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Evaluating Environmental Sustainability of Egyptian New Urban Communities Based on UN Neighborhood Planning Principles

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ABSTRACT
The specialists of the United Nations are doing their best for improving the developing countries in various ways, such as creating appropriate strategies in order to develop these countries, especially in the environmental aspects. Definitely, creating an effective strategy for organizing the urban design of the developing countries is very important for improving their environmental conditions, particularly for the crowded cities in these countries. In this regard, five recommendations have been determined as UN-Habitat's principles for achieving a good urban design. These principles planning guidelines are; planning adequate space for streets and an efficient street network, selecting acceptable residents' density, organizing mixed land-use, affording social mix occupation and limited land use specialization. These UN-Habitat's principles can support the countries in alleviating urban sprawl in addition to achieving sustainable housing development and helping in building a new sustainable relationship between the dwellers and the urban space for increasing the value of lands. Accordingly, these principles can be employed for assessing any Egyptian urban area and determining its compatibility with these principles. In this paper, Al-Yasmeen neighborhood in New Cairo has been considered as a case study to figure out its compatibility with the UN-Habitat's principles. The results of analyzing the considered areas related to each principle reveal that there are significant deviations from the suggested percentages of the UN-Habitats. Hence, some interventions have been suggested to enhance the compliance of such areas with the recommended values.

Keywords: *Developing countries; Urban sprawl; Housing; Neighborhoods; Sustainability principles.*

1. Introduction

1.1 Urban Sprawl in Addition to its Causes and Problems

Generally, the design of new cities and the new residential communities depends on many of effective considerations that affect the proposed urban designs. Some of these considerations are related to international standard urban criteria, and others are related to the social and cultural legacies of local communities. Furthermore, some marketing considerations regarding the residential and service units in the new residential neighborhoods lead to the designers may give a priority to the criteria related to the social and cultural legacies rather than the considerations of the international standards criteria. There are many published researches focusing on these important criteria that might be considered for the urban design.

Many of dangerous unplanned problems such as the urban congestion and rural depopulation associated with the rising and development of the industrial revolution which afforded many of new promising jobs especially in the new cities. These problems generate many of bad effects such as; pollution, insufficient sanitation [1]. On the other hand, the new technologies have certainly generated new urban possibilities beside the arising problems. In this regard, the economic health, and the quality of working peoples' lives can be considered as the main motivations for planned urban growth.

Many of residents prefer living in the distinct middle urban lands between city and country far from the cities' noise. These areas are known as the urban sprawl sprawling suburbs. However, sprawl most commonly refers to the low-density, amorphous, aggregate in many shapes such as; housing subdivisions, office parks, shopping malls which are connected via narrow or wide roadways. These new urban areas are diffuse, de-centered, without definite

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boundaries as well as, it is usually a patchwork of privatized spaces, with a few public space such as; greens, squares, or plazas [2].

Historically, people have clustered usually together to be close to essential and critical resources such as; water, food in addition to for mutual security. Recently, they are looking for available rail hubs, ports and employment centers. On the other hand, the presence of the automobile and the transportation facilities in addition to the other technological factors provided a new chance to disperse "to go beyond the normal limits of one's own walking range". Furthermore, the increasing crime rates and urban diseases in crowded cities' centers can be considered as effective another factors accelerate the rate of disperse process [3].

Namely, the main factor contributed to sprawl are the increased specialization and standardization of the building, technological development, smart design, and engineering industries developments [4, 5].

The dispersed enlargement of sprawl forces people to depend on the private transportation facility or mobility. Also, there is no economical chance for appearing an effective mass transit as a result of the daily activities such as shopping and working are rarely accessible to pedestrians, in addition to their densities are too low. Therefore, sprawl usually is associated with the need of an excessive space for roadways and parking areas.

Normally, the building access is typically oriented toward the car usage, rather than the pedestrian [6, 7]. One of the bad issues in sprawl suburbs is the street networks' design, where these networks are based on an obligatory hierarchy. Also, these networks depend on local streets (long loopy road) with collectors to arterials. This meaning that, all car trips are suffering from decreasing number of roadways in the higher levels of the network. Here, the main disturbing problem is; creating large collectors and arterials which are becoming increasingly overburdened and congested with new development [7].

One the main problem of suburban pattern is the dependence on the private cars usage. Generally, suburban pattern's planning has a lack a real center, definitive edges, or significant common ground. Of course, this leads to more wasted time is being spent on commuting, where the congestion and incompatible housing in addition to jobs locations force some people to commute for a long time each way. Also, the reliance on private cars usage has a devastating impact on people who have no driving ability in addition to generating air pollution which has a bad effect on the natural green areas that are dedicated to protect the roads network. Even though the suburbs have mixed uses, these mixed uses are unfortunately separate into to individual development areas which are separated by major arterial roadways and property lines. As well as, a large percentage of air pollution results from cars emitting carbon monoxide and toxic gases cause economic losses which can be considered as additional cost reach a billion of dollars annually. Furthermore, the ecosystems and wildlife habitat are also threatened. Also, this affects the air quality and consumption of power and water supply [8-10].

Generally, the costs of infrastructure preparing and services for low density can be double the cost for contiguous, compact development this mainly owing to the difference is caused by reliance on the automobile and its associated infrastructure [7].

1.2 Main Distinguished Strategies of Urban Sprawl:

1.2.1 Open Public Spaces Strategy

Generally, the network of open spaces includes streets and the associated public spaces such as; parks, squares and parkways in addition to the transition areas between these streets and private houses, where shared public spaces can be considered as the main spaces for movement that can accommodate safe playground areas for children. Also, these public spaces give the peoples an open forum for meet and interviews, where people can discuss the many ideas for improving their adjacent garden plots [7, 8].

1.2.2 Transportation and Parking Strategy

The traffic process should be organized according to the private cars density. Also, it should give the peoples sufficient chances for a short walk at a daycare center, shops, bank, or health club. Meanwhile, the streets should be treelined. This can lead to reduce the average auto miles to the half and the time spent by the resident in the car could be transferred for useful time in the community or with the family [8].

1.2.3 Buildings and Urban Landscape Strategy

Of course, the mixed used community in integrated pattern better than the individual isolated islands of the suburbs. In this regard, a wide range of housing of different types must be considered to be built to meet different human interests [7]. Generally, the main characteristics that can be applied on neighborhood scale are [6];

- Urban Growth Boundaries (i.e., defined edges) must be considered.
- A suitable circulation system should function for the pedestrian compatible with regional transit systems.
- The private domains as the cultural centers, commercial districts and residential neighborhoods should form a complementary hierarchy.
- Sufficient affordable housing and a jobs/housing balance must be created (i.e., population and use should be diverse).

1.3 The main effective parameters of suburban Design:

1.3.1 Walkability

Most of the daily activities consume around five to ten minutes' walk between home and work location. Therefore, the optimal size of a neighborhood is a quarter mile from center to edge in an adequate weather. Generally, people no longer want just using the car, but they also want the walking and transit. Hence, the neighborhood which focuses the required user population within walking distance of the stop, makes the walking viable at densities that a suburban pattern cannot sustain [7].

Generally, the number and length of transportation trips can be reduced with the proximity of daily destinations and the convenience. This leads to decrease the private stress of time in traffic and minimize the public-borne expense of road construction and atmospheric pollution.

1.3.2 Connectivity

A clear and specific system must be defined for the internal streets network as well as for the main streets, and a definite specific system for the interconnection between the arterial streets and the main streets must exist. Also, these streets plans must be linked with the security of services and essential commercial areas in addition to schools and parks and other different facilities. Here, the neighborhood streets must be configured to create blocks of appropriate building sites in order to decrease the needed distance pedestrian routes. These network patterns should be in a simple style, straightforward, and avoid twisty paths. Moreover, these networks must provide with a certain routes dedicated to bicycles and pedestrians to travel to anywhere through the small local streets in the neighborhood without crossing arterial road. Often, arranging the local and main streets with the needed requirements is not an easy task for road networks and suburban plan designers, and the poor design of these networks may lead to many problems as the traffic problems [7, 8].

In general, a good design of the connected local and main roads networks is very important for the following reasons [7, 11]:

- Reducing the daily trips time of the persons with avoiding the congestion by keeping most of the daily traffic using the local roads for making up the majority of vehicular journeys.
- Making the process of traveling and moving within cities is more flexible via cars usage.
- Facilitating short trips without vehicles via walking, cycling and public transportation, and that this is safer and more enjoyable than moving on arterial and collection roads.
- Making the process of reaching the city center is easier by designing the traffic to be from all directions that lead directly to the city center.

1.3.3 Diversity (Mixed Uses)

Diversity can be achieved in two different patterns: diversity in residential areas, and diversity of uses in neighborhood center, each neighborhood should accommodate a range of different household types in addition to several land uses patterns. In this regard, four conditions are necessary [3, 12]:

- It must be taken into account that the area is planned to perform more than one basic service.
- The length of most residential blocks should be short; hence, the adjacent streets will have appropriate short lengths and good opportunities for maneuvering.
- The area must include buildings of varying uses and conditions in order to ensure a diversified economic return from them.
- The acceptable density of the population in the area must be considered.

The integrated neighborhood is considered the most important issue that the residents aspire to have it as a comfortable and quiet living. Consequently, neighborhood's designers should provide their urban designs with a wide variety of comfortable requirements such as; shopping places, accessible activities and the adequacy of workers in these places to meet the needs of different users. Hence, the residential neighborhood must contain a balanced mix of activities such as housing, shopping places, schools and other educational places, and places of worship in addition to adjacent areas provide an opportunity of jobs [3]. Furthermore, children needs must be considered such as suitable places for play and practice many types of sports and improving their physical skills. Moreover, these facilities should

be affordable for everyone to get these opportunities in an easy way [12].

1.4 Pedestrian Friendly and Safe Street Design

Generally, the roads networks planners must take into their account many of special requirements. The most important of these demands is that the vehicular traffic must be slow in the pedestrian-dense shopping streets. Moreover, the local streets passing between residential units are not wide roads in order to slow the traffic to provide a suitable, safer and more intimate driving environment. Also, the planning of these networks must consider the main important requirements that must be exist on the right of the road. These requirements are to create pedestrian roads with suitable width and appropriate pavement made from suitable materials. Also, sufficient area of parking lots must be implemented besides the streets. Furthermore, the designers must select the suitable street trees and surfacing materials of roads in addition to the locations of the street lights. Also, the pedestrian paths must have an appropriate width, and that the movement of the car and the movement of pedestrians should be compatible with each other [7].

To create a pedestrian friendly environment, the main services buildings must be establish near to the public streets. This will encourage the peoples for walking via easy pedestrian connections, as well as, interesting the features closer to the street and providing safety through watchful safety cameras. As a result of affording this environment, a safe and human scaled community can exist [12].

1.5 Smart Transportation

Providing neighborhood with a suitable near rail network or shuttle buses beside the usage of bicycles, scooters, and walking as daily transportation can be considered one of the main pillars of smart transportation [13]. Moreover, the light rail and trolleys may be used within a boulevard at the neighborhood edge, in addition to, providing the urban with bus corridors which can pass through neighborhood centers on traditional streets. In this regard, it is preferable that car parking in addition to the hidden parking spaces not be on the front of streets that dedicated for pedestrians or affect the pedestrian intersections, as well as, many of these parking should be placed behind buildings whenever possible. Hence, energetic and visually interesting features of the house can dominate the street view.

1.6 Sustainability

Sustainability means the balance and permanence in any society. It must take into account the balance between the people living in the community and the available jobs, as well as the balance between the constantly available renewable resources and local consumption patterns. In addition, the balance between maintaining a healthy natural environment and the needs of the human society in which it lives.

There are several guidelines and principles for designing an environmentally and friendly neighborhood approach to a sustainable neighborhood. These principles are; urban growth boundaries and greenbelts, sewage biological treatment systems, reusing water, and drainage systems that significantly reduce natural water consumption, suitable arranging of landscaping, and use appropriate energy conservation technologies in buildings [8].

1.7 Un-Habitat Neighborhoods Sustainability Principles

In recent decades, the general attributes of most of the cities especially of the crowded ones is the very rapid growth in urban areas. Also, the most important landscapes that distinguished some of these cities have been disappeared due to the rapid pace of population growth in urban areas. It is well known that the rapid pace of population growth in urban areas is accompanied by another phenomenon, which is urban sprawl. The danger of this large urban expansion in wide areas appear when these wasted lands are agricultural lands, which affects the development plans in these countries.

Another problem is the intensive dependence on private cars which can appear with the possibility of low population density and high separation between uses, which increases environmental pollution. Moreover, speculation on the purchase and use of land by some investors in the field of building lands leads to the emergence of fragmented and inefficient urban spaces where the urban advantage and the concept of the city are lost. In this regard, laws must be issued to reduce this and treat the problems of the current random urban expansion. Hence, an emerged urgent need to suggesting effective strategies to organize cities especially the crowded cities in developing countries to address many of the problems that have appeared due to urban sprawl, as well as to address the environmental problems that accompanied these urban sprawl problems. In this regard, the UN specialists suggested five guidelines as UN-Habitat Principles insure the good urban design. These planning guidelines are; planning sufficient streets space and an efficient streets network, choosing an acceptable density of population, regulating mixed land use, providing a

social mix of occupancy and limited land-use specialization.

The suggested UN-Habitat's principles can support the countries in alleviating urban sprawl and achieving sustainable housing development and helping in creating a new sustainable relationship between the dwellers and the urban space for increasing the value of lands. Of course, these principles can be used for assessing any Egyptian urban area and determining its compatibility with these principles. Objectives of these five principles are;

- Achieve a high density urban growth, maximize land usage efficiency, and alleviate urban sprawl.
- Promote sustainable, diversified and thriving communities in different economically viable ways.
- Reduce car dependency and encourage the persons on walkability.
- Optimize use of land and provide an effective network of streets which facilitate safe, efficient, and comfortable walking, cycling and driving.
- Provide different of houses sizes and types to cater for the diverse housing needs of the community.

These principles can be dustingushed as follows [14-16];

1. The indicator of the first principle can be computed by dividing the street area over the total floor area.
2. The indicator of the second principle is the population density.
3. The third principle has two indicators; the first one can be calculated by dividing the economic floor area over the total floor area, while the second one can be computed by dividing the residential floor area over the total floor area.
4. The fourth principle has two indicators; the first one can be calculated by dividing the single-tenure area over the residential floor area, while the second one can be computed by dividing the affordable housing over the residential floor area.
5. The indicator of the fifth principle can be calculated by dividing the single-function block area over the neighborhood area.

This paper deals with evaluating the environmental sustainability of egyptian new urban communities based on un neighborhood five planning principles. This study is applied on Al-Yasmeen area in egyptian new urban communities in New-Cairo city.

2. The Methodology

2.1. UN-Habitat's Neighborhoods' Five Principles

In this research, the selected UN-Habitat's neighborhoods' five principles were applied on the selected neighborhood to analyze its status with focusing the neighborhood profiling for evaluating its compatibility with the indicators of the UN-Habitat's neighborhoods' five principles. In this regard, many of techniques and tools have been used, such as; site visits, data collection and analysis in addition to applying the suitable quantitative formulas for the collected data and the existing conditions.

Generally, the UN-Habitat's sustainable neighborhood principles mainly aim for a useful neighborhood has many benefits. This neighborhood can be planned to be compact, integrated and connected neighborhood in addition to affording the chance to the developing the relationship between urban spaces and dwellers [15]. For achieving this planning task, it must be combine the qualitative and quantitative methods to be implemented on the selected area for giving the quick intuitive decision about its rate of sustainability in addition to achieve wide-ranging planning for sustainable neighborhood development [16].
The equations of the UN-Habitat methodology are mentioned and discussed in [14, 16]. The five principles situation are interconnected and support each other and provide quantitative measurements that could be used to assess the neighborhood. The equations and units of the UN-Habitat's five sustainable neighborhood planning are listed in Table 1 as in [14].

Table 1. The equations and units of the UN-Habitat's five sustainable neighborhood planning principles

Principle Number	Formula	Units
1	Streets area/ Total floor area	%45–30
2	Population density	60000–15000 people/km^2
3	Economic floor area/ Total floor area	%60–40
	Residential floor area / Total floor area	%50–30
4	Single-tenure area/ Residential floor area	%50–0
	Affordable housing / Residential floor area	%50–20
5	Single-function block area / Neighborhood area	%10–0

2.2. Case Study Analysis and Results

The selected neighborhood area is Al-Yasmeen in New Cairo. The current population of New Cairo is 2.5 million. New Cairo is located to the East of Cairo at a level higher than sea level by about 350 m. The New Cairo is surrounded by Cairo ring road from West, Cairo-Suez road from North in addition to Qattameya-Ain Sokhna road from South as shown in Figure 1. The total area of New Cairo is 85,580 thousand feddans. It consists of five residential communities. These are; first settlement, the third settlement, the eastern extension, and the southern extension in addition to the fifth settlement. The new Cairo has been planned to accommodate many of all activities (residential 43876.37 acres - service 5911 acres - tourist 3180 acres - industrial 1265.9 acres - commercial 5760.59 acres).

Al-Yasmeen neighborhood in New Cairo was selected to be evaluated regarding the five principles of the UN-Habitat. Al-Yasmeen neighborhood's area equals 4792070 square meters distributed between residential and other functions. This neighborhood is located to the North of North 90 Street as shown in Figure 2. There are commercial, educational and religious zones in the heart of the neighborhood which are surrounded by eight residential blocks as shown in Figure 3.

Some of this neighborhood's residential units are not finished yet as shown in Figure 4. Also, some of its lands are still vacant. The dwellers suffer from long walking distances for buying their household needs or for going to their prayers. Therefore, the neighborhood's dwellers transformed some residential units into different functions such as nurseries, educational centers, co-working spaces, companies, offices, consultancies, real estate, private clothing stores, private furniture stores and mosques. Furthermore, the green areas in the neighborhood as shown in Figure 5 are not at all in a good condition and need to be maintained.

Figure 1 – New Cairo city highlighting Al-Yasmeen neighborhood

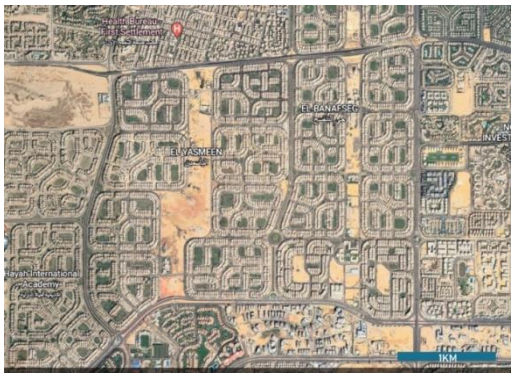

Figure 2 – Al-Yasmeen neighborhood in New Cairo

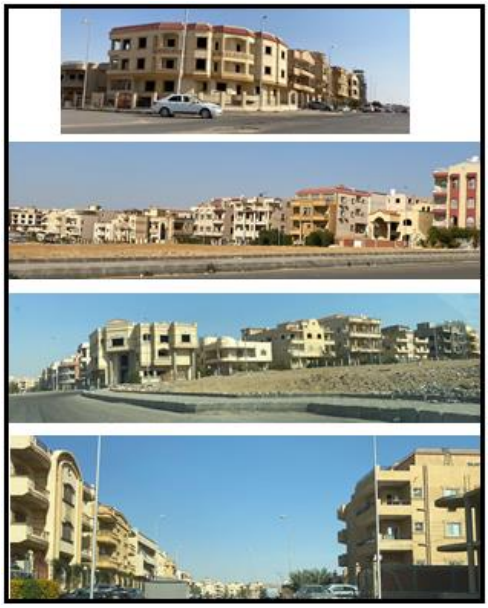

Figure 3 –The commercial, educational and religious buildings in the heart of Al-Yasmeen neighborhood

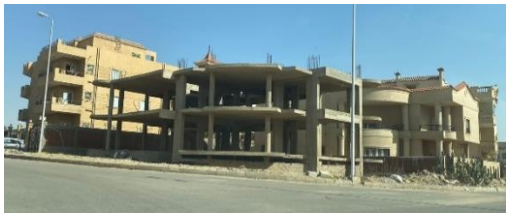

Figure 4 –The unfinished residential units of the neighborhood

Figure 5 –The green areas in the neighborhood

Regarding to Al-Yasmeen neighborhood and its urban form, Figure 6 demonstrates its land-use distribution, and Figure 7 illustrates the street network. This network should comprise a ratio between (30% and 45%) from the total area of the neighborhood when considering the first principle as in Table 1, [14]. The methodology employed in this case study entails using GIS ArcMap software to calculate the needed data which includes the total land area, residential land area, economic land area, green area, and streets, in addition to the vacant lands and single function blocks. In the calculation procedures, it should be noted that the economic floor area includes some mixed uses in the residential area such as; educational, religious, private residential rent units, elderly homes, medical, fitness and recreational, commercial, companies, administrative as well as public facilities. After calculating the different areas, these obtained areas have been substituted into the UN-Habitat's principles' equations to assess the percentage of each principle. Finally, the obtained percentages have to be compared with the recommended UN-Habitat's values to assess its compliance before interventions suggestions.

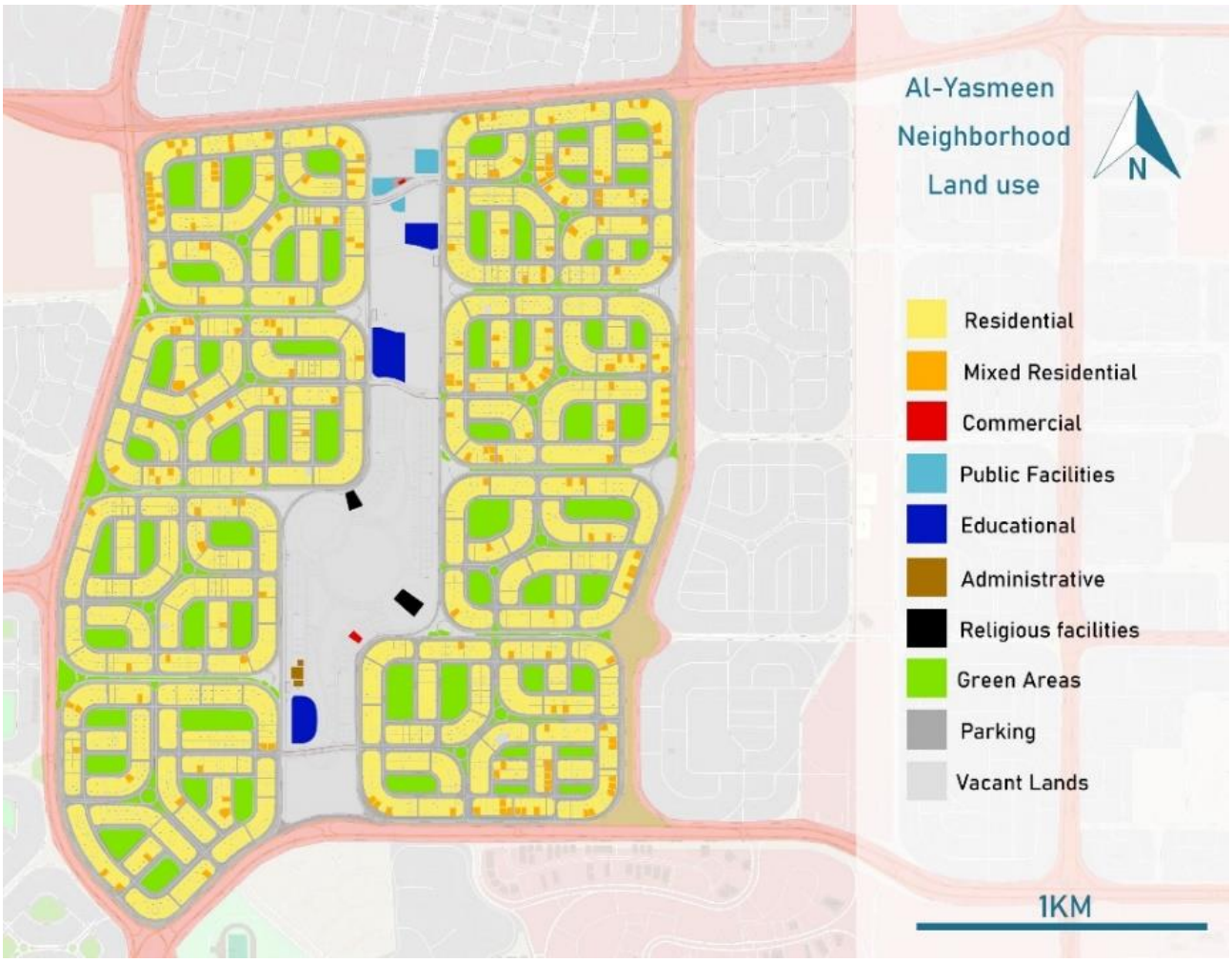

Figure 6 - The land-use distribution of Al-Yasmeen neighborhood

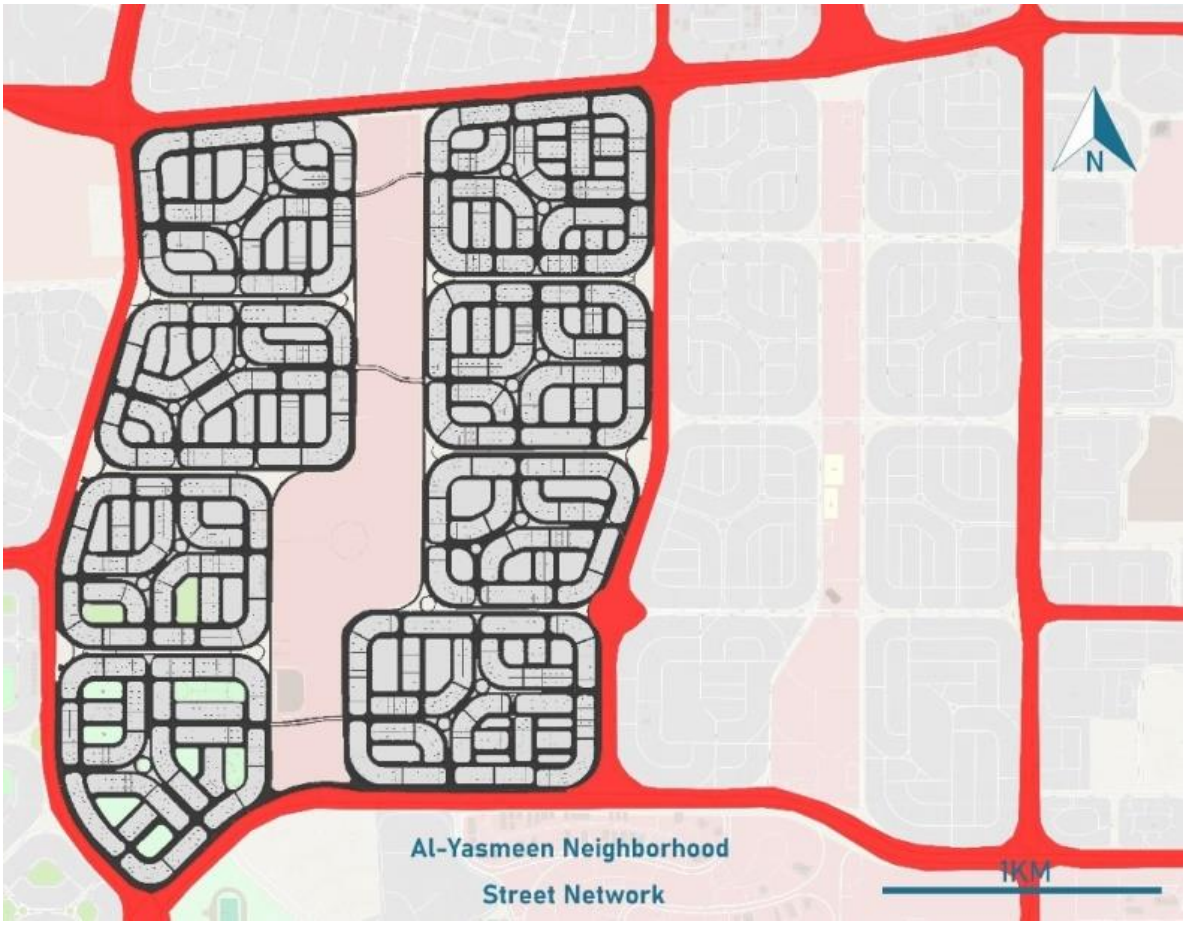

Figure 7 - The street network of Al-Yasmeen neighborhood

3. Results and Discussions

3.1 Calculating the Land Use and Block Function

Both of the land use and block functions areas of Al-Yasmeen neighborhoods are calculated with considering the different areas in Figure 6. The land uses of Al-Yasmeen neighborhood are tabulated in Table 2, while block functions are listed in Table 3.

3.2 Observations from the Site Visit

There are many of important observations can be noticed from the site visit. Some of these observations are;

1. Many residential blocks transformed their ground floor to mosques to adapt with the long walking distances for their nearest mosques.
2. Large number of private nurseries and day care is created in the neighborhood, as well as the number of schools.
3. Services' offices and headquarters take the largest area mixed with residential.
4. Many elderly homes are very popular to be seen in Al-Yasmeen neighborhood in addition to some rehabilitation centers.
5. Medical uses are also found such as some laboratories and pharmaceutical companies' head offices.
6. Many deliveries use bicycles not motorcycles, as well as there are many of the doormen are working as deliveries in residential blocks for avoiding the large walking distances for getting household supplies that are located quite far from the residential densities.
7. Not all the units are totally delivered for their owners.
8. Open green areas in between the residential blocks are not maintained but it's noticeable to find the kids are playing on the grass or walking their dogs especially during nighttime.
9. No sufficient banks on near ATMs.

Table 2. The land use areas of Al-Yasmeen neighborhood

Land use	Area (square meters)	of total area %
Total land area	4792070	100
Residential land area	1955850	%40
Economic land area	666240	%14
Green areas	460390	%10
Streets	1709590	%36

Table 3. The block function of Al-Yasmeen neighborhood

Block function	Area (square meters)	of total % area
Residential floor area	3950710	%92
Mixed use in residential area	77130	
Educational	11880	
Religious	5040	
Private residential rent units	9360	
Elderly homes	7560	
Medical	5760	
Fitness/Recreational/Commercial/Companies	34970	
Commercial	500	
Public Facilities	33500	
Educational	150620	
Administrative	55800	
Religious	11730	
Total Economic area	329280	%8
TOTAL Floor area	4279990	%100
Vacant lands	414590	%9
Function Block area-Single	1933340	%40

3.3 Calculating the Indicators of the Principles

Sample of public facilities in the neighborhood are illustrated in Figure 8. Moreover, Sample of the streets in addition to the open green spaces in the neighborhood is shown in Figure 9. Furthermore, Sample of unfinished residential units and converted to religious use are shown in Figure 10. Also, sample of the different functions in the neighborhood such as schools and mosques are presented in Figure 11. Finally, the calculated indicators of the principles are tabulated in Table 4.

Figure 8 - Sample of public facilities in the neighborhood

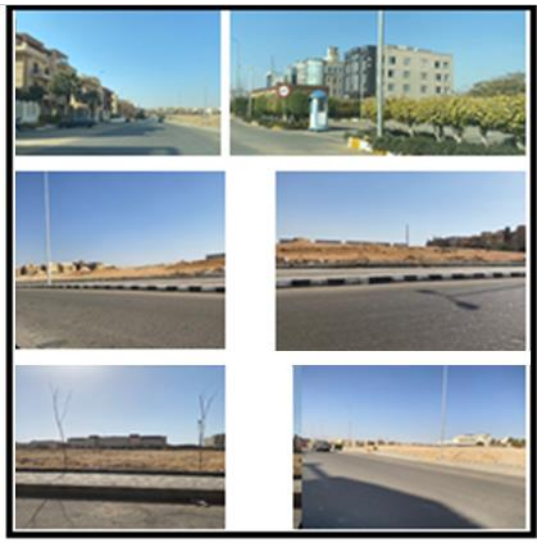

Figure 9 - Sample of the streets and the open green spaces in the neighborhood

Figure 10 - Sample of unfinished residential units and converted to religious use

Figure 11 - The different functions in the neighborhood such as schools and mosques

Table 4. The calculated indicators of the principles

Number Principle	Formula	Units	Case Study	Observation	Difference
1	Street and land use area/ Total floor area	%45–30	%36	Achieved	--
	Open green spaces / Total floor area		%10	Not achieved	%20
2	Population density	60000–15000 people/km^2	7000 people/km^2	Not achieved	8000 people/km^2
3	Economic floor area/ Total floor area	%60–40	%4	Not achieved	%36
	Residential floor area / Total floor area	%50–30	%96		%46
5	Single-function block area / Neighborhood area	%10–0	%40	Not achieved	%30

4. Conclusions and Recommendations

Many serious and critical problems such as urban sprawl emerged as a result of the absence of comprehensive and sustainable planning strategies in neighbourhoods design. Fortunately, some of the latest effective planning principles have emerged in recent years for sustainable neighbourhoods. The most important of these principles are the UN-Habitat Five Principles that can be used during neighbourhoods planning or when effectively assessing existing cities and neighbourhoods. Hence, this research aimed to identify the main problems affecting the urban sustainability of Al-Yasmeen neighbourhood in New Cairo using the UN-Habitat's principles, which provide quantitative sustainability indicators. This study was done in Al-Yasmeen community in New Cairo, which is considered one of the new Egyptian neighbourhoods in New Cairo city.

The study found that the most of the urban sustainability indicators are not within the appropriate ranges in Al-Yasmeen neighborhood according to the evaluation equations of UN-Habitat and site visits. Hence, major infrastructure works are needed to achieve the goal. Although one of the scopes was moderate such as a street network in the specific neighborhood with 36% of the total area. Moreover, there are a limited number of open public spaces, which must be increased to suit the population density in the chosen neighborhood. Furthermore, its economic area is not suitable to the total area. The third in addition to the fifth principles can be achieved when a variety of land uses should be added and mixed in the selected neighborhood.

Generally, these five principles can be considered as a comprehensive theoretical principles of sustainable urban planning and cover only some of the basic characteristics. Hence, the five principles can be used initially to judge whether a neighborhood has the potential for sustainable development and can be used in the initial stages of formulating urban scenarios and urban plans.

Finally, the following important points are recommended for the development of an effective and a sustainable urban renewal of Al-Yasmeen neighborhood;

- Attention to developing an effective plan to implement the safe internal road network connected to pedestrian and bicycle networks to encourage walking and cycling.
- Creating more open public spaces using vacant plots of land.
- Providing the neighborhood with housing of different sizes suitable for different social classes.

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