

Assessment of Urban Spaces of Mixed-Use Areas and Their Role in Achieving Social Sustainability in Closed Urban Communities in Greater Cairo

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Abstract - The spatial formation of multi-use urban areas is one of the main reasons for the emergence of some positive or negative social phenomena among the population in Egypt, where the value of the urban space lies in the total social and cultural relations that arise in it and its ability to create opportunities for interaction between a different group of individuals. Hence, this research discusses the concept and evaluation of urban spaces in terms of the positives or negatives of multi-use areas and their role in achieving social sustainability in closed urban communities in Greater Cairo. Therefore, the study aims to evaluate mixed-use urban spaces, from a functional and social perspective, which is a tool to increase the social sustainability of urban communities in general and closed mixed urban communities in Egypt in particular. So that some conclusions and recommendations can be made on how to establish for mixed-use lands as a basic approach in sustainable urban development.

This paper deals with many important axes, the first axis deals with the urban space, the most important concepts, foundations and standards necessary to design a sustainable urban space. The second axis deals with the mixed-use in terms of concept, historical development, positives and negatives. While the third axis deals with social sustainability in terms of concept, theoretical background and its elements. The fourth axis deals with the criteria and principles presented from the perspective of Habitat Organization to assess the overlap of mixed land uses (in Al Rehab and Ashgar Cities) and measure the success of many variables such as, mixed land use, urban spaces and social sustainability in these cities to reach the interrelationship between these variables. Where the research proved a direct relationship between these variables, the greater the percentage of multi-use urban spaces, the more social sustainability.

Keywords: spatial formation; mixed-use; social sustainability; closed communities.

1. Introduction

The need for a greater mix of land uses, by integrating residential, commercial, civic and recreational uses, has become a common trend in urban planning [1]. In fact, manuscripts believe that the use of mixed-use urban spaces is a very important component of the urban development model in new communities and sustainable urban development models [5,4,3,2]. Overlapping land use is popular in many urban planning concepts around the world [6&7&8]. One of the most important criteria and foundations were presented through Habitat Organization 2014 for the concept of mixed land uses, in addition to the principles and indicators to determine the characteristics of overlapping land uses that must be applied in new residential areas to achieve the dimensions of sustainability represented in achieving maximum efficiency for land use as follows:

- 1) Access to social justice by creating different housing styles.
- 2) Economic recovery.
- 3) Encourage the development of neighborhoods based on increasing the pedestrian paths then reduce the use of motorized traffic.
- 4) Creating a connected and safe road network that facilitates movement between the different uses.
- 5) Achieving self-sufficiency in services, which reduces frequency for surrounding service centers.

The study aims to evaluate the relationship between the percentage of multi-use urban spaces, achievement of social sustainability, as well as identify the negatives and positives issues, then review the results and recommendations on how to establish the principle of urban spaces for mixed-use lands as a fundamental approach in sustainable urban development.

2. Urban Space, Mixed Use and Social Sustainability

2.1 The first axis is the urban space; the most important concepts and foundations necessary to design a sustainable urban space. The concept of urban space, all spaces between buildings are urban spaces that are geometrically and aesthetically related to the different types of facades surrounding the space, which helps human consciousness to perceive the external space as an urban space. (Krir, 1981).

The urban space is one of the elements that affect and are affected by the social and economic content of urban communities, which qualifies it to represent a social value and an economic resource as a dynamic element active in cities and embodies the types of reciprocal interactions of influence between the environment and humans, Figure (1). The design of urban spaces is related to users, functions and activities that they carry out, as well as the urban formation of the space, which has a significant impact on the feelings and reactions of humans and controls the proportions, forms and scale of the space in determining the extent to which it is contained, there are many forms to contain. The research deals with the relationship of humans with urban spaces and the extent of its impact on social sustainability. That is, the urban space is the final form of the relationship between man and the things he perceives.



Figure (1): Public squares and parks that represent social life in the urban space, Source - <https://pin.it/2A6DGBf>

The importance of the urban space: Urban spaces are the direct interface of architecture and urbanism and one of the most important components of the city and a major axis of development, the importance of urban spaces can be summarized as follows:

- 1) The urban space is concerned with the relations between new and existing urban areas in the field of socially, politically and economically available requirements and possibilities and the relationship between the movement and its various forms to urban development.
- 2) The urban space is the measure of public life and mixed social life outside housing, in streets, squares, large parks, social spaces and market squares, and this life is often in the open space of the city in a mixed-use area where users gather in these spaces.
- 3) Urban space is the visual expression of planning and direct return to the aesthetics of urbanism, the environment, the visual and specific formation of activities and uses, and their impressions in humans' minds.

Design of urban spaces: Urban design takes its features from the overlap of architectural design and urban planning, derives from architecture the idea of spatial formation and visual formation such as balance and structural unity, and derives from urban planning a sense of the surrounding spaces and the activities that occur in them.

Standards for designing urban spaces: There are design criteria that determine the relationship between the human and the surrounding place at different levels, through which the work can be evaluated first hand until the design done in its final form, namely: effectiveness, permeability, diversity, induction, subjective personality, richness, visual suitability (Figure 2).

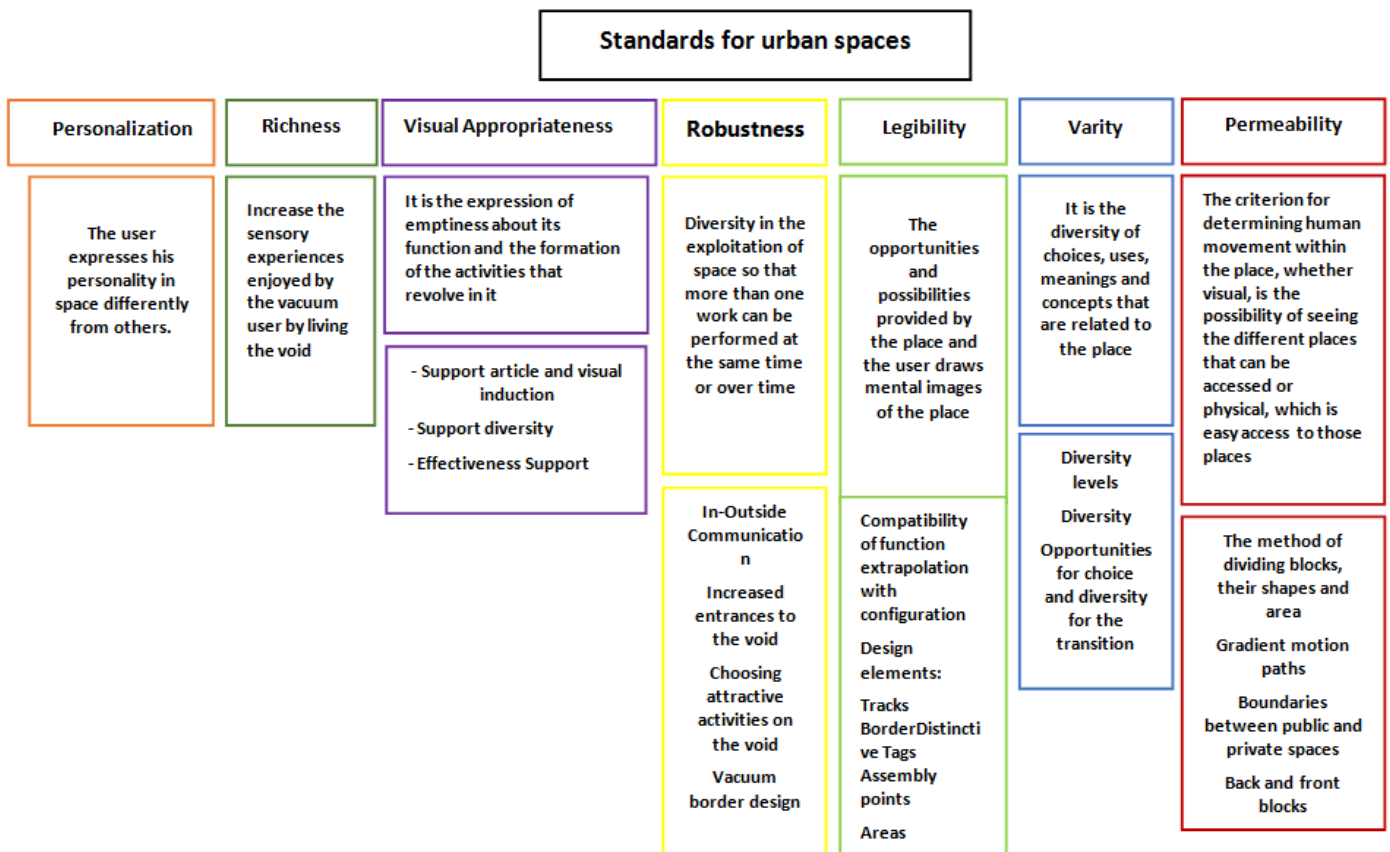


Figure (2): Standards for Urban Spaces design

Urban spaces types

Public space: in which different types of people are present for multiple and general purposes, as it is allocated to practice various activities in markets and multi-use areas.

Semi-general space: in which there are different types of people, for multiple purposes.

Semi-special space: in which there are different types of people, for a specific purpose (Figure 3).

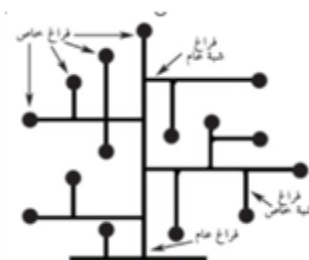


Figure (3): Types of urban spaces within the urban fabric

2.2 The second axis, the mixed-use in terms of concept, historical development, positives and negatives

The concept of mixed-use: Mixed use of land has many concepts, but these concepts combine to show human's direct interest, activity and interaction with the surrounding environment which defined as: "the actions carried out by human on a certain area of land using his natural resources by exploiting the best human potential." It is also defined as: "Human's need for land to live or use it for other life purposes and increase housing on it", or it is " facilities that used by a group of people for the purpose of obtaining their basic needs for mixed land use, it refers to a mix of many types of buildings having different uses in the same public location. For example, there may be a mix of homes located near offices, shops, cinemas, schools and cafes, parks and transport

stations. Some describe it as inconsistent land use in geographically limited areas and usually involves residential, commercial, institutional, industrial, recreational and agricultural land uses. Mixed land use is divided into two types, horizontally or vertically as shown in Figure (4, A & B).

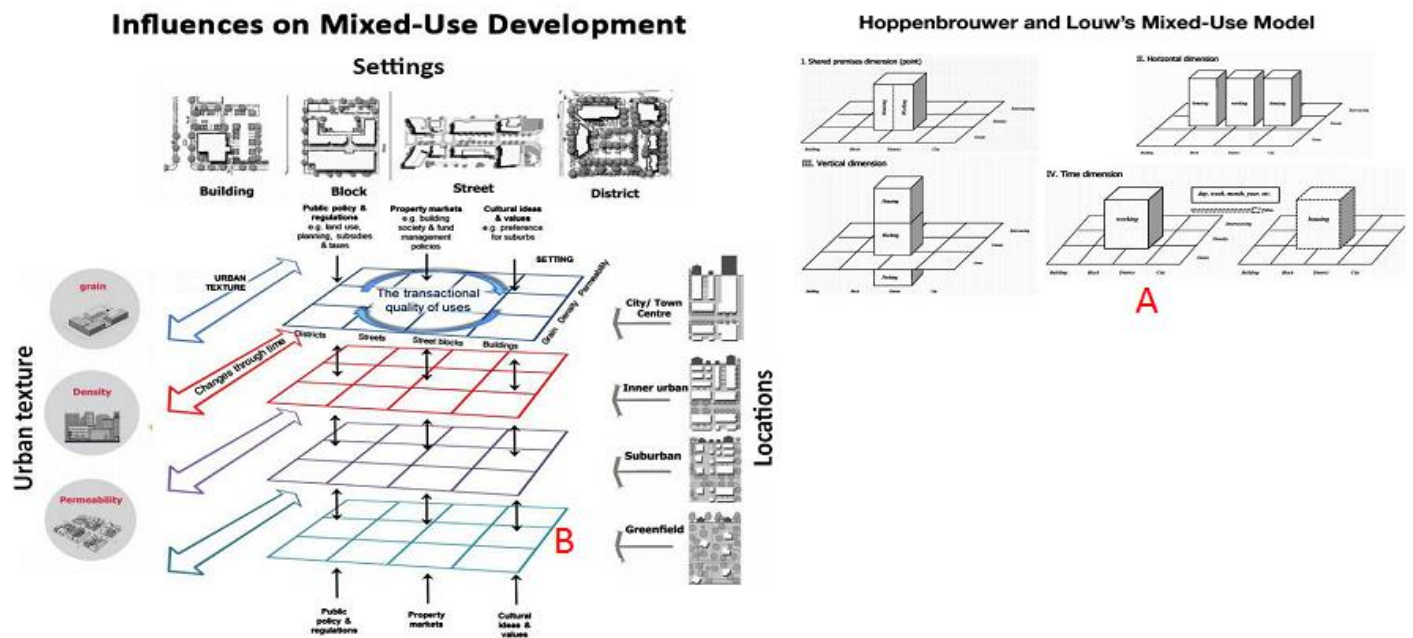


Figure (4): (A) The concept of mixed development in the vertical direction (After Rowley, 1996), (B): The concept of mixed development in the horizon direction after Hoppen Brouwer & Louw, 2005

Historical background of the concept of mixed use (within mixed communities): There are many questions that cause disagreement among researchers. While some of them defend and promote the idea of mixed use, others urge separation of uses due to the negatives resulting from mixing uses. Hence, we will review the historical development of the idea of multiple uses in order to identify its current situation, which can be summarized in the following points:

- 1) From (3500 BC to 1000 BC) ancient civilizations emerged (Mesopotamian cities - ancient Egyptian cities - ancient Greek cities). These cities were based on segregation of uses, while services centered around the religious element and then the areas designated for residence.
- 2) From (700 BC AD - to 1900 AD), Roman cities were the beginning of the emergence of mixed use. Non-residential use became widespread on horizontal and vertical axes scattered across residential areas and then the idea developed in medieval cities. While cities relied in their planning on the idea of mixed use and the convergence of a set of services with each other. Since there was no ownership of cars at the time, resorting to the idea of mixed use was necessary to achieve the forms of alternative to transportation.
- 3) With the advent of the industrial revolution (1750-1850), problems of mixed use began to emerge.
- 4) From 1910 to 1900, after World War II and with a dramatic increase in car ownership, a mass migration from central cities to the suburbs began in search of life in the new cities. The idea of separation of uses was adopted due to the negatives resulting from mixing uses, and thus an increasing dependence on cars emerged.
- 5) From (1960 – early 1970), mixed uses began to re-emerge as a performer of the revitalization of major urban areas, as well as major mixed-use projects and mixed-use development.
- 6) In the late seventies and until the end of the eighties (1970-1980), mixed use was returned as a rehabilitation fee in degraded areas.
- 7) From (1990-2000) the use mix was emphasized as one of the principles of contemporary planning, as well as a key element in the design of sustainable housing principles of neighborhood and smart growth 5
- 8) From the above, we conclude that at the moment there is a call for a return to mixed use as a key element of sustainable planning and smart growth.

General Traits features of the mixed-use of urban communities

In this research, we focus on the general traits due to their close association and direct impact on achieving social sustainability. Mixed-use lands are characterized by a large number of features, including:

- 1) The type and functions of land use that will be mixed (residential, commercial, cultural, and recreational).
- 2) High population densities (versatile pattern vertically or horizontally).
- 3) High rates of services and percentage of buildings (high-rise or low-rise buildings).
- 4) Access to public transport, walking, and cycling to socialize and bring different segments of society closer together. Especially if there are sidewalks and other bicycle paths.
- 5) Number of land uses, diversity, mix of buildings, accessibility of commercial areas and average street length.

Positives and negatives of overlapping uses in urban communities:

First, the positives: Mixed uses have a lot of positive advantages for urban communities:

- 1) Adaptation of the structural output and the need to take into account that there is flexibility in planning to allow changing uses.
- 2) The speed of circulation of housing and trade rates due to the presence of tenants near the work place itself.
- 3) Increased safety due to mixed uses that allow working long hours during the day.
- 4) The presence of urban spaces that improve the standard of living, streets are vitally moving through the diversity of activities.
- 5) Efficient use of infrastructure, more efficient use of land and reduced dependence on transportation.
- 6) Easy access to various facilities, increasing energy efficiency and increasing the efficiency of the use of urban spaces and buildings, enhancing pedestrian and bicycle movement, which many people consider a growing social phenomenon that falls under urban planning policies and considerations (Figure 5, A).

Second, the negatives: The disadvantages of mixed land use relate to a set of the following considerations:

- 1) Overlapping of different uses and residential areas, leading to a source of air pollution within communities.
- 2) Various uses lead to pollution (i.e., environment and noise) within the urban mass.
- 3) Lack of specificity in some mixed-use communities.
- 4) Reduce affordability options, especially for middle- and low-income residents. This is because many mixed land use development projects are located in the denser and already more expensive areas of cities.
- 5) Excessive reliance on zoning for individual use, reduces social diversity of housing (apartments and multi-family units), giving priority to single-family homes (villas). (Figure 5, B).

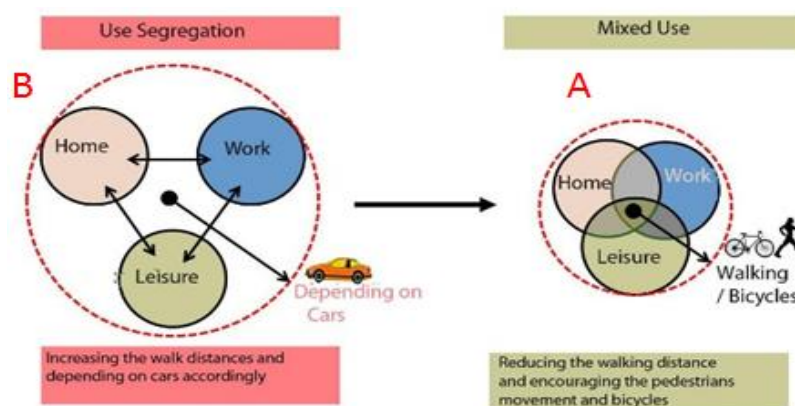


Figure (5): The impact of mixed use on everyday life, Source: (Nabil, & Abd Eldayem, 2015)

2.3 The Third Axis: Social sustainability in terms of concept, theoretical background and its elements

The concept of sustainable development: Sustainable development is a development that meets the needs of the present without compromising the ability of future generations to meet their own needs." According to the definition of the Brundt land

Commission (1987). Achieving sustainable development requires harmonizing four main axes: economic growth, social growth, environmental protection (environmental sustainability) (Figure6) and institutional dimensions. These axes are interrelated and essential to the well-being of individuals and communities. To this end, opportunities must be created for all inequalities are reduced, basic standards of living are raised, equitable social development, social inclusion are supported, the promotion of integrated and sustainable management of natural resources and ecosystems.

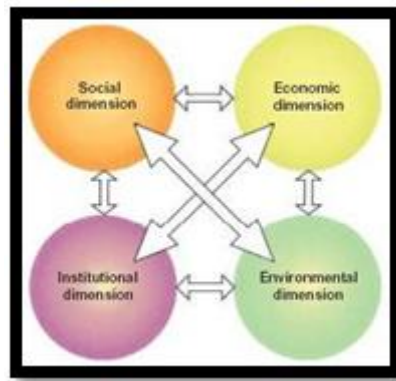


Figure (6): Sustainable development and its social, economic, environmental and institutional dimensions

The concept of social sustainability:

It is known that the term or concept of sustainable development in the report of the Portland Commission known as "Our Common Future" in 1987, to denote development that takes into account the future dimension and the right of future generations to the environment and natural resources available to meet their needs, and this has led to the restructuring of development processes at various levels (International, regional and local) to suit the frameworks of sustainability, and therefore attention has been focused on the development of urban communities in a sustainable manner. Social sustainability has become its constitutes a real challenge to the issues of urban development specially in increasing population growth in mixed-use urban communities, and perhaps the most complex levels of sustainable development are those related to the social level because they are related to the composition of the continuous expansion of religion, namely (the city) on the one hand, and on the other hand, the urban and social level constitutes that the link with the rest of the spatial levels and the starting point towards it, so the urban development has become a tool for achieving social sustainability, which can be defined based on the foundations of sustainability (environmental, social, economic and institutional).¹

Theoretical background of social sustainability:

From an environmental point of view, urban sustainability means organizing the development processes of the city without excessive reliance on its rural backer with natural resources, and this means its dependence on alternative and renewable energy sources to reach a reduction in its environmental footprint with less production of pollutants, more efficient use of urban land, and greater adoption of recycling operations, thereby reducing the city's contribution to climate change.

From socially view, urban sustainability means the practical application of community planning to ensure longer-viability, better quality of life and sustainable self-sufficiency urban systems so that development processes do not exceed the limits of absorptive capacity and the ability to replenish the natural system of that society.

In economic terms: It is a measure of the extent to which environmental and urban development methodologies, policies and plans meet the needs of urban society. In addition to, the extent in which the methodological means used by the contributing parties, including central and local authorities, the private sector and civil society organizations, which are able to communicate and disseminate individual successes achieved in service sectors such as education, housing, urban community development and basic urban services.

¹Muhammad Ali Al-Anbari, Hiam Hamid Abdul Majeed, Selection of the Urban Sustainability Indicators Set for Hilla City, Journal of Engineering and Sustainable Development, Volume 30, Issue 20, 2016.

Institutionally: It is the administrative methodology that provides the city has procedures and policies that determine the manner in which development processes are efficiently managed. Governance sets the framework for ethical decision-making and ethical procedures for management within the city based on transparency, accountability, and clear roles defined for employees. Emphasizes user performance monitoring, reporting, development, improvement recesses, business procedures. Thus, it can be said that urban sustainability is a state of balance and reformulation of the environmental, economic, social, political and institutional determinants and objectives of the city, which provides a greater opportunity to achieve sustainable urban development, and thus urban sustainability combines in fact the sustainability of natural resources with technical, financial and societal sustainability and the institutional structure of that city under the shadow of sustainable urban development.

Aspects of social sustainability of mixed-use communities

First, the physical aspect of social sustainability: The built environment of residential communities is the physical environment in which a person lives and provides his needs. Which includes three dimensions of components: the planning dimension, the urban dimension, and the architectural dimension:

Planning dimension: Creating the appropriate climate that allows communities to find the necessary means to achieve an adequate living framework for their residents, to provide comfort and well-being within residential areas. It specializes in the study of land uses, site planning, and design of infrastructure projects.

Urban dimension: Part of city planning those deals with urban formations. It specializes in studying the visual composition of the built environment from buildings, spaces and landscape elements.

Architectural dimension: A term that focuses on the building as a single unit and includes technological development and the fulfillment of human needs. With the aim of making the building combine utility, stability and beauty in line with human behavior and technological development. It specializes in the study of the exterior and interior design of buildings.

Second: The moral aspect of social sustainability: The main supporter of the moral aspect of social interactions, such as; the concept of neighborhood, which is the interaction between residents who live next to each other or in the same residential block, or as the form of behavior that is followed in interactions between neighbors, and the concept of social coincidence, which is informal social contact between residents who do not know each other and not neighbors. The concept of community participation is interaction in community issues or sharing in community problems and related activities.

The role of applying the mixed land use approach in achieving the principles of sustainability for residential areas

Due to the fact that separate land uses have caused the waste of land value in addition to some environmental repercussions and consumption in basic and social and economic facilities, which led to the adoption of the idea of mixing land uses by many international studies and experiences due to its role in achieving the various dimensions of sustainability, which can be explained in the following table (1).

Table (1): Achieving the principles of sustainability for mixed-use lands in urban communities. Source: UN-Habitat, “A new strategy of sustainable neighborhood planning”, 2014

Sustainability Dimensions		The role of applying the mixed land use approach in achieving sustainability
principles of social sustainability	1/ Health returns to the population	Depending on walking and using bicycles and minimizing the use of cars (2001 Angotti and Hanhardt)
	2/ Equality and diversity	It is achieved by providing different social classes within the same residential area and providing job opportunities and services for different income levels. Berube 2005
	3/Safety & Security	The overlap between uses leads to the constant presence of residents or visitors to the activities and services in the residential area throughout the day and thus achieving safety and security within the residential area (Brandes et al., 2010).
	4 / Reduce trips for services and work	Allowing mixing between residential and non-residential uses helps to have most of the services and work areas within the residential area without resorting to the most remote areas and thus reduce the number of trips leaving the residential area (Charles, 2005)

	<p>5/ Adaptation, interaction and a sense of belonging</p>	<p>The ability to adapt and sense of belonging increases with the availability of different types of housing and different spaces within the same residential area, which makes the same family move with those patterns based on the change in their requirements during different age stages (Berube, 2005).</p>
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2.4 The fourth axis: The criteria and principles presented from the perspective of the Habitat Organization for the applied of overlapping mixed land uses (case study of the cities of El-Rehab and Ashgar City)

In view of the criteria and indicators set by the habitat (2014) to determine the characteristics of overlapping land uses that must be applied in new residential areas to achieve the dimensions of sustainability represented in achieving the maximum possible efficiency of land use. The following are the most important of these criteria and indicators:

First criterion: planning of the road network suitable for mixed-use residential areas

This principle was based on identifying the most important characteristics of the road network and pedestrian paths that help support the application of the principle of interference in land use, and these characteristics are:

A) Proportions and lengths suitable for automatic movement methods:

Allocating sufficient areas of roads and streets with high design efficiency that enable the presence of a variety of activities on them with high density and make them neighborhood streets in the residential area, so that roads and waiting areas must occupy at least 30% of the entire land area in the residential area, and this percentage increases in commercial centers and mixed uses (40: 60%).

B) Walkability Promote Idea:

Supporting the idea of providing pedestrian movement paths in the residential area and trying to reduce the use of cars by allocating pedestrian and bicycle paths in a way that achieves comfort and safety for their users, creating landscapes, creating barriers between automatic movement paths, parking lots and pedestrian paths. Marking the pedestrian paths and linking these paths to vital non-residential uses, as well as linking them to public spaces, as well as linking them to the public transport routes and its assembly points, (Figure 7).

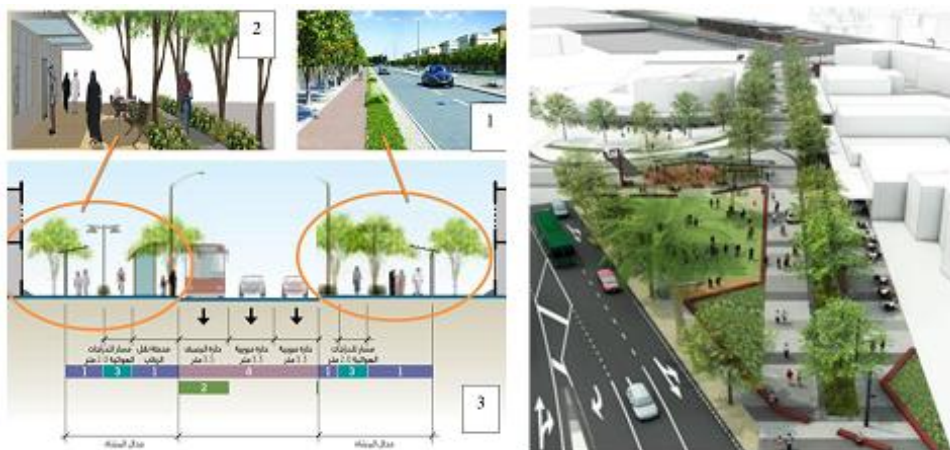


Figure (7): Pedestrian paths characteristics within the residential area

C) Gradation in the arterial road network and local streets:

It requires that the gradation in the road network according to the difference in the volumes of traffic on the roads so that the internal roads are the lowest in traffic volumes, and the distance between the two arterial roads must range From 800 to 1000 meters, which determines the size of the residential neighborhood, and it is preferable that the distance between the two local roads within the neighborhood should be 111 meters, in addition to the need to identify different development patterns of open spaces, service areas and activities in a main road network in order to improve access to them (Figure 8).

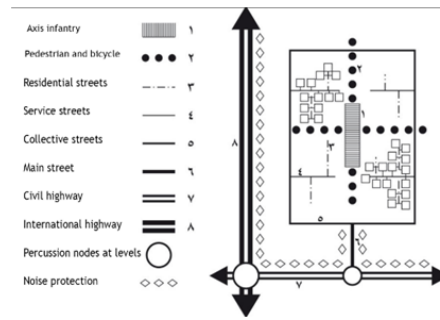


Figure (8): Gradation in the network of streets and roads in cities

D) Encouraging the use of public transport in the residential area: Public transport

This caliber aims to reduce the use of private cars and congestion on the roads and that the stations of these means are at an appropriate distance from the residential area, minibus stops should be 200 meters away and buses and metro lines should be 300 meters away, while the parking lots of Railways can be found at distances beyond 1km. (Figure 9)



Figure (9): Encouraging the use of public transportation in the residential area. Public transport routes in Oradea, provided by O.T.L. (realized by the authors in ArcGIS Online) Romania

E) Linking the entrances to residential buildings and the elements of the road network:

It requires the presence of at least one entrance to residential buildings on the axes of the main roads that overlook them with the presence of rear waiting places, the entrances to the buildings, the path of automatic movement and waiting places must be separated by allowing them to be linked to pedestrian paths as shown in (Figure 10).

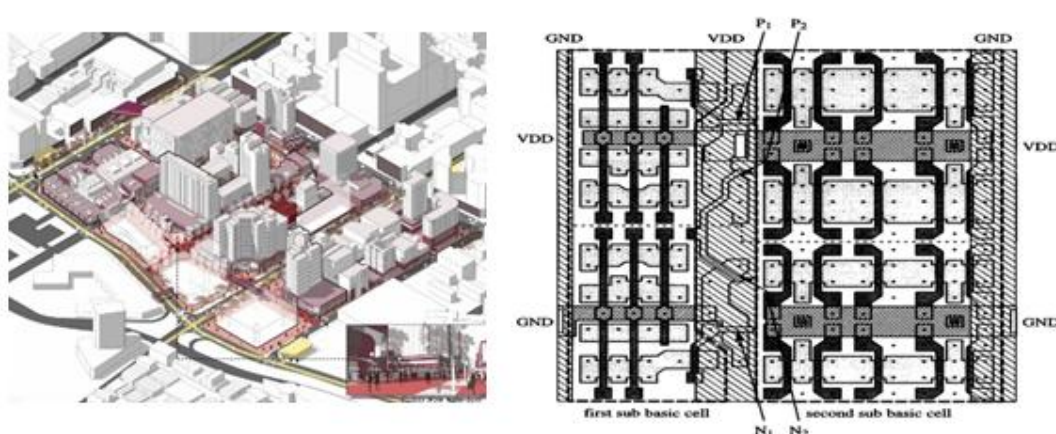


Figure (10): Relationship of building entrances and road network elements

The Second criterion: Appropriate population density in the residential area

Mixed urban communities must have a high population density of 140people /acre, since the population density reflects the demand for services and activities through which a balance is achieved between demand and supply and satisfies the material and moral needs of the population through diversity in activities and services in the same residential area. By determining the appropriate population density, a set of other returns are achieved, the most important of which are: Land use efficiency, reducing the costs of obtaining public services, the possibility of providing most services due to the presence of a population that allows this working on the efficiency of using energy and resources available in the residential area. (Figure 11)

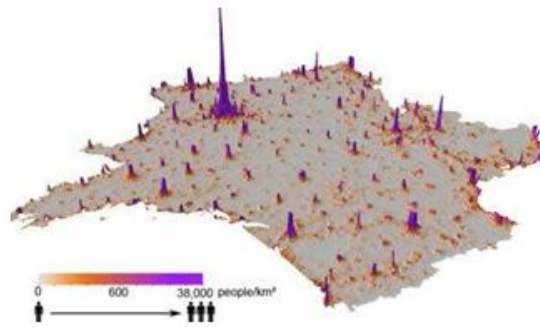


Figure (11): Relationship of Population Density to Exploitation Area

The third criterion: proportions and types of interference in land use, including:

A) Percentage of overlap in the use of residential land based on the size of the diversity and mixing of the unit and the value of the density of non-residential uses, which is calculated by the total area of the units for activities and uses on the total area of the building.

B) The different conditions allowed for overlap between residential and non-residential uses: The principle of overlap in land use is achieved through spatial convergence between residential and non-residential uses horizontally or vertically. Horizontal or vertical overlap pattern takes several permissible forms Figure (13&12), in the case of vertical mixing, the residential use must be on the high floors or on the ground floor, and when it is located on the ground floor, its percentage should not exceed 50% of the ground floor area.

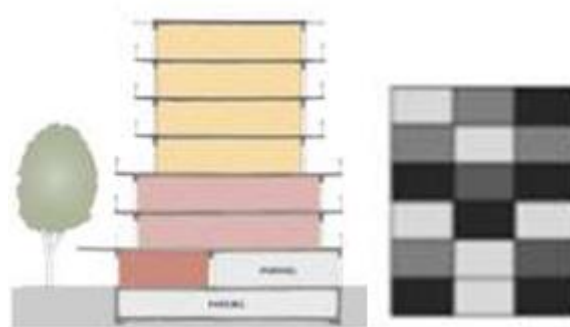


Figure (12): Horizontal Overlap Patterns

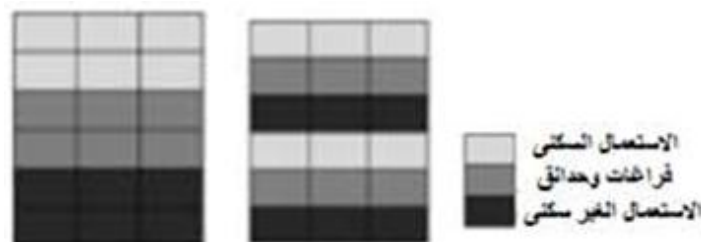


Figure (13) Vertical Overlap Pattern

C) The type of non-residential uses to be available:

The integrated overlap process requires the provision of most of the services needed by the population, which are (shops, companies, retail trade, restaurants, recreational services, sports areas, schools and health and security services (some non-residential uses are allowed to overlap vertically with residential use such as companies and offices - retail trade - restaurants - Cafeteria- Some recreational services for the residents, and do not cause negative effects on it.

D) Percentage of spaces and waiting areas:

The overlap of land use requires the provision of public spaces in which a range of social, cultural and recreational activities and waiting places for various means of transportation appear, in addition to their willingness to accept additional activities, as for waiting areas, 60 meters of ground space must be allocated for each building in addition to what is provided outside the buildings in public spaces. And to reduce the land areas that need to be allocated to places. it is possible to create complex waiting areas in which more than one share the use of Figure (14) or resort to waiting on one of the sides of some roads according to the characteristics of each road and the volume of movement expected in it, Figure (15) or allocate places for waiting outside the roads. In the case of allocating land for waiting areas, it requires its presence behind or next to buildings, in addition to not being located at road intersections.



Figure (14): Combined parking space locations



Figure (15): Road parking lots

E) Social dimensions and their relationship to changes in the spatial composition of mixed communities

Urban spaces are considered the direct interface of architecture and urbanism and one of the most important components of the city and a major axis of development, from the most important foundations and objectives that are taken into account when designing and forming the urban space in mixed-use communities, which are: the Figure, type, size and proportions of the space and the gradation of spaces, feelings within the space and space activities. While the visual aspects are represented in the spatial sequence, visual perception of spaces, attention to the elements of site coordination. Table (2)

Table (2): Levels of achievement of the objectives of forming urban spaces in mixed communities

Objectives and foundations of the urban space stemming	Emptiness is done in harmony and sequence
	Physical and moral containment of urban spaces
	Linking commercial spaces with public urban spaces and squares
	Prioritize pedestrian spaces and make car spaces enablers
	Attention to spatial elements with visual impact and maintaining guidance to and from them
	Taking into account the design of urban spaces to work 24 hours a day with movement and various activities
	Create some spaces with a specific function
	Taking into account the integration of the urban space with the surrounding built block, with great attention to coordinating open spaces and gardens to create an integrated spatial structure
	Spaces are formed according to actual needs with the study of modern techniques for designing space as a place of daily life
	Realize the visual element in the design of mixed spaces and the movement within the space is taken into account as a new dimension
	Seeking to achieve a complete separation between pedestrian and mechanical movement from the need to reduce mechanical movement within open urban spaces

Assessing the Current Status of Mixed Land Use Bases: A Case Study of Closed Urban Communities in Greater Cairo

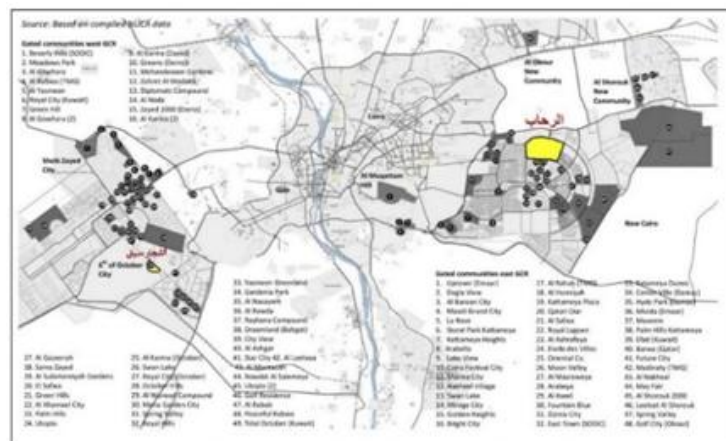
In this paper a comparison between what is theoretically presented and what is present in the current situation and coming up with results that clarify the extent of compatibility or difference between them, so that some recommendations can be made to emphasize the maximization of the current positive aspects and take into account the shortcomings in future projects.

Analysis of social sustainability criteria within mixed-use closed urban communities (with the aim of reaching standards for mixed-use communities)

The analytical study aims to study two models of closed and mixed-use urban communities around Greater Cairo (Phase V of Al Rehab City -Ashgar City October Project) to reach the positives and negatives of overlapping uses in closed urban communities in order to benefit from them in developing a methodology for the formation of overlapping urban communities with social sustainability.

3. Reasons for Choosing the Experiments under Study

Two projects, Al-Rehab East Cairo and Ashgar City West Cairo Project, were selected as models for conducting the targeted applied study for the following reasons: Their difference in the total area of the project, where Al-Rehab represents an integrated residential city, while Ashgar City represents a residential neighborhood, which creates fundamental differences in development methods and the pattern of service distribution, which gives the research the opportunity to present two types of development patterns in each of the two projects and assess the success of the overlap in the use of The lands in them (Figure19).



شكل (٤٠) خريطة الأحياء القاهرة القروى والإسكانات العمرانية حوله والتجمعات الخاصة المنطقة. المصدر: Ahmed M. Yousoy (٢٠٠٠). The Privatization of Urban Development in Cairo. Lessons Learned from The Development Experience of AlRehab Gated Community. NUCA Conference.

Figure (19): The site of Al-Rehab city, and Ashgar City project within the scope of Cairo city

Al-Rehab City project in New Cairo (Phase 5): was chosen to be the first case study for new urban communities because of their distinctive characteristics of the service sector, the scheme was adopted as Al-Rehab Sports Club as the center of the city, surrounded by three rings, and the design was keen that the service ring be located in the middle of each of the areas and linked to each other by one main road to facilitate the transition from one area to another, and the diversity of mixed urban spaces led to uses. The open and green areas, which represent more than two-thirds of the project area, and are the most perceived areas by the residents, so the fifth phase of Al-Rehab City has become an integrated, mixed, socially sustainable urban community. (Figure 20).



Figure (20): The general plan of Al-Rehab City and the distribution of services in the city

Ashgar City project, Sixth of October City: In this case study, we will focus on the impact of the mixed-use design on the social sustainability of the project, This project was built on an area of 148 acres, of which 70% was allocated to green spaces, parks and water bodies, and 30% housing, which is characterized by the integration of services, and its strategic location, (Figure 21 A) the design relied on dividing the project area into six different areas, separated by the main roads, and the social club occupies one of the six areas, and services are distributed on the borders of each of these areas, and therefore the design did not take the idea of centralization in services, and the proportions and lengths of the roads in them were taken into account to suit the paths of automatic movement and the allocation of a network of pedestrian paths, without affecting the privacy of residential areas, where all entrances to residential areas were placed on the internal courtyards within the framework of traditional social sustainability considerations, (Figure 21 B).









Figure (21): (A) Urban plan of Ashgar city, (B) project location on the 6th of October City





The standards of mixed land use in new urban communities (Al-Rehab City, Phase 5 and Ashgar City project) and their relationship to Habitat Organization standards.

The following table (3) shows the standards of overlapping land uses that were offered by the Habitat Organization, evaluate and probability of applied them in fifth phase in Al-Rehab City and in the Ashgar City project.

Table (3): Shows the standards of overlapping land uses that were offered by the Habitat Organization, evaluate and probability of applied them in fifth phase in Al-Rehab City and in the Ashgar City project

Basics of mixed use	Indicators for measuring interference in land use in Ashgar City project	Indicators for measuring interference in the use of land latch in the fifth phase in Al-Rehab City
	<p>Proportions and lengths suitable for automatic traffic paths the road network surface represents 28% of the project area. The road lengths are 1.4 km per 1 km² of the study area, figure (22)</p>  <p>Figure (22) Road and service network</p>	<p>Proportions and lengths of suitability for automatic traffic paths 36% The road network surface represents 36% of the area under study Road lengths within 9.2 km per 1 km² of the study area, Figure (23)</p>  <p>Figure (23) Road network and services</p>
	<p>Walkability Pedestrian paths have been allocated within residential groups separated from mechanical traffic, Figure (24) The average length of pedestrian paths from the entrances to residential buildings to the waiting areas grouped around the service areas ranges from 100 m to 250 m.</p>  <p>Figure (24) Pedestrian paths within the area</p>	<p>Walkability The residential buildings and the waiting areas are connected by a network of pedestrian paths within the residential groups, Figure (25) The lengths of pedestrian paths from residential buildings to waiting areas are within 100 meters. Pedestrian paths are also designed to connect each residential group to services and within acceptable walking distances (400 - 450 meters).</p>  <p>Figure (25) Pedestrian paths within the area</p>
	<p>Gradual development in the arterial road network and local streets There are two types of road network It consists of one arterial road and the rest of the local road network to separate residential groups. The plan did not rely on a surrounding road network, and the internal roads were designed to separate the different residential areas, as shown in the previous figures, the average distance between local roads, 160m</p>	<p>Creating a gradient in the arterial road network and local streets the gradient in the road network was taken into account according to for the general plan of Al-Rehab City, there are no arterial roads within the neighborhood, but rather surrounding it, and the distance between the two main roads surrounding the area is approximately, 900meters. The distance between each internal road and the last 200 meters. The area is surrounded by a main road network linking it with the rest of the city.</p>
	<p>Encouraging the use of public transport There are no proposals from the company to provide combined transport networks due to the small assembly area.</p>	<p>Encouraging the use of public transport, the city administration has provided transportation means for the city linking it to the areas of Heliopolis and Nasr City, points have been identified for the stationing of buses by a point for each stage of development in the city and pass along the road surrounding the city. The distance between each point is within 400 meters.</p>

	Achieving an appropriate relationship between the entrances to buildings and the road network, an indirect relationship, as the entrances are located on the internal spaces and the network of pedestrian paths and from there to the roads of automatic movement. Or bounded by roads from the back in some cases	Achieving an appropriate relationship between the entrances to buildings and the road network is an indirect relationship, where the entrances are located on the internal spaces and the network of pedestrian paths and from them to the roads of automatic movement, or limited by roads and waiting areas from the back in some areas.
The second principle Population density	The average population density of the project 120 people/acre.	The average population density of the project is 85 people / acre and increases in the fifth phase to reach 128 people / acre, as this area is dedicated to residential buildings and does not include villas.
The third principle is the quality and ratio of interference in land use	Forget the overlap in land use the percentage of the area of commercial uses and services within the study area is about 16% of the total project area, which is less than that listed in the habitat report and is located on the boundaries of the different residential areas as shown in Figure (26)	Forget about the overlap in land use the percentage of commercial uses and services within the study area is about 14% of the total area, which is lower than that included in the habitat report, but it is enhanced by a range of services surrounding the neighborhood in addition to the social club that mediates all areas. The service area is in the middle of the residential area and it is located on the main road that passes through the center of the area and connects it to the surrounding roads as shown in the previous figure (27).
	 <p>Figure (26) service sites in Ashgar City</p>	 <p>Figure (27) Service sites Al Rehab</p>
	Permissible conditions in the overlap of land use There is a clear horizontal overlap between the service areas and residential buildings, where they are adjacent to each other in the same residential group without separation by ways of movement to it. There is no vertical overlap between residential units and services, as it is determined to separate residential units and allocate independent lands for services.	Permissible conditions in land use interference All services are grouped in a central area in the middle of the neighborhood, and are not separated from it. There is no vertical overlap between residential and non-residential uses.
	The type of non-residential uses allowed to overlap vertically with residential uses There is no vertical overlap and mixing of services, as one use is allocated to each plot of land.	The quality of non-residential uses allowed to overlap vertically with residential uses There is no vertical overlap between residential units and services, as it was determined to separate residential units into separate buildings and allocate independent lands for services
	The type of non-residential uses to be present Services in the project: gym, primary school, mosque, medical complex, commercial mall - administrative buildings.	Type of non-residential uses to be present Services in the residential area: primary school, mosque, church, shopping mall that includes 20 shops, while medical services, restaurants, and cinemas are located in a citywide area.
	The presence of convergence between uses shows services spread over the entire plan and each of them is located on a road, some linked to pedestrian paths and some not. The average distance between services is 250 m.	The presence of convergence between uses with an average distance of 300 meters between one service and the other
	The percentage of spaces and waiting areas is grouped on the borders of residential groups and linked to car roads around the different areas, amounting to 5% of the total area.	Percentage of spaces and waiting places the percentage of waiting places is 6% of the total area grouped around residential groups, and some of them are located on the internal roads of the neighborhood and some on the external roads.

The fourth principle is social mixing and homogeneity	<p>The percentage of different housing types within the residential area - Diversity of residential areas Housing units with areas ranging from 85 m² to 270 m² were provided to cover the different needs of the population - Mixing and mixing housing levels The residential areas were divided according to housing levels and the areas of the residential units, where a separate residential area was allocated for small units with an area of 80 m² to 105 m⁴, and another area for medium residential units with an area of 112 m² to 148 m², and an area Other, for large units from 163 m² to 270 m² Figure (28) - Low housing ratios The percentage of housing units less than 105 m² is about 15% of the total number of housing units.</p>	<p>The percentage of different housing patterns within the residential area Housing units was provided with areas ranging from 50 m² to 250 m², Figure. (29) No residential areas were allocated to divide the housing units according to their flat area Where the single residential model included most of the designed areas as shown in Figure(29) The proportions of housing units less than 90 m² are about 23% of the total number of housing units in the study area.</p>
		
	<p>Figure (28) Distribution of residential areas</p>	<p>Figure (29) Residential models in the study area</p>
	<p>Characteristics of dwellings and blocks Homogeneity in the characteristics of dwellings and blocks was taken into account, Figure (30)</p>	<p>Housing Characteristics and Blocks Homogeneity was taken into account in the construction output of the project, Figure. (31)</p>
		
<p>Figure (30) Homogeneity in the architectural characteristics of the Ashgar City project</p>	<p>Figure (31) Homogeneity in the architectural characteristics of Al- Rehab project</p>	
<p>There are no single-use blocks in the project, where residential uses are separate from service blocks, and service blocks are allocated to one service.</p>	<p>There are no single-use blocks in the project, where residential uses are separate from service blocks, and service blocks are allocated to one service.</p>	

4. Conclusions and Recommendations

This research aimed to study a set of urban models that depend on the application of the standards of mixed land uses offered locally with models of closed urban communities around Greater Cairo, namely the fifth phase of the Al-Rehab project in New Cairo, and the Ashgar City project in Sixth of October City, in order to evaluate the relationship between urban spaces, mixed use and social sustainability.

This is to come out with some results and recommendations on how to establish basic approach of the mixed-use of lands in sustainable urban development.

Thus, the research concluded a set of general considerations for successful mixed-use development, whether at the level of processing and planning or at the level of spatial formation of its urban design. The complexity that characterizes mixed-use development and its diversity according to the location and size of the project and the local context of development, there may be another set of considerations for each project according to its characteristics, which needs other research papers to cover it.

This study concluded a direct relationship between the spatial formation of urban design, mixed use and social sustainability.

This research found that mixed-use development within the framework of prior planning and adequate studies within the framework of social sustainability considerations creates a vibrant and attractive urban environment that achieves high economic

feasibility and combines housing, work, services and entertainment in one place, such as the evaluation criteria of Al-Rehab City, Phase V, and Ashgar City project in Sixth of October City.

These evaluation processes resulted in a set of consequences that reflect the compatibility and differences between what was proposed by the urban plans of these projects and the principles put forward by international organization for the overlap of land use, which are:

A) Planning a road network suitable for the overlapping use of land within the residential area:

The two projects under study succeeded in taking into account the standards and principles of the road network, the most important of which is the connection between residential buildings, services and waiting areas, through the design of a network of pedestrian paths. The two projects took into account the international standards for the proposed road network design ratios, the percentage of roads in Ashgar City project is 28% while the percentage ranges 36% in the Al Rehab project. Since the percentage adopted by the principles of international sustainability is 30%, it was supposed to reduce the distances between the internal roads in the Ashgar City project to reach a better connection between the different uses.

B) Appropriate population density in the residential area:

Population densities in the two case study projects (128 people/acre in Al Rehab, 125 people / acre in Ashgar City), and since the average population density included in the sustainability indicators is 61 people/acre, therefore the two study projects achieved high densities, which contributes to increasing the demand for services and thus the growth and diversity of a larger number of services according to the demand.

C) Quality and percentage of land use interference:

The percentage of services in the Al Rehab and Ashgar City projects reached (14% and 16% respectively), compared to the percentages listed in the international principles of land use overlap, which is 21%. This necessitates the need to choose the total area of the project and the size of the population in a way that allows accommodating the number and areas included in the indicators. It is considered a basic determinant of the implementation of the principles of the pattern of overlapping land uses.

D) Level of mixing and social homogeneity:

The two projects agreed on a way to mix housing levels, even if small spaces were provided. As for the different types of housing within the residential area: where the focus was on the levels of luxury and above-average housing in the two study projects, with a small percentage allocated to small housing units, which did not provide the conditions and determinants to achieve social mixing in an optimal manner.

5. Recommendations

Due to what has been addressed about mixed-use urban spaces and their relationship to social sustainability, the research recommended the following:

- 1) The application of mixed-use areas should be adopted as it contributes to the creation of sustainable urban environments, as this approach integrates housing, work and entertainment, supports pedestrian movement and social relations, reduces travel distances and rationalizes energy consumption and utility and infrastructure costs.
- 2) Experienced designer should be involved, as well as the involvement of the community and developers, and sufficient studies should be carried out for the successful design of urban spaces related to the mixed-use development projects.
- 3) The need to develop urban requirements for the project to ensure the preservation of its distinctive features and not leave this to the mechanisms of the market, supply and demand.
- 4) The need to take into account the design foundations of automated traffic networks and the requirements of each use in terms of waiting places to avoid potential negatives.
- 5) Adopting modern technological systems such as smart transportation systems, renewable energy and green architecture with the aim of integrating systems in producing a sustainable social urban environment.

- 6) Accelerating the rate of development and balanced management to reach the densities listed in the plans effectively, which contributes to increasing the demand for services and thus the growth and diversity of a larger number of services according to the demand.
- 7) Inclusion of different housing patterns in the same residential area to achieve long-term social sustainability, especially taking into account the existence of economic housing at reasonable prices.
- 8) Diversity and integration of services and their multiplicity in the urban space (application of vertical overlap of uses), which contributes to maximizing the positives through which the achievement of sustainability goals is achieved in all environmental, economic and social aspects of projects.
- 9) The need to choose the total area of the project and the size of the population in a way that allows accommodating the rates of services included in the indicators "number, total percentage of area, distribution pattern and spacing rates. This is considered a basic determinant of the application of the foundations of the land use overlap approach.
- 10) The distribution of services and the scope of their service according to walking distances, whether grouped or distributed. the functional relationships between the elements of the movement network, which contributes to support the overlapping land use and moderate population densities and meeting the unobservable ratios of services to approach international sustainability standards.
- 11) Develops the principle of mixing and integration between non-residential uses with residential use vertically with the choice of compatible ones such as offices, companies and shops.
- 12) The need to apply all the principles of overlapping land uses in closed communities to ensure sustainability.

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