Study of the Random Growth Areas of Some Residential Areas in Kut City Using Geographic Information Systems (GIS)

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Abstract. With the advent of the housing problem in Kut city, many residents have resorted to set up informal housing scheme to achieve the need for housing. This has a significant urban, environmental and social impact on those residents. This research focuses on the impact of unplanned growth of urban areas on the environmental behavior. The phenomenon of random or informal housing is one of the most negative urban phenomena facing larger cities because of the burden on the processes of economic and social development. In Kut city, there are a lot of scattered areas such as Al-Hakim1, Al-Hakim2, Al-Jawadeen neighborhood, etc. Most of these areas were agricultural, areas for military use and vacant lands then they were encroached upon by the indiscriminate residential encroachment which has a negative impact on them. GIS is used to study the temporal and spatial changes of this phenomenon from 2005 to 2017 and to estimate the percentage of change of each period and the disparity in the areas of random overtaking between other areas.

1. Introduction
The economic changes in most countries have led to a radical change in the nature of work and production of people. The interest in the agricultural sector has changed due to machine development which was the declaration of entry into the industry and service area. This led to the neglect of rural areas and the migration of their population to urban areas and led to an imbalance in economic systems and their relationships with population densities [1].

The indiscriminate housing areas are a kind of self-resolution that individuals resort to solve their housing problems that the state cannot solve. The consideration of the growth of these areas and the failure to take measurements to formulate balanced economic and social policies reduce the rates of internal migration between rural and urban areas to decrease this human crawl. In spite of this, the slums produced many economic, social and cultural problems as well as security, in the absence of laws of urban planning and the organization of construction on them [2].

The basic designs of cities are established in order to organize the distribution of different land uses according to certain ratios (residential, industrial and commercial). The residential neighborhood (resulting from several resident groups) consists of residential units, some public utility buildings and a road network used by residents [3]. Hence, informal urban growth represents a defect in urban development in cities. The absence of both design and planning standards with uncontrolled application of the organizing laws lead to severe problems[4].

The methodology adopted in this paper depends on the theoretical study for the informal urban areas and their different patterns. It also depends on the study of the distinct features and Characteristics for these informal and unplanned areas including the social, environmental or urban
features. For this purpose, Arc Map software has been used to calculate and determine the random growth based on the satellite images.

2. Research Problem
Most cities in Iraq suffer from the phenomenon of informal housing growth because of economic and social conditions. Nowadays the problem of random housing is considered as the most important in Iraq. It should be noted that this phenomenon appeared in all cities of Iraq, including Kut city after 2003, whereas a large area of the agricultural areas used for the purpose of housing.

3. Aim
The aim of this research is to show the growth areas of some slums in Kut city in order to address this problem and develop appropriate solutions and treatments for it.

4. Random Housing
4.1 Concept of random housing
The informal zones defined as the areas within the administrative boundaries of any city that arose without plot planning of land. These areas may be built on public or private property. This area can be small or large and does not apply to planning instructions[5].

4.2 Reasons for random housing in Kut city.
1. Political factors.
2. Economic factors.
3. Population factors (population growth).
4. Planning factors.
5. Social factors.
6. Proximity to the city center and access to services.

5. Study area
The study area is Kut city and some of the random areas in it. Kut is a city in Iraq as shown in Figure (1). It is located on the banks of Tigris River in the southeast of Baghdad. Kut city is bounded between these coordinates 45°46'00" to 45°53'20" E and 32°27'00" to 32°34'00" N. It is covers an area of about 5640 km2. It is considered as the administrative center of Wasit Governorate. The largest city in the province of Wasit based on population and the area that cover this city. Kut was founded in the early 19th century. Tigris River enters the city from the northwest to the south-east. The city has a specific feature which is the course of Tigris runs through the city center making the neighborhoods overlooking the banks of the river. The river has many curves around the city on three sides making the city a river peninsula.
5.1 Basic design of Kut city
Kut city has witnessed many of its basic designs during various periods of time. Figure (2) shown the last base basic design of the city which was prepared in 2014 [6].

5.2 Random expansion within the city.
Informal areas or random housing represent a phenomenon that was arisen and accompanied by the rapid urban growth in cities. It is the result of the high demands of housing while the offered is insufficient. The term “informal areas” refers to a residential area in societies where their inhabitants build their own shelter. This can be observed when there is a lack in the formal housing with prices that fit incomes[7,8]. These areas are called informal as they represent informal development in terms of law or urban status or both. The city of Kut witnessed a large random expansion after 2003 as shown in Figure (3), which resulted from the removing of large areas of green agricultural areas located within the city, as well as military sites and centers (Al-Hakim1, Al-Hakim2, etc.), which are agricultural areas belonging to individuals. Where these individuals were divided into small areas such as 100 m² or 200 m² and then sell to citizens at convenient prices. Landowners submit applications to state departments for electricity, water and street paving [9].
Figure 3. Land use in Kut city (A) before 2003 and (B) after 2003

6. Results and Discussions.

1. Total area of random areas in 2005 was (0.922) $\text{km}^2$ while the total area of informal settlements in 2017 was (15.25) $\text{km}^2$. Figure (4) shows the random expansion in 2005 and 2017, the reason for this increment the weak control of government agencies in the following-up and stopping this residential invasion.

![Figure 4. The random expansion in 2005 and 2017.](image)

2. Figures (5 to 8) illustrate the largest random growth in area of residential in Al-Jawadeen, Al-Hakim1, Al-Hakim2 and Al-Jihad neighborhood, respectively. The area in 2005 for Al-Hakim1 was (0.42) $\text{km}^2$ and for Al-Hakim2 was (0.26) $\text{km}^2$. The largest area of random growth in 2017 for Al-Hakim1 was (4.55) $\text{km}^2$ and for Al-Jawadeen was (4.1) $\text{km}^2$ as shown in the table (1). The researcher is believed to be the exploitation of most of the area were exploited in the second wise neighborhood, forcing residents to buy houses in other areas.

| Name of the neighborhood | Area ($\text{km}^2$) in 2005 | Area ($\text{km}^2$) in 2017 |
|--------------------------|-----------------------------|-----------------------------|
| Al-Hakim 1               | 0.42                        | 4.55                        |
| Al-Hakim 2               | 0.26                        | 3.5                         |
| Al-Jawadeen              | 0.042                       | 4.1                         |
| Al-Jihad                 | 0.2                         | 3.1                         |
Figure 5. The area of AL-Jawadeen (A) in 2005 and (B) in 2017

Figure 6. The area of AL-Hakeem1 (A) in 2005 and (B) in 2017

Figure 7. The area of AL-Hakeem2 (A) in 2005 and (B) in 2017
3. The highest percentage exceeded the agricultural land was in Al-Hakem1 which equals to 44.9%, then in Al-Hakem2 up to 34.6% and Al-Jihad equals to 20.5%, while the percentage exceeded the highest military territory in the neighborhood of Al Jawadeen was 83% and then Al-Jihad neighborhood equals to 17%. The highest percentage exceeded vacant lands in Al-Jawadeen was 26%, Al-Jihad neighborhood up to 74%. The Figures (9 to 11) below illustrate these results.

Figure 8. The area of Jihad neighborhood (A) in 2005 and (B) in 2017

Figure 9. Override rates on agricultural land.

Figure 10. Override rates on land of military use.
Figure 11. Override rates on vacant land.

The official sectorial designs prepared for these areas lack the basic criteria for residential neighborhoods, which include sub-streets, a mosque, a kindergarten, a school and a local market. The width of the streets varies; the maximum width is 6 meters, and the services of the mosque, kindergarten and school. All buildings in these areas have not received official building permits and they lack building controls. These areas lack regular networks of infrastructure services.

4. Most of the slums were close to the center of the city and the reason is as follow:
   a) Services are available in the city center.
   b) Agricultural land surrounding cities.
   c) Vacant spaces that were not exploited by the governorate administration.
   d) Lands of military use after 2003.

7. Conclusions

1. The areas of random growth for the study areas in 2005 and 2017 are different as shown in the table (1).
2. The largest random growth in 2005 was in Hakim1 and Hakim2 in 2017, Hakim1 and then the Al-Jawadeen.
3. The highest percentage exceeded the agricultural land in Al-Hakim1 was 44.9%, then in Al-Hakem2 was 34.6% and Al-Jihad equals to 20.5%, while the percentage exceeded the highest military territory in the neighborhood of Al-Jawadeen was 83% and then Al-Jihad neighborhood was 17%. The highest percentage exceeded vacant lands in Al-Jihad neighborhood was 74% and then Al-Jawadeen 26%.
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8. Recommendations

1. Emphasize the activation of the role of government regulatory bodies to reduce or prevent
recurrence of such phenomenon in the future in other regions.

2. As long as these informal areas occupy large areas and occupied by the population, it is necessary to rehabilitate them by providing the basic services networks (water, sewage, electricity) as soon as possible.

3. The paving of the internal streets as it is currently characterized by the lack of any settlement work.

4. Prevent any new construction work in these areas in order to maintain the minimum environmental safety.

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Acknowledgments

This research was partially supported by Kut Technical Institute. The authors would like to thank their colleagues [Ali, Ahmed and Omer] who provided insight and expertise that greatly assisted the research, although they may not agree with all of the interpretations and conclusions of this paper.