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The Role of Sustainable Ecological Neighborhood in Reducing Energy (Al-Durra Residential Neighborhood in the Karbala City as a Case Study)

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ABSTRACT

One of the most significant contemporary issues that emerging cities face is the idea of a sustainable environmental neighbourhood, which has been researched in recent decades in an effort to achieve sustainability and is seen as a component of sustainable development. The primary components of a sustainable neighborhood—social interaction, residential variety, and sustainable green transportation—have been covered in this study. It helps to lower energy usage. The practical study was carried out in the Al-Durra neighbourhood of Karbala, Iraq, and field surveys, charts, and maps based on geographic information systems were utilised to analyse and quantify the indicators resulting from these aspects. The issue of inadequate use of sustainable environmental neighbourhood indicators that aid in energy conservation is addressed in this study report. Through a knowledge of the fundamental role of neighbourhood factors and indicators that lower energy usage, this study employed a method that seeks to establish a sustainable environmental neighbourhood. The study's findings can be used as a tool by engineers and urban planners to create sustainable residential neighbourhoods. The study assumes the existence of a set of factors, indicators and standards through which a low-energy environmental neighborhood can be achieved. The results of the study revealed that the study area (Al-Durra neighborhood) obtained a high percentage in the access to services index, the social communication index and the direction of buildings according to the local climate, and a respectable proportion on the indicator of residential diversity. This has a favourable impact on the subject of energy reduction research. The research aids in identifying the environmental, social, and economic elements of a sustainable neighbourhood as well as the different functions it fulfils, despite the fact that it discovered that the study area lacked a public transportation index and that the building materials index was not sustainable.

1. INTRODUCTION

Meeting the many needs of present and future residents as well as their children, enhancing their quality of life, and offering them options and possibilities are characteristics of ecological neighbourhoods. Effective use of natural resources, environmental improvement, social inclusion and cohesion, economic prosperity, sustainable transportation, renewable energy sources, and waste and water recycling are ways to achieve this [1]. The term ecology combines the two Greek words "oikos" which means "home" or place of residence and "logos" which means study to denote such relationships between an organism and its environment [2]. The concept of ecology was first introduced by the German philosopher Ernst Haeckel in 1866, where he used a special ecological perspective on the ways of adaptation and variation of living organisms in their local environment [3]. In 1912, the botanist Arthur Tansley founded and assumed its presidency of the British Ecological Society (BES), making it the oldest professional organization for ecologists in the world, as it is considered one of the oldest professional environmental organizations in the world, focusing on promoting the study of ecology and its applications in the field of environmental conservation, sustainability and management [4, 5].

In 1928, the foundation of ecology was established and applied in the field of engineering and architectural design by 25 leading European architects headed by Le Corbusier, where it was established as a platform for the advancement of contemporary architecture. This phase is seen as ecology's introduction into architecture [6, 7].

A new category of basic ecological neighbourhoods arose in 1980, when activists and specialists who supported green building and sustainable development applied the concepts of sustainable neighbourhoods to the construction of tiny buildings on the fringes of rural and urban regions. Later, Germany, Austria, and the Netherlands adopted this concept. This movement laid the groundwork for future sustainable neighbourhoods by signifying a significant shift towards environmentally conscious planning and development [8].

In 1990, the second advanced type of ecological neighborhood models emerged, where communities took advantage of urban events such as the Hannover Exhibition and the Olympic Games to create ecologically sustainable neighborhoods [9].

The ecological neighborhood model was also developed in 1995, which focused on achieving environmental quality goals such as reducing pollution, improving energy efficiency, conserving natural resources, enhancing biodiversity and supporting pedestrian movement. This period was the stage of ecology entering urban planning [10].

According to a 2022 study by Amir Bonifacius Poerwoningsih, city roadways have a significant role in open spaces. In order to create a favourable perception of the city and emphasise the value of streets as places, the idea of sustainable urban ecological design for city streets and neighbourhoods was the main focus. In order to improve the city's image towards sustainability with social, economic, and environmental benefits, the study investigated how to improve streetscapes through a strategy integrated with sustainable ecological planning that includes street afforestation, street furniture, and promoting pedestrian movement [11].

The elements and indicators that specifically contribute to energy reduction—a fundamental aspect of ecological neighbourhoods on a wide scale—have not been examined in prior research. This study intends to close this gap by examining the factors of social interaction, residential diversity, and green transportation; identifying pertinent indicators; talking about measurement techniques; and establishing criteria for creating an environmentally friendly neighbourhood with low energy use. The research will focus specifically on measuring the extracted indicators in the Al-Durra residential neighborhood in Karbala, a residential neighborhood located in Karbala Governorate in Iraq, 5 kilometers away from the city center.

2. SUSTAINABLE ECOLOGICAL NEIGHBOURHOOD CONCEPT

The term sustainable eco-neighborhood refers to a small urban area that contains social, economic and environmental necessities. This unit is an essential element in promoting social and economic well-being with low environmental impact [12]. EcoDistrictsTM, a non-profit organization in the United States, defines it as "a complete investment strategy for ecosystems that integrates resource efficiency, environmental diversity, mobility and community well-being. Energy costs in ecosystems are also reduced through the construction of low-energy buildings in terms of materials, guidance, insulation and ventilation. The eco-logical neighborhood consists of buildings that produce positive energy and are designed to produce more energy than is consumed. Sustainable development techniques and strategies include: renewable energy, zero waste, water management, green streets, smart green, rainwater harvesting, green roads, pedestrian pathways, bike lanes and TOD) transport-oriented development, multimodal transport, environmental farms and new roads. Green Zone Planning [13]. The ecological neighborhood is part of an ecological city, which refers to an urban unit that adheres to the principles of sustainability in all its aspects. This concept focuses on the environmental dimension to achieve coherence and integration in line with the level of population satisfaction and the characteristics of urban infrastructure. It aims to maintain the environmental balance and durability of life in the city. Examples include the promotion of green buildings, diverse and balanced land use, provision of public green space and forest areas, promotion of sustainable transport and renewable energy [14]. Based on this, a sustainable ecological neighborhood can achieve long-term sustainability by balancing urban systems and applying the three principles of sustainability. Thus, it is considered an ideal model for sustainable neighbourhoods where the sustainable ecological neighbourhood includes factors and indicators that contribute to reducing energy consumption and which are discussed in the following paragraphs.

3. GREEN SUSTAINABLE TRANSPORT

The goal of green transportation is to provide comfortable and safe urban transportation while reducing pollution. Sustainable green transportation is essential in ecosystems, contributes to reducing dependence on vehicles, improving air quality, and improving the health of citizens by reducing fuel emissions and thus contributes to reducing energy [15]. The World Business Council for Sustainable Development (WBCSD) defines sustainable transport as the ability to provide society's Needs for freedom of movement, accessibility, communication and association without sacrificing the human and environmental values that will affect society today or in the future. Sustainable transport and associated indicators are essential for achieving the economic, social and environmental objectives of sustainable urban neighbourhoods. The use of basic transportation such as walking and bicycles is promoted, which contributes to the creation of a sustainable urban environment [16]. It includes two sub-indicators for measuring sustainable transport in residential neighborhood's: multiple transport patterns and accessibility.

3.1 Multiple transport patterns

Sustainable modes of transport are diverse and effective to reduce energy use, with low or no emissions and reasonable costs. Their use aims to reduce the environmental impact [17]. Sustainable modes of transport are diverse and effective to reduce energy use, with low or no emissions and reasonable costs. Their use aims to reduce the environmental impact [14]. It contains three measures:

3.1.1 Bike and pedestrian trips

Bike mobility is an environmentally friendly and healthy mode of transport, which does not need fuel or electric power, and does not produce polluting emissions, making it a sustainable option in urban ecological neighbourhoods [18]. What walks is considered a "green" mode of transport and contributes to the reduction of environmental pollution, which is a useful and social means of travel. They include components such as sidewalks and crossings, and provide access to all, including children and the elderly [19].

3.1.2 Trips made by public transport

Public transport plays a vital role in promoting sustainable transport and reducing carbon emissions and congestion resulting in reduced energy. By efficiently transporting a large number of people, it is essential in a sustainable environmental neighbourhood that includes buses and electric trains, improving air quality and reducing greenhouse gases [20].

3.2 Transport flights

Excessive reliance on cars in cities is an environmental and social problem, including air pollution, congestion and resource depletion. Traffic noise also causes health problems, making finding sustainable solutions for urban transport essential [21]. The green, sustainable transport factor can be measured through the questionnaire form, comparison with the field survey criteria of the study area, knowledge of the population's views and rely on the following criteria [22].

- Pedestrian traffic 10%
- Cycling 25%
- Public transport 20%
- Private transport 45%

3.3 Easy access factor

Accessibility is an important factor in determining how close a location is to services, as research has shown that providing activities and services close to residential areas reduces travel time, reduces reliance on cars, encourages walking, and thus reduces environmental pollution, which enhances energy efficiency [23].

This ease reflects the proximity, distance, and access routes to diverse destinations, including various uses and public transport stations. Accessibility depends mainly on the distance travelled. The shorter the distance, the easier it is to access multiple destinations [24]. This factor includes an indicator of the distance of access to different services and methods of measuring them:

3.3.1 Access distance for different service

Proximity to services represents the degree of overlap between land uses near each other in an urban area. Proximity refers to the average distance individuals have to walk or use green transportation from their homes to their destinations such as shopping malls, services, work and entertainment sites [25-28]. Service access distances are a measure that shows the dimension between a given activity and other destinations, expressed as a percentage of the number of dwellings within a specified radius. Studies indicate that the optimal distance to facilitate access to services ranges from 400 to 600 meters, and is acceptable depending on the type of destination and the reason for the trip [29].

The distance determined by the standard can be measured according to the following criteria [30, 31]:

- Nearest green or leisure space within a maximum distance of 400m
- Accessibility Standard for Educational Services: Within 400m radii reach distance
- Accessibility Standard for Health Services: Within 800m Radius Reach Distance
- Ease of Access Standard for Commercial Services: Within 600m Radius Reach Distance

4. RESIDENTIAL LAND USES

Residential use patterns include the surrounding environment, including the number, size, types and services required. These patterns are linked to the characteristics and design of the dwelling itself and the characteristics of the surrounding environment. The sustainable design of the dwelling is a contributing size to the reduction of energy [32]. The housing use patterns factor consists of secondary factors, derived indicators, standards and measurement methods, as follows.

4.1 Residential diversity

Sustainable housing diversity refers to choices that meet environmental, social and economic needs, promote sustainability, reduce monotony, and achieve economic goals while reducing environmental footprint and energy [33]. The principle of the diversity of housing spaces enhances affordability and provides multiple options, contributing to the distribution of affordable housing among high-cost units. It also increases population density and reduces travel distances, leading to sustainable neighbourhoods that meet the needs of all segments of society, which includes a vertical and horizontal housing index [34].

Housing diversity is measured by the Simpson coefficient index, where the 0 value indicates homogeneity of housing and full diversity. Value 0.5 represents the minimum diversity, and 0.7 expresses the ideal diversity as in the equation [35].

$$D=1-\Sigma\,[(n/N)^2] \tag{1}$$

D=Diversity factor
n=Number of each type of housing in the study area
N=Total number of housing units in the study area

4.2 Residential units' underlying design

Latent design is an effective strategy to reduce energy consumption in residential buildings. Focuses on guiding buildings to achieve a balance of dimensions, enhancing the utilization of solar energy and reducing reliance on conventional heating and cooling [36].

It focuses on regulating the relationship between residential blocks and surrounding space through actions aimed at reducing energy consumption, reflecting multiple environmental considerations. The idea of sustainability is linked to the orientation of human activities within urban spaces and blocks, so it is necessary to design housing blocks appropriately in terms of size, measurement, color, materials, and lighting level [14]. The study consists of two sub-indicators measuring the neighbourhood's housing diversity.

4.3 Building orientation

The orientation of the buildings indicates their direction for solar radiation and wind, improving environmental gains and reducing the need for heating and cooling. Ideal guidance is to be the longest east-west axis, or shorter north-south axis depending on the region's local climate which reduces solar heat gain and greenhouse gas emissions [37]. According to the study It can be measured through images of the site and field survey.

4.4 Building materials

The underlying design includes choosing insulating building materials for walls, ceilings and eco-friendly, with the building directed to be in line with heat and air movement. This reduces reliance on mechanical systems and energy consumption, and reduces CO_2 emissions [38, 39].

This indicator can be measured through field survey, viewing and in-person monitoring of the study area.

5. SOCIAL INTERACTION

Public infrastructure is necessary to promote a social life and a sense of belonging. It encourages social participation and interaction. Public spaces, such as streets, parks and recreational spaces, contribute to strengthening social and emotional ties by providing spaces for joint activities, whether necessary or optional. These environments promote social interaction and enrich personal experiences, increasing interdependence in society [40].

The introduction and increase of recreational and green spaces within urban ecological borders enhance the ecosystem's basic services, such as the storage of drinking water, the conservation of biodiversity, the protection of natural habitats, as well as the preservation of agricultural spaces and forests. These spaces also include green parks and water areas, which contribute to fostering a sense of belonging within the neighbourhood [41]. This factor contains two sub-indicators as follows. Figure 1 illustrates how the neighborhood's parks and gardens foster social contact among its people.

Figure 1. Social interaction

5.1 Diversity of green spaces

UNEP emphasizes the importance of green spaces and their diversity in cities and neighbourhoods, where they contribute to regulate natural processes and mitigating problems such as rising local temperatures, thereby reducing energy consumption. Several studies have been conducted exploring the relationship between urban green spaces, including parks and trees, and the sustainability of the environment in cities and neighbourhoods [42].

The study consists of two sub-indicators: parks and green spaces at the residential level and the indicator of recreational spaces as follows.

5.1.1 Gardens

Gardens at the residential neighbourhood level are public green spaces located within residential areas [43]. They can be measured through field surveys and by assessing residents' perceptions via questionnaires. According to the standard specified by 50% that indicates a high percentage of social interaction among the population [44].

5.1.2 Recreational spaces

Are spaces designed and managed as green space parks such as children's play areas and sports facilities [1]. Measured through questionnaire and field survey form. According to the Lectert scale (point Likert-Scale), where it consists of five points starting with (1) and referring to (I disagree strongly) and ending with (5) and referring to strongly agreeing, the scale values (1-2) are not fully contributing and (3-2.1) means non-contributing and (4-3.1) contributions to some extent and (5-4.1) contributions and (5) contributorally contributing [45].

6. RESEARCH METHODOLOGY

The researcher relied on reviewing a number of previous literatures that dealt with the concept of the sustainable ecological neighborhood, focusing on its factors derived from aspects of sustainable development. Through this review, a number of effective indicators were reached to determine the role of the sustainable ecological neighborhood in reducing energy, which can be applied in the urban context of Iraqi cities. Some of these indicators depend on mathematical equations and geographic information systems maps to be measured, while other indicators depend on field surveys and questionnaires. Some information was also obtained from the Directorate of Municipalities and Urban Planning in the city of Karbala. The boundaries of the Al-Durra residential neighborhood in the city of Karbala represent the spatial boundaries of the research. These boundaries extend from. The spatial bounds of the study are the limits of the Al-Durra residential neighbourhood in Karbala (Figure 2).

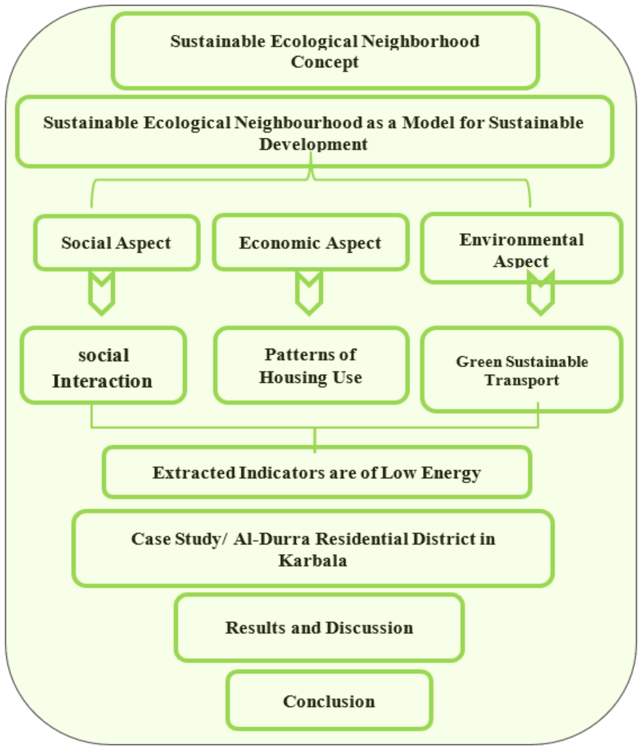

Figure 2. Research methodology

7. STUDY AREA: DORA RESIDENTIAL COMPLEX/KARBALA CITY

The Durra Karbala Investment Complex is located near Saif Saad neighbourhood, 5 km from the city center. The project has 1266 residential units and 140,000 square meters of green space, making it environmentally friendly. The indicators presented in the harmful framework were used to identify problems and achieve a sustainable low-energy ecological neighbourhood. The boundaries of the selected residential district from the Karbala Governorate are depicted in Figure 3.

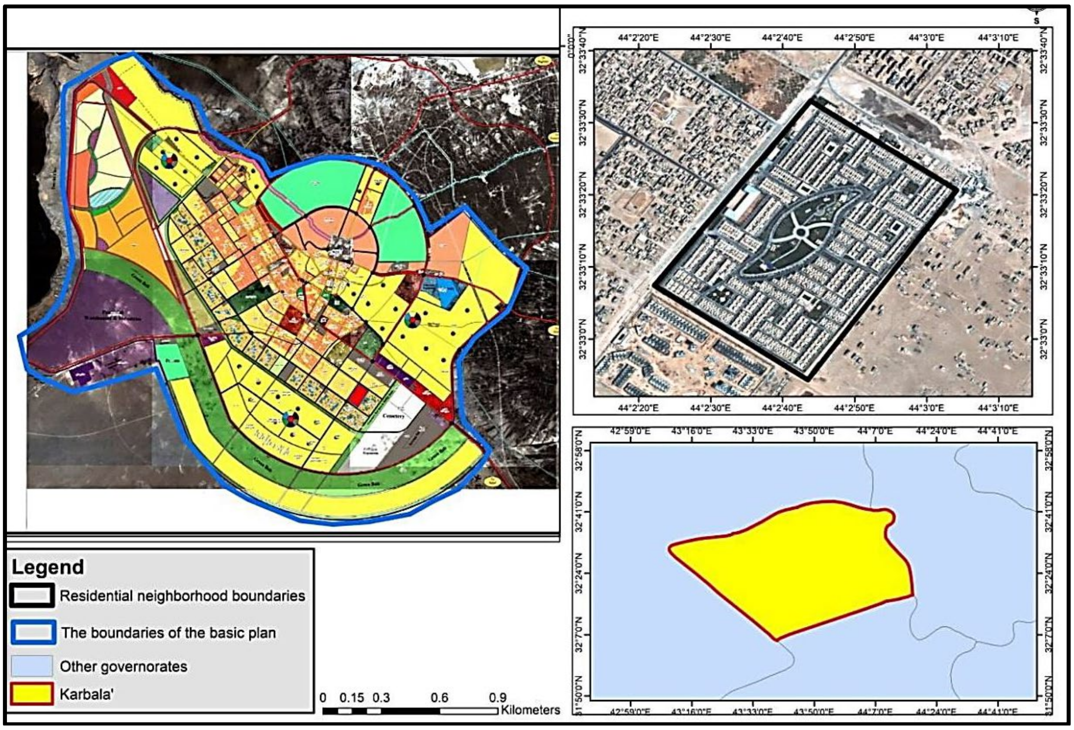

Figure 3. Location of study area (Durra residential complex) from Karbala City
Source: Researchers based on ArcGis

8. ANALYSIS OF INDICATORS EXTRACTED IN THE STUDY AREA

Data used in the practical framework of the study were collected from the relevant government agencies, namely the Urban Planning Directorate of Karbala, the Municipal Directorate of Karbala Statistics Department in Karbala and the field survey conducted by the researcher, as well as the use of the (ArcGis) program.

8.1 Green sustainable transport factor

This factor can be measured by two indicators.

8.1.1 Multiple transport patterns

Green transportation aims to reduce the negative impacts associated with transportation, in response to the growing need for urban transportation. The ability to reduce energy consumption, pollution and other nuisances is crucial to the economic, social and environmental development of neighborhoods, not only today but also in the future [46]. Multimodal transportation measurement includes three metrics: pedestrian, bicycle, public and private transportation. The field survey and questionnaire in the residential neighborhood of Al Durra showed a lack of diversity in transportation modes, with poor transportation, no public transportation and low private transportation ratios, while pedestrian and bicycle movement achieved good ratios. The percentages of the neighborhood's multi-modal transport index are displayed in Tables 1-4.

The percentages of the neighborhood's commercial, educational, recreational, and health areas that are easily accessible by foot are displayed in Figure 4.

Table 1. Multiple transport pattern index ratios

Major Factor	Indicator	Measurement Method	Standard	Receiving Area	Analysis
Green transport	Multiple transport patterns	Pedestrian	10%	33%	Complete
		Bicycle	25%	18%	Unverified
		Public transport	20%	0%	Unverified
		Private transport	45%	49%	In Unverified

Source: Researcher

Table 2. Easy access indicator ratios

Major Factor	Indicator	Transportation	Standard	Receiving Area	Analysis
Green transport	Easy access for different services	Green spaces	400	Buffer	Completed
		Health service	800	Buffer	Completed
		Commercial services	600	Buffer	Completed
		Educational and cultural	400	Buffer	Completed

Source: Researcher

Table 3. The proportions of the housing diversity patterns index

Major Factor	The Indicator	Type	Number of Units	Standard	Fact	Analysis
Residential Diversity	Horizontal Housing	A 200	40	0.1	0.6	Achieve housing patterns
		B 300	130			
		C 220	580	0.5-0.7		
		D 200	527			

Source: Researcher

Table 4. The latent design of the housing units

Major Factor	The Indicator	Measure	Standard	Analysis
Residential units' underlying design	Building orientation	North to the shorter axis	-	Complete
	Building material	Field survey and viewing	Conductivity Watt/m. Kelvin 0.2446	Incomplete

Source: Researchers

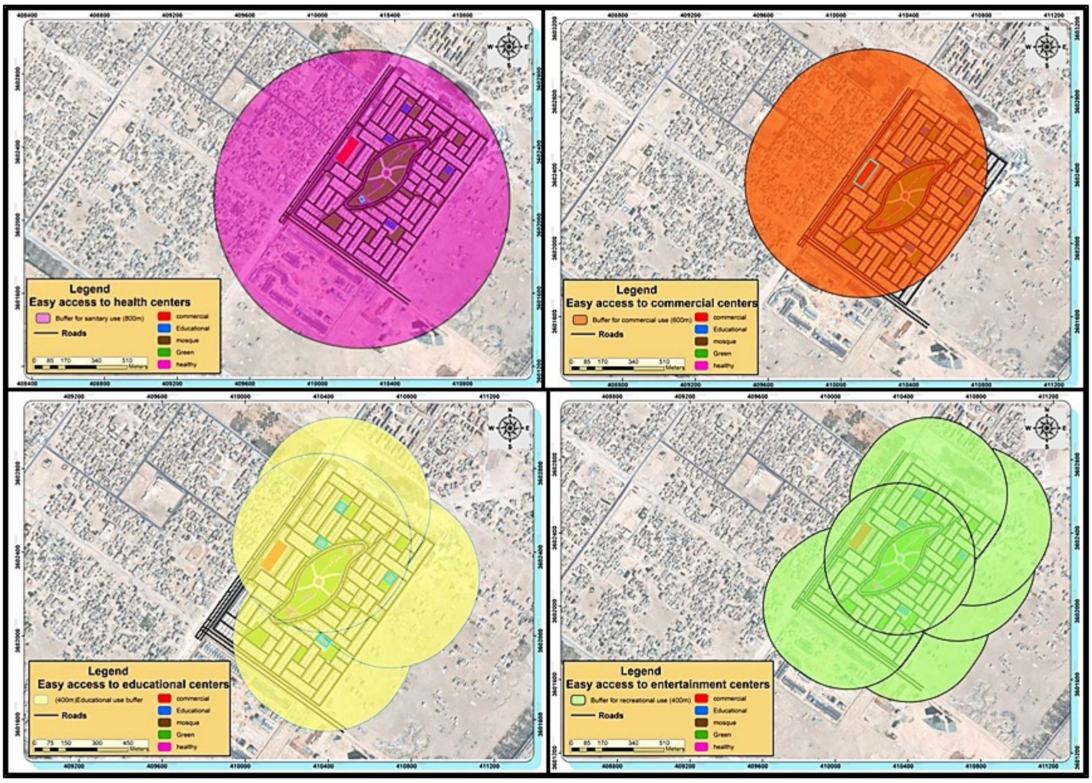

Figure 4. Distance to recreational, educational, health and commercial services
Source: Researchers based on ArcGis.

8.1.2 Accessibility

Criteria have been developed to determine the most appropriate amount to measure the index of accessibility to basic services within the neighborhood. The measurement of the indicator depends on the ability of 100% of the population. to access services. Through comparison with the standard, it was found that there is a high degree of accessibility within the neighborhood as a result of the availability of safety for pedestrians and the proximity of services to each other. The results showed that ease of access has been achieved to a large degree, and thus it contributes to achieving the objectives of the study and creating a sustainable urban environment. The neighborhood's ease of access to services is displayed in Table 2 and Figure 4.

8.2 Residential land uses

This factor can be measured by indicating the diversity of the patterns and spaces of housing within the residential neighbourhood:

8.2.1 Residential diversity

Housing diversity refers to the provision of a variety of housing types that vary in size, type, ownership methods, and the financial capacity of families. This diversity aims to meet the needs of different segments of society, facilitate access to adequate housing, and enhance social and economic sustainability [28]. The presence of housing diversity that suits different social classes of the population achieves a sustainable low-energy environment and is measured by the Simpson coefficient, whose value ranges from 0-1. The value of 1 reflects the optimal diversity of housing types, 0 reflects the homogeneity of housing in the area and 0.5 represents the minimum diversity. 0.7 represents the optimal diversity of housing in the study area. As in the equation

$$D=1-\sum[(Ai/An)]^2$$

The results of the field survey of the study area and reliance on digital data, which includes four categories according to the areas of the Al-Durra residential neighborhood (400 300 220 200), where the value of the Simpson coefficient reached 0.6, representing good residential diversity in the neighborhood, where energy is used more efficiently.

8.2.2 Latent design of residential units

Latent design is an effective strategy to reduce energy consumption in residential buildings. This indicator includes sub-indicators, the building orientation indicator and construction materials index.

1. Building orientation: Indicates their orientation relative to solar radiation and wind, which improves environmental gains and reduces the need for heating and cooling. Through the results of the field survey and inspection of the study area, the orientation of buildings in the neighborhood in the northeast direction, which is the shortest axis, is suitable for the study area and contributes to reducing energy in cooling and heatingstudy area

2. Building materials: This indicator aims to measure the use of insulating materials in the construction of residential units within the study area neighborhood. Through field survey and inspection, it was found that the neighborhood consists of building materials of hollow red brick with a thermal insulation of 0.6, and a thermal insulation thermostat of 0.21. It was found that these are materials with poor thermal insulation according to their comparison with the standard specified for the best thermal insulation ratio, which is 0.0244 [47].

8.3 Social interaction

Social interaction is a prominent feature of sustainable cities and urban neighborhoods, and this sense of connectedness is enhanced by the provision of a variety of spaces including green and recreational spaces. These spaces contribute to creating a comfortable and welcoming environment and also contribute to energy reduction through environmental awareness and information exchange as well as supporting renewable energy initiatives [28]. This factor can be measured by two indicators, including the Green Space Diversity Index and the Recreational Space Index as follows:

8.3.1 Green spaces at the level of the central district park

This indicator measures through field survey, questionnaire and viewing form and conformed to the standard set at 50%, indicating a high percentage of social interaction among the population. The social interaction rate was 80.4%, a high percentage of social interaction that exceeds the standard. A substantial portion of the district—140,000 m²—is made up of green spaces. Additionally, by lowering temperatures and enhancing air quality, these areas aid in lowering energy use.

Figure 5 depicts neighbourhood parks and green spaces that encourage social interaction.

Figure 5. The green spaces in the neighbourhood

8.3.2 Diversity of recreational spaces

Urban recreational spaces that have elements of safety and security encourage visitors to stay longer, thus increasing their attractiveness. This contributes to attracting more people, and creating a network of social relations within the neighborhood [48] (Table 5).

Table 5. The percentages of social interaction

Major Factor	The Indicator	Measure	Standard	Analysis
Social interaction	Green spaces at the level of Central Neighborhood	Questionnaire	50%	Complete
	Park recreational spaces	Lycert Quintuple Scale (4-3.1)	Where it consists of five points starting with (1) and referring to (I disagree strongly) and ending with (5) and referring to I strongly agree so that the values of the scale (1-2) are not fully contributory and (3-2.1) means non-contributory and (-3.1) somewhat 4 contribution and (5-4.1) contribution and (5) contribution	Complete

Source: Researchers

9. RESULTS AND DISCUSSION

This research study addressed the importance and function of the environmental neighborhood in energy conservation, and extracted analysis and measurement of environmental neighborhood indicators that support the achievement of sustainable development goals. Thus, an environmentally friendly residential neighborhood can be created and help save energy. The housing diversity index was 0.06, indicating good housing diversity compared to the standards in the research area, according to the results of the analysis, field survey, charts and maps. There are four different types of residential areas in the area. In terms of the architectural design of the buildings, the survey data and my own observations revealed that the building materials (such as hollow red brick and thermal stone) used were not sustainable and the insulation efficiency was ineffective when compared to the specified standard. This indicates that the neighborhood did not maintain adequate heating and cooling, and in terms of the building orientation in the neighborhood, it was favorable in terms of the standard and local climate. The field study revealed regarding the multiplicity and means of transportation index, according to the population survey and comparison with the standard, the study area provides a variety of transportation options, but public transportation is not used much due to the lack of many nearby stations and the lack of a network of main roads connecting the area to the city. Access to basic services was achieved at a very high rate, indicating that the accessibility index is very good based on the study area survey and the specified standards. Regarding the social interaction element. According to the study area standards and field survey, the availability of green spaces, mixed uses and ease of access all contribute to improving community interaction and participation. As a result, it was achieved at a high rate. The results indicated that walking, cycling and private transportation are common means of transportation in the research area, but they do not meet the required standards for sustainable green transportation. According to the research results, the Al-Durra residential district contains residential and planning features that achieve a number of strategic and sustainability goals. It can be said that the study area is qualified to be a sustainable urban environment due to a set of positive features. As shown in Table 6, some indicators that yielded weak results can be addressed by using planning techniques gradually to produce sustainable environmental housing for its residents.

Table 6. The final results of calculating the indicator values and measurement methods according to the proposed methodology for the study area (Al-Durra residential neighborhood)

Major Factor	Indicator	Measure	Methods of Measuring	Standards	Fact	Analysis
Green Sustainable Transport	Multiple transport patterns	Pedestrian	Sustainable standard	10%	33%	Bike transport is below standard, pedestrian transportation is superior. Public transport is negative because it does not exist, and private transport beats the standard.
		Bicycle		25%	18%	
		public transport		20%	0%	
		Private transport		45%	49%	
	Proximity to Services	Green and recreational areas	Sustainable standard	400m	Buffer	Completed
		Educational		400m	Buffer	Completed
		health service		800m	Buffer	Completed
		commercial services		600m	Buffer	Completed
		religious services		800m	Buffer	Completed
Use of residential land	Patterns of residential diversity	A B C D	Simpson Housing Diversity Index	0-1	0.6	This ratio is considered good according to the standard, indicating the housing diversity of all segments of society
	The latent design of residential buildings	Building	Luxor Axis North-South	-	northern	The northern orientation of the residential neighbourhood is good for the region's climate
		building material	Field survey and viewing	Conductivity Watt/mKelvin 0.24466	Unverified	According to the standard, good insulation was not achieved.
A sense of belonging	green space	Neighbourhood Gardens	Scan and Watch	50%	84%	This percentage is considered to be high in social interaction according to its comparison to the standard
	recreational spaces	Sports Facilities	Lycert Quintuple Scale	(2-1) (There is no social interaction and (3-2.1) weak interaction and (4-5.1) strong interaction	(4-3.1)	This degree according to the standard is a degree of social interaction.

Source: Researcher

10. CONCLUSION

Thus, the derived features can be employed in urban planning to encourage people to live in a sustainable ecological place that satisfies their fundamental needs and wants to improve their physical and social quality of life. Some of the study's shortcomings, including not taking public transit, should be consolidated, according to the findings. In order to improve sustainability, the research area also requires a variety of planning tools. This is because the choice of building materials may be counterproductive to sustainability, as they may not provide adequate thermal insulation and hence fail to regulate heating. Thus, a robust method for that energy is required in the study region. The study also begins research horizons indicators of the sustainable ecological neighborhood in other neighborhoods of Karbala city, based on the shortcomings and weaknesses suffered by the service sector in the residential neighborhood of Al-Durra. The research concluded that a set of major planning solutions should be implemented for energy rest, by establishing public transportation stations, providing distinctive means of transportation for movement in the vital city center, in addition to encouraging the use of transportation in the Find for the pink such as cycling and improving dedicated paths. It is also important to invest and neighborhood managers. It depends on some original things to adopt solid materials in addition to construction and manufacturing products.

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