

## **The Role Of Spatial Organization Elements In The Sustainability Of The City**

**By**

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### **Abstract**

The knowledge of the spatial systems of the organizational process of any place is not sufficient in understanding the mechanism that works to create that place without understanding the elements that make it up and control it, as these actors share relationships and behaviors with spatial and functional characteristics that differ in the amount and levels of influence among them, and that the development of means of transportation and privacy occupied by the urban transport system is one of the most influential components in the urban environment, the stages of development of the city's growth over time are a reflection of the accompanying changes in transportation technology and land uses, and urban sustainability policies require the existence of special standards that reduce the need for movement and movement to long distances by harmonizing land uses and the movement system in it, and working to apply the vocabulary of the sustainable transport system, which will help reduce land consumption and ensure easy access to the population of their goods and needs and achieve a healthy life for current and future generations, therefore, the research problem stemmed from the cognitive weakness in the application of indicators of movement axes and the method of distributing events in the urban land uses of the city, while the research paper aims to identify the mechanism that can help improve the performance of the transport and movement network in the city through accuracy in diagnosis and knowledge in dealing with the system according to standards, and work to achieve the needs of the population in line with sustainable principles, therefore, the hypothesis adopted the importance of measuring movement and transport indicators and their role in the sustainability of urban land uses of the city through measurement and comparison with the approved planning standards and the possibility of providing the necessary treatments that help preserve resources, absorb urban changes, maintain balance for urban systems and enable them to provide their duties according to scientific contexts, and the research paper adopted the methodology of comparative quantitative analysis by adopting measurement and comparison with standards after identifying indicators for active and influential elements, The research paper dealt with the most important concepts related to the movement and transport system and presented a set of conclusions that strengthened the hypothesis of the research paper and showed the importance of these indicators and their role in achieving a sustainable urban environment, and made recommendations that will help in understanding and knowing spatial relationships and functional links with varying effects in presenting the city according to sustainable concepts.

**Keywords:** elements of spatial organization, city, accessibility concept, mixed land uses, diversity.

## Introduction

The spatial organization of land uses and the axes of movement of the transport system is one of the basics for the sustainability of the city, and the process of control and identification of destinations requires knowledge of the elements affecting land use plans and the diverse transport system with sustainable orientations, as the axis of movement and transportation within the concept of the general is related in terms of the concept of ease of access to land uses and the effectiveness of the transport network, which makes the signing of residential events near functional events important in reducing the required trips with the expansion and multiplicity of community requirements according to their different needs, and therefore The possibility of providing a service scope for residential neighbourhoods that meets the needs and maintains the principles of safety and security for the community.

### *1- The spatial organization of the city*

The city is a clustered population grouping and limited by a population number, which is organized economically and socially (Safita, Attia, 2006, p. 26), and spatial organization requires the interaction of various structural and functional aspects of the city, and the system is the components or its interacting parts through a group of links (Debs, 2015, p. 258), and the city system is a group of interactive entities, and may be in balance as a result of planning, management and organization, and the city changes responsively to many individual and collective decisions, and does not return to its previous position, but rather looks for a state of equilibrium new, because its change is definitive, as it resembles biological systems more than mechanical systems (Batty, 2013, p37), The city is defined as a stable human with a large and complex urban structure, especially with regard to land uses from site selection and determining the type of use and the relationship of uses with each other, and the pattern of the road network in it, in addition to the complexity is not in its urban structure, but in gatherings and human activities (Al-Amiri, 2012, p. 4), and the city is a form of spatial organization for all communities, which represents the spatial distribution of population and land uses within the urban area or is the pattern of daily trips within the urban area (Jassim, 2007, p7), Its urban entity is an independent system that takes its permanence from local and recurring interactions on a daily basis, and the urban system is restricted in two directions, the first is the interactions of residents and urban institutions, and the second is the interactions of competing cities. (Pulselli&Tiezzi,2009, p1).

the process of spatial organization requires knowledge of the basic components (population - land uses - environment), as vocabulary and as rules governing the relationships and interactions between these components, and any change in one of the components of the system is the result of the positive or negative impact of an element or group of elements on changing the structural structure of these components relatively (Faraj, 2021, p. 35).

### *2- Elements of spatial Organizations*

Knowledge of the systems that govern the organizational process of any place is insufficient in understanding the mechanism that works to make that place without understanding the elements that make up the main structure of it, with the importance of analysing the level of homogeneity of those elements and understanding the behaviors and making them measurable, because the main elements that form any spatial organization share relationships and behaviors among themselves in that organic space whose parts and qualities are integrated spatially and functionally despite the difference in the level of limits and degree of influence between them, The variation is a true reflection of the level of imbalance

between the elements of the organization of that place, in addition to being the justification for the state of sequential dependence of the hierarchical functional pattern of the elements of spatial organization (Tamimi, 2009, p. 3).

The organization consists of active elements that are based on the analysis process to find out the mechanism of the organization's work, represented by activities (people's ideas translated into their multiple and different actions and behaviors, as these activities are grouped into groups known as systems that interact according to the nature of each system), interactions (which express the size of the association of each activity with another according to their associations), intellectual and moral guidance (which expresses the internal state of man and society, and is one of the forms of interaction with the environment surrounding the activity), values and standards (people's ideas are represented). The hope they seek, or can be considered as the assumptions that are the standard, ideal form related to the achievement of the population's goals in life, they are the guide of people's behavior). (Al-Qara Gholi, 2004, p. 8), with regard to the division of the elements of spatial organization, which represent a special measurable system within the concept of spatial behavior, whose elements all interact at once, and share a kind of follow-up and measurable behavior, the elements of the organization (Al-Tamimi, 2009, p. 4) are divided into:

- 1- The Hinter Land is the part surrounding the study area, that is, there is an ocean, back or adjacent to the space under study, as well as the part related to events that tend to gather in central systems and in a way that allows easy access.
- 2- Scattering of Locations, which means specialized activities and events that tend to focus and gather in hotspots, nodes or gatherings due to the privacy of the location of the place and the positives it provides.
- 3- Accessibility depends on the interconnection of transportation systems and movement axes that constitute urban development trends.

These elements are organized within a special system subject to measurement according to the concept of spatial behavior (Mahmoud, 2011, p. 29), and that one of the most important problems facing the process of understanding and analyzing any organization is the inability to touch the constituent elements of that organization, which were known as systems, and are felt and seen through the general structure, and this means that the link between the general structure and the systems is a tangible and intangible relationship, and this is what makes it difficult to deal with the group of organizations and their systems, as it is not possible to draw Boundaries between each organization and another (Al-Qara Gholi, 2004, p. 8).

#### **4- *The concept of accessibility***

The concept of accessibility refers to the effectiveness of access to meet the needs within multiple means, and that ease of access is greatly affected by the privacy of the place, people and the nature of activities (Omran, 2012, p. 12), and it is considered one of the important indicators that express the distance and the extent of the link between uses in order to achieve ease of access and movement between residents, We can prepare some of the following vocabulary that shows the features of ease of access that can lie in (the choice of residents, walking pattern and lack of use of cars - reducing the journey time - increasing the proportion of trips that do not depend on the engine, public transport, walking to public transport stations - high frequencies for trips with high access - short-distance travel in residential neighborhoods - easy access to neighborhoods near the urban center for their use

of public transport with the importance of activating transportation on foot more than the suburbs - height Proportion of walking style in mixed-use urban centres with side walkways, transit areas and an enabling environment (Krizek, 2000, p:10-18), In order to achieve sustainable urban stability, the urban transport system must protect the features of future urban environments by creating a system that prioritizes walking and cycling and encourages public transport (Moughtin, 2003, p. 193).

This indicator includes a number of sub-indicators that will be applied in the study area (the city of Kut, which includes 69 residential localities) through spatial analysis, which aims to clarify the method of spatial correlations between events, as it is one of the methods used in measuring spatial relationships (Dawood, 2012, p. 6):

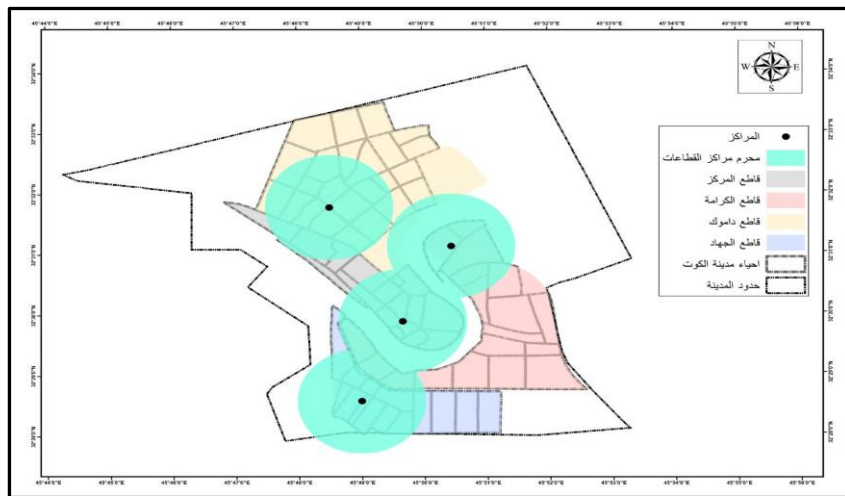
1- Easy access to residential shops centers: This sub-indicator is measured at the first level, considering that 100% of the residents can reach the residential center of the locality and within a walking distance of (400) m, which is travelled at a time rate of five minutes, and when making coverage (Buffer), we found that the amount of coverage for residential shops centers (69) in the city of Kut is (78.5%) of the total areas of residential shops in the figure 1, and it is possible to cover a wider percentage if distributed better, with the importance of pointing to the weak spatial distribution And the functional organization of some residential shops, especially in the shops of Al-Jihad neighborhood, and the need to redistribute events and spatial activities to accommodate the population density in them and provide services in an acceptable manner.



**Figure 1.** Coverage Scope of Residential Shops Centers  
**Source:** Researcher based on field study

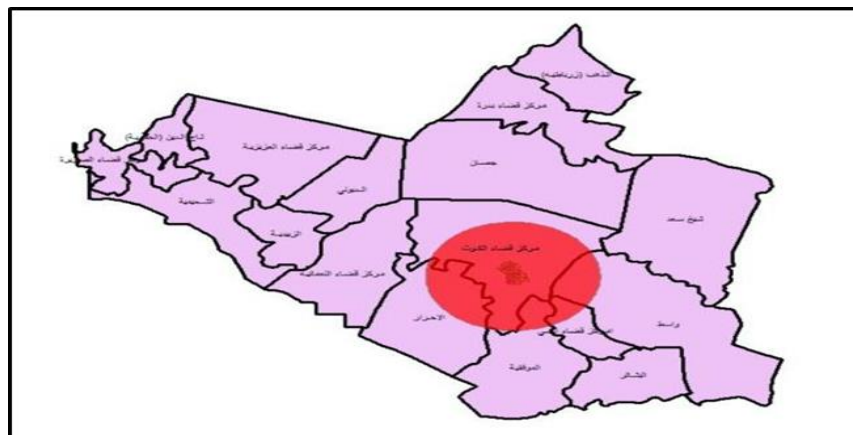


2- Easy access to sectoral centers: The spatial arrangement of the sectoral centers and according to the hierarchy of the city organization comes at the second level, as this indicator can be measured from the possibility of 100% of the residents reaching the sectoral centers and within a distance of 1600 m and the study area includes four sectoral centers distributed two on the northern side (left) and two on the southern side (right), and the service of sectoral centers and according to the approved standards covers 62.25%, of the total areas of the four sectors of the city, and through Figure 2 the imbalance in the distribution of centers is clear Sectors and the need for reorganization and the creation of new sectoral centers that can accommodate the basic needs of the population, especially in the lighting and agricultural sector, and help the uses to provide their functions well and effectively.



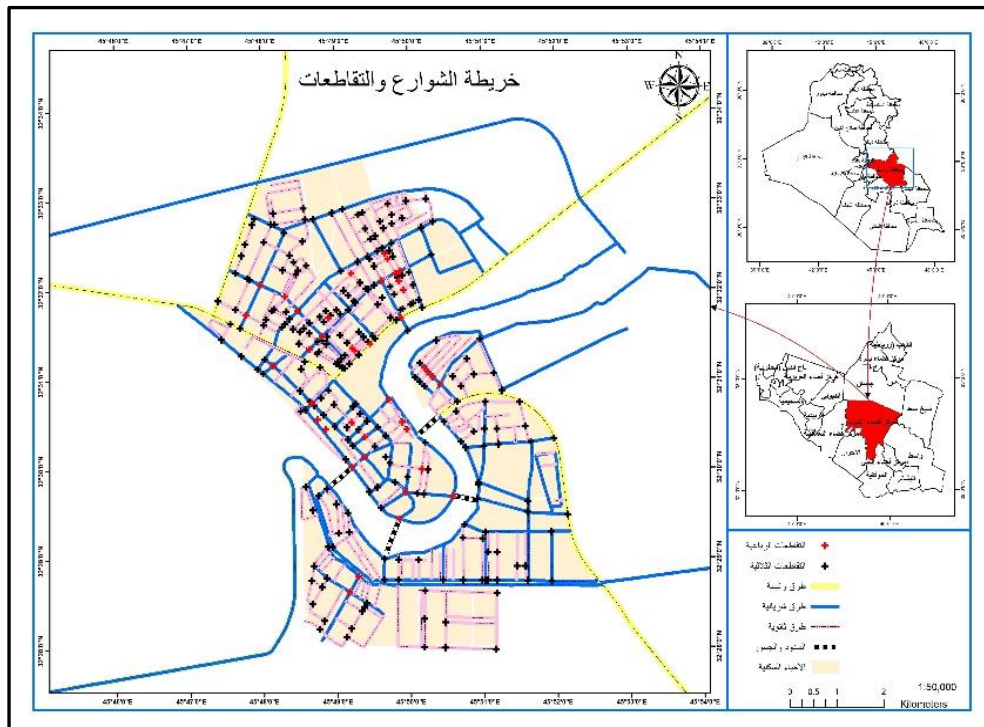
**Figure 2.** Coverage Scope for Sector Centers in Kut City  
**Source:** Researcher based on field study

3- Easy access to the city center: The city includes one major commercial center that cuts in the first sector, in which most government institutions are located, and this indicator, which represents the third level, can be measured by the ability of residents to reach the main city center (Litman, 2003, p: 31) within a distance of 24 km, which can be travelled within 30 minutes using private or public transport, and when applying this indicator to the study area, it was found that the maximum distance to the central business area is 9.4 km, so Accessibility achieved, Figure 3.

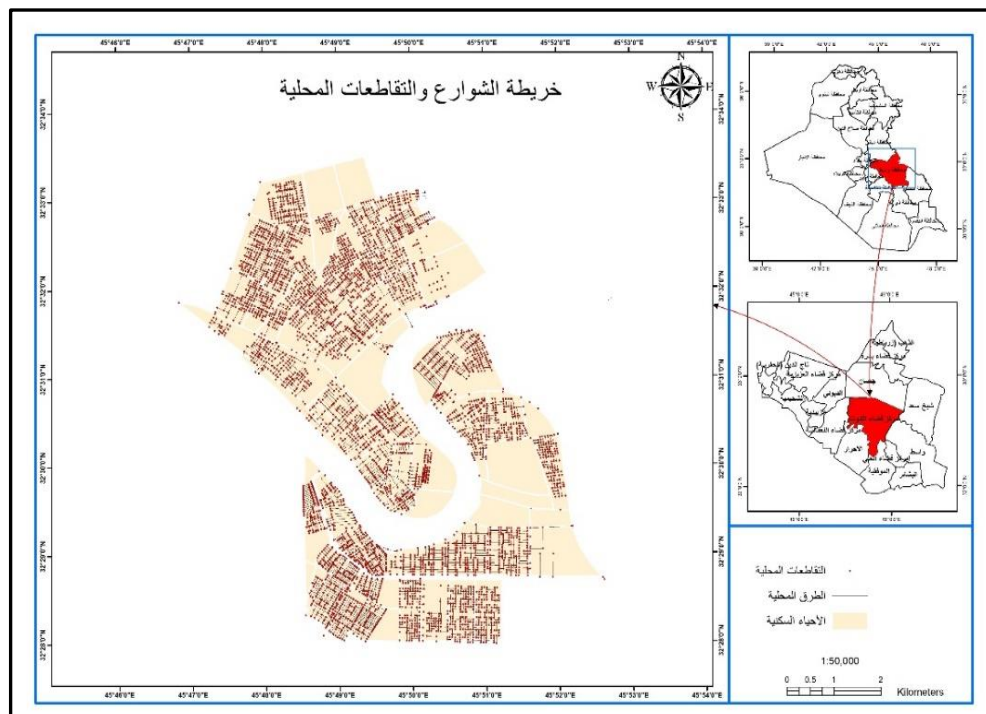


**Figure 3.** Coverage Scope of Kut City Center  
**Source:** Researcher based on field study

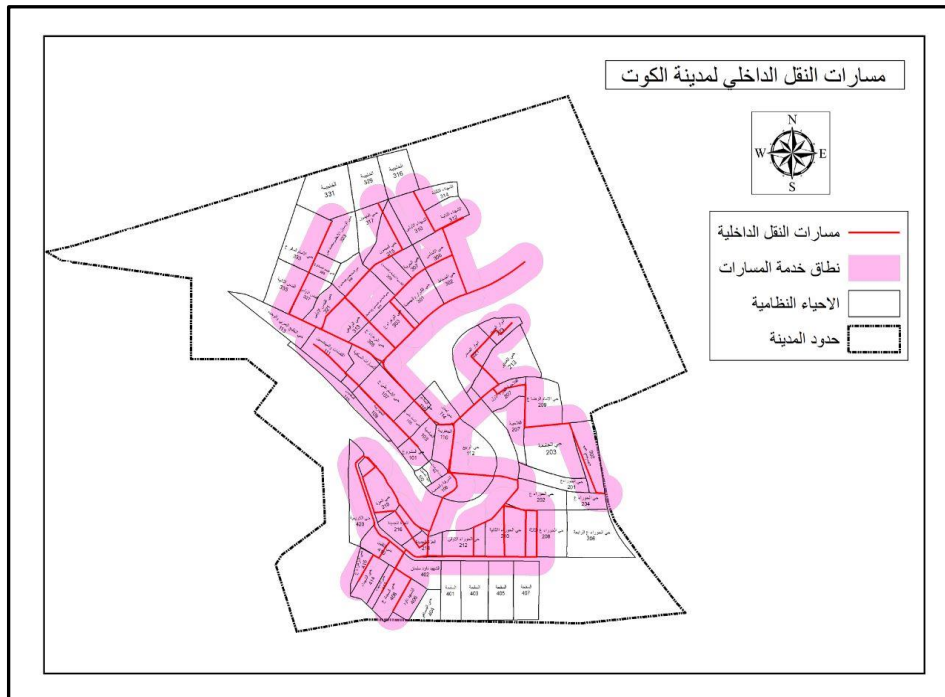
The vocabulary of access facilities within the hierarchy of the city's components (according to the classification and scope of service coverage), which gives a perception of the extent of organization and interaction of land uses, which are within the effectiveness of the urban transport system through the availability of transport stations and the method of their distribution, and through the field survey of the public transport lines of the study area, the stops were (10) and spaced at non-planning distances, including a number of main lines, especially in the Rumaila line and the Damuk line, while the standards indicate according to the guideline for the design of stations Crossing of the Washington, D.C. District Authority (KFH Group, 2009, p: 58) to the need to have (3-4) stations every 1600 m, and the distance between stations (200-600) m, as for the public transportation lines of the study area, The external transport lines were represented in two parts by lines linking with the districts and districts of the province and another linking with the neighboring provinces, and the Kut-Baghdad line represented the highest operating lines in terms of the number of cars, while the Kut-Hay line represented the highest operating lines in terms of the number of cars in transport within the province, while the internal transport lines amounted to 18 lines, where the center line with jihad formed the highest operating lines, followed by the line of Zahra and martyrs, and it is possible that the reason is due to the population density of these areas and the limited income for them and the link Their business with the Central Business District, and the internal lines depend on minibuses (Mini Bus), with a capacity of (11-14) passengers, in addition to very few lines (Rumaila line) that use medium buses with a capacity of (18 passengers), and to know the effectiveness of public transport by determining the coverage range of public transport routes relative to the area of the urban area of the city, as the coverage range (400 meters) was made right and left of the line, where it represents the average distance of access to public transport services, and after using the analysis tools in the GIS program, the coverage rate was (80%), and despite the coverage of most of the city's residential shops, there is a defect in the effectiveness of the public transport system, as a result of weakness in the rest of the elements of the system (at the level of providing comfortable means of transportation and supporting means that encourage the activation of public transport), as the poor public transport services encouraged citizens not to use them and promoted the use of private cars, and the effectiveness and efficiency of the transport network depends on the degree of connection and access to the city network, represented by the extent to which the internal network is linked with the public network along the city limits and the mobility of it through the network access scale, which is calculated by dividing the number of points of connection of the internal network by the area of the urban area, and through field surveys and the use of the GIS program, the number of points Connectivity to the internal network of residential shops with the network of main streets 287 points of contact, while the number of connection points for the local network reached 5802, and therefore the measure of access to the network through the connection points is (178 connection points per 256 hectares), which is a lower value than the limits of the standards (Montgomery, 1998, p: 107) that indicate the existence of (250 connection points per 256 hectares), while the network connectivity depends on the number of intersections divided by the area of the urban area, and therefore through field survey and the use of GIS program, and therefore the network connectivity index is 0.7 While the criteria (Kellett & others, 2009, p: 30) indicate that there should be (1.2-2.5) intersections per hectare, figure 4, 5, 6.



**Figure 4.** Local Streets Network and Quadruple and Triangular Intersections in Kut City  
Source: Researcher based on field study



**Figure 5.** Local Street and Intersections Network in Al Kut City  
Source: Researcher based on field study



**Figure 6.** Coverage of Inland Transport Routes in Al Kut City  
Source: Researcher based on field study

#### 5- Road density

The road density index is one of the important indicators that show the way roads are distributed and their density levels in the city and thus the possibility of evaluating the service provided, as the road density is measured according to the lengths of roads in relation to the population, and the lengths of roads in relation to the area of the urban area.

When applying this indicator to the study area, the results were:

Road density for population = road lengths (km) / Population) (Al-Jazaeri, 2020, pp. 62-95)

$$= 941.868 / 410070$$

$$= 229.68 \text{ km per } 100,000 \text{ inhabitants}$$

Compared to the global average density of 496 km per 100,000 inhabitants, the level of road density is very low in the urban area.

Road density in relation to area = road lengths (km) / urban area (km<sup>2</sup>)

$$= 941.868 / 87.31$$

$$= 10.79 \text{ km per } 1000 \text{ km}$$

Compared to the global average density of 105 km per 1000 km<sup>2</sup>, the level of road density relative to area is very low in the urban area.



### 6- *Floor Area Ratio*

The building density is represented by the floor coverage rate and the ground coverage rate, and the term building density ratio rate or the rate of use of the land, which represents the ratio of the size of the buildings, which is defined as the total area of all floors relative to the land area, which is calculated from the built area of the ground floor multiplied by the number of floors allowed and divided by the total land area, while the ground coverage rate represents the ratio of the ground area to the area of the separated plot of land, from the field study and communication with the Directorate of Urban Planning and the Directorate of Kut Municipality, the residential neighborhoods were classified according to their shops and the mechanism of secretion followed into four categories, where the ground coverage ranged between one floor, one and a half floors and two floors in most residential shops, and therefore the floor coverage of the first category and the smallest area detached (less than 100 m<sup>2</sup>) (1.65), while the second category with an area of (100-200) m<sup>2</sup> achieved ground coverage (1.5), and the third category (201-300) m<sup>2</sup> achieved ground coverage (1.3), while the second category with an area of (100-200) m<sup>2</sup> achieved ground coverage (1.3), while Category IV (greater than 300) m<sup>2</sup> ground coverage (0.80), Table 1.

**Table 1.** *Floor coverage rate in Kut City*

| <b>Secretion Categories</b>  | <b>Floor Coverage</b> | <b>Rate Standard</b> |
|------------------------------|-----------------------|----------------------|
| Less than 100 m <sup>2</sup> | 1.65                  | 0.75 – 0.90          |
| 100-200 m <sup>2</sup>       | 1.5                   | 0.60 – 0.80          |
| 201-300 m <sup>2</sup>       | 1.3                   | 0.45 – 0.65          |
| Above 300 m <sup>2</sup>     | 0.80                  | 0.39 – 0.45          |

**Source:** *Researcher based on field study*

As for the ground coverage and through the field study and classifications of residential neighborhoods according to their shops and the mechanism of secretion followed into four categories, where the ground coverage ranged between one floor, one and a half floors and two floors in most residential shops, and therefore the floor coverage of the first and smallest category was a detached area (less than 100 m<sup>2</sup>) (0.88), while the second category with an area of (100-200) m<sup>2</sup> achieved ground coverage (0.82), and the third category (201-300) m<sup>2</sup> achieved ground coverage (0.76), while the fourth category (greater than 300) achieved M<sup>2</sup> ground coverage (0.55), table 2.

**Table 2.** *Ground Coverage in Al Kut City*

| <b>Categories of secretion</b> | <b>Ground coverage</b> | <b>rate Standard</b> |
|--------------------------------|------------------------|----------------------|
| Less than 100 m <sup>2</sup>   | 0.88                   | 0.75                 |
| 100-200 m <sup>2</sup>         | 0.82                   | 0.65                 |
| 201-300 m <sup>2</sup>         | 0.76                   | 0.60                 |
| Above 300 m <sup>2</sup>       | 0.55                   | 0.50                 |

**Source:** *Researcher based on field study*

### 7- *Proximity:*

The compact urban environment is considered one of the best sustainable urban environments, as the compact urban form is the most applicable model for achieving the pillars of sustainability, and this is achieved through the method of spatial distribution of land uses through the pressure of the built environment, and reducing useless urban expansions, this indicator is closely related to densities and can be calculated by the equation

of the inclusion index (Min, 2010, p6) and after applying the equation it was found that the inclusion index is equal to (0.10), which is of a low value, as whenever the value of the index increases (which ranges from 0-1) this indicates a high inclusion in the urban area, and the low index is due to the fact that the residential neighborhoods in the city have specific heights (one and a half to two floors), and the multi-storey buildings (most of them are low and medium heights), and thus the trend towards Horizontal expansion, which leads to the need for large areas for the purpose of covering the future residential and service need in light of the residential increase.

When applying the mixed land use index (this indicator expresses a methodology that includes mixing multiple and diverse land uses and making them close to each other and allowing increased mixing between sectors and public land uses or activities that work in a complementary manner) on the total urban land uses of the study area, we find that the amount of its value achieved (0.60) and thus it is within the sustainable value, as the basis in the process of mixing uses or activities within its formative concept of interaction and convergence is the formation of an effective complementary system that serves Population requirements and utilization of the refresher tools created by mixed use.

As for the diversity index (the diversity of housing units in terms of the type of housing units or their areas is one of the indicators of sustainable land use planning) and through the field study, the dominance of horizontal housing is clear on the type of housing units in the city of Kut, as horizontal housing constitutes 98.2% of residential use compared to 1.8% for vertical housing, and when applying this indicator to the total areas of housing units for the divided categories of the study area, the value of the diversity index was (0.68), i.e. within the sustainable value of the diversity of unit areas. Residential while the dominance of horizontal housing is evident at the expense of vertical housing.

## **Conclusions**

- The elements of spatial organization of urban land uses that are most influential and contribute to the effectiveness of land use and the sustainability of urban life.
- The functional relationships of urban land uses are organized according to a special system that needs to be studied, analyzed, understood and known in the spatial organization of them according to spatial and temporal dimensions and economic, social, environmental and urban characteristics to reach the sustainable concept of land uses.
- The importance of spatial distribution of the population, land uses and road network in accordance with the standards and the concept of competition, spread and spatial integration to ensure the order of social behaviors within the preferences of society and the activities of each system.
- The process of controlling urban events and functions lies in the ability of uses to meet services and cover current and future population needs.
- The way residential shops are distributed in some sectors has led to an imbalance in the ability of these shops to meet the different basic needs of citizens.
- The distribution and organization of service sector centers has created a clear lack of coverage of large parts of the city and the possibility of providing community services.
- The residential shops in the study area vary in terms of the mixed land use index and the cadastral diversity index, and when applied to the total urban land uses of the

study area, we find that the amount of its value achieved (0.60), (0.68) respectively, which is within the sustainable value.

## **Recommendations**

- The need to conduct detailed studies of the functional interactions of land uses and work to absorb the active variables in them and their linkages, and to direct and benefit from them in the sustainability of uses.
- The need to move towards high and medium densities, diversity in residential uses and area, mixed use, and compactness of urban land uses to ensure sustainability.
- The presence of residential shops with good indicators in achieving sustainability, which requires preservation, enhancement and support.

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