the provision of urban services that meet needs and facilitate access to public transport facilities and services.

(3) Accessibility, which consists in accessing the main services without delay through the connected streets, whether on foot or by means of transport.

Among the factors affecting the quality of accessibility are: the speed of movement of private vehicles and public transport, the density of the connection between streets, the connection between streets and public transport, the locations of services on the street, the type of events and the distance between them, the intensity of mixing events and services on the street.

(4) Social environment, the principle of achieving a social environment on the street is associated with the principle of vitality. It is the living street that provides a greater opportunity for choice, gathering, meeting and social interaction.

(5) Vitality, it is represented by the abundance of social activities, events, services, functions and the number of its users. This requires an appropriate urban design of the street in terms of providing sufficient spaces to accommodate social activities, events and various services, and vitality is directly related to attractiveness.

(6) Comfort, is achieved through an appropriate design to accommodate users' events and social activities and achieve their environmental protection, as natural and industrial furnishing contributes to improving the street functionally, aesthetically and environmentally. One of the most important elements of achieving comfort is the provision of mobility requirements for people with special needs.

(7) Safety, the feeling of safety on the street is associated with the lack or absence of crimes and the lack of traffic accidents. The relationship between the sense of safety and comfort is a direct relationship, the greater the feeling of safety on the street, the greater the feeling of comfort according to it.

- A study dealt with the planning and design requirements for streets, including [3]:

(1) Identity, the street must have an identity that distinguishes it and makes an impression on the minds of citizens. This trait enhances a person's sense of belonging to the place and vice versa. Ling, one of the founding pioneers of contemporary urban design, said that identity is the key to understanding the image of the city and represents the connection with history, the features of which were formed and completed through time. "The foundations of the street's identity lie in its structural features and functional features," he said. Building a mental image of the urban environment, of which the street is an important part, depends on three main factors: identity, structure and meaning. The identity of the

street is strengthened when the name is combined with the nature of the work on that street, such as the street of blacksmiths and carpenters.

(2) Street physical construction: the paved buildings on both sides of the street in many countries of the world, and the streets of Iraq are no exception, constitute a heterogeneous mixture of shapes, materials and colors that are not connected by a bond except to compete on the arena of conflict to attract attention, and to consecrate self-identity and not the public identity of the street, due to the lack of building controls or a defect in following up their implementation, if any.

Alberti and Palladio adopted the application of a repeating architectural unit (Module) in their works to preserve the general context of the street in the Renaissance, and used the colonnaded or arched arcade and unified their shapes and dimensions to ensure minimal continuity and harmony between the Constituent vocabulary of urban space.

(3) - Street artistic construction: the street and the forms of relationships that connect its elements form an artistic composition within the main composition of the city. The formation of the street facade requires the achievement of both the principle of balance and unity through shapes, lines, sizes, colors, texture, finishing materials, as well as light values and their reflections, whether natural or artificial

The proportional relationships between the components of one thing are one of the most important values in achieving perfection of the final product of all the assets in the universe.

- A study examined the factors affecting commercial streets and included [10]:

(1) Functional factors, including:

- Traffic: it consists in collecting data about the area from studying the route of cars and their daily rate, knowing the peak hours during the day, intersections and the quality of cars should be studied.

- Pedestrian traffic: represented by a study:

A-the purpose of pedestrians walking on the Commercial Street and the quality of various activities (terminated trips, functional trips, recreational trips).

B-the relationship between pedestrian traffic and automated traffic on the Commercial Street to ensure comfort and safety and separation between them through: either temporal separation using traffic lights, or spatial separation using special pedestrian tunnels and bridges or by increasing the width of the sidewalk.

C-services: include sewage, electricity, telephone lines, drinking water supply and gas, which must be buried underground to not distort the visual image of the street.

D-maintenance: consists in the maintenance of damaged parts, garbage removal, rainwater drainage and care of plants and trees.

(2) Natural factors

- Climate: affects human efficiency and the extent of his sense and visual perception of the Commercial Street, and includes temperature, humidity, the movement of wind, rain and the movement of the sun. It is possible to control the protection of commercial vacuums by: limiting direct and reflected sunlight, balancing the degree of air humidity through plants and water bodies.

- Soil and groundwater: it must be studied and know its suitability for planting to choose the right plant type, and know the water level and proximity to the ground.

- Topography of the Earth: exploiting the teams of levels, if any, and treating them using ladders and slopes.

(3) Social and economic factors

Find out how successful the streets are after their development, and the amount of revenues compared to the costs spent on the street through a feasibility study and market analysis.

(4) Political and legal factors

Interested in deciding whether to make the street dedicated to pedestrians or not, and interested in the problems of street vendors and issuing decisions to evacuate them or provide fixed places instead of displaying their goods on the sidewalks. It also consists of finding laws related to traffic violations to provide security and safety for users of commercial streets.

- The study touched on the elements of coordination of commercial streets and included [11]:

(1) Pavements: the purpose of paving is to create a solid, durable, non-slip surface that is weather-resistant and suitable for the use of pedestrians and cars, paving also has other secondary functions such as guiding and guiding pedestrians, creating a visually comfortable floor and to give a beautiful character to the place whether public or private; recreational or government ... etc., it also helps to connect buildings with each other with appropriate balanced relationships. When choosing the right floor, the following factors should be taken into account: ease of movement, safety, cost, and overall appearance.

(2) Elements of sculptural and plastic pieces in commercial streets: they are considered important elements that increase the beauty of the mental image of open areas, which must be handled with great care in terms of distribution in order not to form visual pollution on the street. The sculptural pieces are placed in the places that represent the nodes, providing the base and background that match the size and shape of the sculptural pieces. The sculptures are surrounded by the required illumination in terms of the angle of incidence of light, the amount of illumination, its color and location.

(3) Barriers and obstacles: they are mainly used to separate motorized traffic from pedestrian traffic, but this does not prevent the presence of aesthetic functions of barriers.

(4) Lighting: it is one of the most important elements in furnishing the streets from a functional and aesthetic point of view, especially when interacting with the rest of the elements in the place of fountains and sculptural pieces. The following must be taken into account in the design of street lighting:

A. the human scale, that is, the height should not exceed 3.6 meters

B. the lighting source should not achieve unnatural shadows on the faces of pedestrians

C. evenly distribute the light on the walls specified for the voids

D. lighting the places of stairs and places of changing

direction or the presence of a curve in the road

E. choosing calm colors that do not cause dazzle in the eye of pedestrians.

(5) Street furniture: it is considered one of the complementary elements of the street, represented by seating benches, flower beds, telephone booths, umbrellas, garbage baskets and fountains.

A study dealt with shading using trees as a tool to improve thermal performance in the streets, as trees trap direct solar radiation and reduce its temperature by 12 degrees Celsius in high-density areas, where the presence of dense trees increases the efficiency of thermal paths in summer. Trees with dark-colored leaves are considered to be highly absorbable because their reflectivity is low. The study also pointed out that shading trees reduces the air temperature around and below the trees, as it blocks the access of solar radiation, and reduces the temperature of the surfaces below by at least 25% compared to the temperature of the unshaded surface [1].

A study discussed the dimension of environmental aspects in the design of commercial streets, as the main consumer of fossil fuels, which has increased from 4% of global energy consumption in the early twentieth century to more than 86% at the present time. Environment and energy are two sides of the same coin and to achieve a sustainable green environment on the streets, the study put forward a set of solutions:

- Reducing carbon dioxide emissions: by reducing fossil energy consumption, using renewable energies, using recyclable materials, recycling waste, and taking advantage of natural lighting.

- Adaptation to climate change: through the use of smart materials and smart technologies that respond to external stimuli in commercial streets, the use of high-performance materials in resisting heat and cold, working to increase vegetation cover in the streets, and preserving rainwater to benefit from them.

3. THE THEORETICAL FRAMEWORK OF SUSTAINABLE COMMERCIAL STREETS

After reviewing a set of studies and literature that dealt with the topic of sustainability in commercial streets, the theoretical framework of the mechanisms of employing the principles of sustainability in the design and development of commercial streets in Iraq will be determined, by sorting and classifying a set of variables related to the principles of Sustainable Streets in (Table 1), for the purpose of applying them to the selected samples.

Table 1. Possible values of variables related to sustainability in commercial streets / [Researcher]

| Main Variables | Sub-Variants | Possible Values |
|----------------------------------|-------------------------------------|---|
| Street sustainability principles | Diversity and multi-use of the land | The different shapes and ages of buildings; the diversity of movement in terms of stopping and containment; The diversity of the street shape in terms of (narrowness and wideness, straightness and curvature, frequent diversions, and many angles); the integration of functions through vertical and horizontal planning |
| | Improving the link | Sub-streets (joints), nodes |
| | Accessibility | The speed of the movement of public and private vehicles; the intensity of the link between the streets; the link between the streets and the public transportation; the services sites in the street; the type of events and the distance between them; the intensity of mixing events and services in the street |
| | Achieving a good social | It is linked to the principle of vitality |

| | | |
|--|--|--|
| Design and planning requirements | environment | |
| | Vitality | Lots of social activities and events, services and jobs; Adequate spaces to accommodate social activities and events; Vitality is directly related to gravity |
| | Comfort | Natural and industrial furnishing; Providing movement requirements for people with special needs |
| | Safety | Less crime; less traffic accidents; safety is directly related to the principle of comfort. |
| | Achieving identity | Communication with history; the foundations of identity drawing for the street depend on (its structural features, its functional features) |
| | Street physical construct | Harmony between the constituent vocabulary of urban space |
| Factors affecting commercial streets | Street artistic construct | Achieving the principle of balance and unity through (shapes, lines, sizes, colors, textures, and finishing materials as well as light values and their reflections, whether natural or industrial); Proportional relationships between the components of one thing Studying traffic; studying pedestrian movement in the street is: pedestrian purpose of walking in the street (expired trips, functional trips, travel trips); and the relationship between automatic traffic and pedestrians. Services (sewage, electricity, phone lines, drinking water and gas supplies). Maintenance: maintenance of the affected parts, removal of garbage, drainage of rain water, and caring for plants and trees |
| | Functional factors | |
| | Natural factors | Climate, soil, groundwater, and land topography |
| | Economic factors | Compare revenue with costs expended |
| | Political and legal factors | Allocating the street, providing fixed places for street vendors or evacuating them, creating laws regarding traffic violations |
| Commercial street coordination elements | Pavements | Use of a non-slip surface suitable for use by pedestrians and cars. Employed in guiding and guiding pedestrians. Taking into account the ease of movement, safety, cost, and general appearance in choosing floors |
| | Elements of sculptural and artistic pieces | Good distribution (in the nodes); providing the base and background that are commensurate with the size and shape of the sculptural pieces, and providing appropriate lighting for them in terms of angle of incidence, amount of lighting, color and location |
| | Barriers and obstacles | Separation of automated traffic from pedestrian traffic; placed for aesthetic purposes |
| | Lighting | Consideration: the human scale, avoiding shadows on the faces of pedestrians, equal distribution, lighting stairs and places to change direction, choosing quiet colors |
| | Street furniture | Benches, flower beds, phone booths, umbrellas, trash cans and fountains |
| Environmental dimensions of sustainable commercial streets | Shading elements | Using trees with dark leaves |
| | Reducing carbon dioxide emissions | Reducing fossil energy consumption; employing renewable energies; using recyclable materials; recycling waste; and taking advantage of natural lighting |
| | Adaptation to climate change | Using smart materials and smart technologies, using high-performance materials to resist heat and cold, working to increase vegetation in the streets, and preserving rainwater to benefit from it |

A) Analysis of the street in terms of achieving the principles of sustainability in it

- (1) At the level of diversity and the multiplicity of land uses, it was found that the street achieved some of the vocabulary of diversity in terms of difference in the forms of buildings and the integration of functions and did not achieve other requirements at the level of the shape of the street in terms of narrowness and breadth, frequent conversions, and the large number of angles.
- (2) At the link level, we may notice, as shown in the Figure 3, the presence of several sub-streets that are connected to the Republic Street. At the same time, there are no nodes and assembly areas on the street.
- (3) At the level of accessibility, there is little car traffic on the street and it is reserved for certain people who have permissions by the government, and it intersects with pedestrian traffic, which makes it difficult for the motorist and pedestrians to move at the same time. As for the general public, they can only get to the street from specific areas, whether by public or private transport.
- (4) At the level of mixing events, we find that there are various events within the street and at close distances, where you find shops, hotels, restaurants and other events within close distances.
- (5) Many social and religious activities take place on the street during the year, as Republic Street is one of the most crowded and lively Commercial streets, but it lacks all the spaces to accommodate these activities.
- (6) The street lacks the elements of comfort represented by natural and industrial furnishing, as well as the requirements of movement for people with special needs. Because safety is directly related to the provision of comfort, the street suffers from safety problems due to: large randomness, the intersection of car traffic with pedestrian traffic, and the presence of many street vendors in the middle of the street without supervision. As well as the presence of columns carrying shading elements in the middle of the street, which causes collision with them during congestion.

B) Analysis of the street in terms of design and planning requirements

- (1) At the level of identity achievement, the street suffers in terms of design that takes into account the architectural identity and due to the recent development of the street, and the placement of artificial shading elements on both sides of the street, which caused the obscuration of the vision from all the buildings that make up the street, which led to the loss of the entire street identity and the inability to distinguish the relationship between the vocabulary that makes up the urban space.
- (2) The lack of proportional relationships between the components of the same thing, as well as the lack of unity and balance in the street at the level of colors, texture, finishing materials, optical values and their natural and industrial reflections.

C) Analyze the street in terms of factors affecting it

- (1) At the level of function, the street is functionally affected by the bad traffic inside it, and its intersection with pedestrian traffic, which affects the pedestrian purpose of walking on the street, whether the purpose is recreational or functional or to cross to another area. As for the services provided by the street, they are very few

compared to the large numbers and various jobs on the street.

- (2) The street is affected by natural factors, the most important of which are the high temperatures in summer and hurricanes loaded with dust, which prompted the local government in Karbala province to make umbrellas to block the sun's rays in an unstudied way that increased the suffering of the street occupants and visitors.
- (3) At the level of political and legal factors affecting the street, we find that chaos prevails on the street due to the large number of peddlers and the lack of designated places for them, and there are no deterrent laws to isolate violators. The absence of laws on traffic violations on the street.

D) Street analysis in terms of elements of commercial street coordination

- (1) Suitable Pavements were used in terms of durability and shape, with a non-slip surface suitable for pedestrian and automobile use, and they were not employed in directing pedestrians.
- (2) The scarcity of sculptural pieces or assortment in the street, taking into account the lighting, base and background that suit the existing sculptural elements.
- (3) There is no separation between pedestrian traffic and cars by barriers and obstacles, except at the beginning of the street from the entrance of the (Tuwairij) district, where there is a barrier that prevents cars from entering.
- (4) There are lighting elements along the street, but they are not distributed in such a way as to achieve convenience for pedestrians and sellers.

E) Street analysis in terms of the environmental dimensions of sustainable commercial streets

- (1) The street was shaded with artificial shading elements that interfere with pedestrian traffic, and there are no natural shading elements from trees and others.
- (2) At the level of carbon emissions, the street suffers from a lot of carbon dioxide emissions, all the energy consumed comes from fossil fuels, renewable energies have not been employed, recyclable materials have not been used, nor waste recycling.
- (3) The street lacks the use of smart technologies and materials in the design of infrastructure buildings, heat-resistant materials have not been used, there is a lack of vegetation, and waste of rainwater that has not been used. As a result, this reflects on the street's ability to adapt to climate change.

Below is a selection of photos of Al-Jumhuriya Commercial Street (Figure 4).



(a) Al-Jumhuriya Street before rehabilitation



(b) A photo of the street after the redevelopment shows the intersection of car traffic with pedestrians



(c) A night photo of the street shows street vendors in various places



(d) A photo showing the location of the columns carrying the shading elements and their intersection with pedestrian traffic, as well as the shading elements blocking the view of buildings on both sides of the street

Figure 4. A collection of photos on Al-Jumhuriya Commercial Street

5. RESULTS AND DISCUSSION

From the above, as a result of the analysis of the selected sample, we find that the street has achieved few of the principles of sustainable design at the design and planning level and aspects related to the environment and climate

change. The street's problems have increased after the recent rehabilitation, which increased the suffering of the street's occupants and visitors as a result of the narrowing of spaces, the loss of street identity, due to blocking the view of buildings and advertisements, which increased the difficulty of access.

The above-mentioned research results indicate the need to apply the theoretical framework that the research sought to find in order to revitalize and sustain commercial streets in Iraq.

6. CONCLUSIONS

1. The research problem focused on addressing the lack of knowledge about the principles of sustainability in commercial streets in Iraq, to come up with a set of mechanisms that are employed to achieve the principles of sustainability in commercial streets in Iraq and activate them socially and economically.
2. The use of sustainability principles in the design and construction of streets is of utmost importance, making these principles the first thing a designer should embrace throughout the architectural design phases and at all levels of the structure. To create the groundwork for solid thinking for the implementation phase in all its aspects, this is in addition to the structural and formative details. Whether it concerns cost, energy, or building materials, this may help produce a structure whose features and composition have the lexicon of sustainability.
3. A concept known as sustainable design can be realized by employing the vocabulary of sustainability at all design levels, including the idea, the entire form, and the details, in a manner that ensures the production of methods and mechanisms, provides a design that is both contemporary and modern, and takes into account the reduction of energy consumption and the reliance on natural energies. Additionally, technology ought to be utilized as a means of constructive environmental management.
4. One of the most important factors to achieve success in the design of commercial streets is: social sustainability, through the provision of comfort and vitality elements of: services, furniture and places that accommodate various events and activities on the street.
5. Commercial streets are public places that reflect the culture of the state and its people, they must be rehabilitated to ensure their sustainability while preserving their identity.
6. The design of commercial streets takes into account saving energy consumed, reducing dependence on fossil fuels and trying to use renewable energies, especially in the atmosphere of Iraq, where the sun's Rays are present all year round.
7. The design of streets in Iraq takes into account the shading of evergreen trees with dark leaves to block solar radiation, reduce temperatures and provide a sustainable health environment.

7. FUTURE RESEARCH PROSPECTS

The research suggests expanding the study of aspects related to social sustainability and focusing on the use of technology in achieving communication and safety for commercial street users in Iraq, as it lacks this a lot.

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