

The Effect of Koya University on the Urban Morphology of Koya City

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Abstract

Koya city is one of the most important cities in Kurdistan-Iraq because of its rich history and important geographical location between three main cities in Kurdistan (Erbil, Sulaymaniyah and Kirkuk). However, the development of the city and its growth was slow over the time.

This paper discusses the most important period of growth of this city, which followed the establishment of koya University in 2003. Where there has been a change in the speed, shape and direction of city's growth. Since 1940 the growth of the city was centred around the main market in the centre of the city, but after 2003 it became linear, away from the centre towards the university site, which affected the morphology of the city and its structural characteristics. Using the Depth Map UCL Software which is based on the theory of Space Syntax by Hillier, this paper focused on studying and analysing the city plans in three different stages, the first was in 1940 where the city consisted of four residential neighbourhoods only, while the second stage was before the establishment of the university in 2003, and the city plan ten years after the establishment of the university in 2013.

The main new axes which were generated have been identified, by analysing the values and graphs for each of the Integration, the Main Depth and Connectivity at each of the three stages, and compare the results before and after university, and by analysing the values and graphs for each of Integration, Main Depth and Connectivity at each of the three stages, and compare the results before and after university, The main new axes which were generated have been identified and how the integration node of the has changed and moved from the centre towards the university site.

Keywords: Koya University, Depth Map, City Growth, Urban Morphology, Space Syntax.

I. INTRODUCTION

The establishment of universities in cities leads to developing them on several levels, especially on the urban level, where the university quickly becomes the main node of the development of its urban environment and directly affect the urban structure of the city as a whole. Therefore, choosing the university's location in the city requires many kinds of studies especially the urban studies [1].

After the establishment of Koya University in 2003 in Koya (Koy Sanjaq) located in Kurdistan Region- Iraq, the growth of this city has changed in terms of speed and direction in addition to changing the shape of the city and its urban structure. This paper focuses on studying this morphological effect in order to identify the role of Koya University in changing the morphology of Koya city, assuming that the establishment of Koya University led to pull the integration node from the old city centre towards the university and create a new spatial configuration in the city.

II. THE URBAN MORPHOLOGY

Most studies related to morphology confirm that it is a concept related to the form and physical phenomena, in addition, urban morphology is directly related to the study and analysis of the city's basic structural elements which represent both mass and space, such as buildings, open spaces, movement axes and everything related to the spatial structure of the city. And studying the city as a unity and the relations between the elements.

Urban morphology can be defined as an approach or method to study the urban form, which takes into account both the physical and spatial components of the urban structure such as blocks, streets, buildings and open spaces and studying them as part of the history of the city which affects any development process or Expansion of the city [2].

It can also be considered as an expression of the structure of the urban form and contribute to understanding the physical complexities on different scales, from individual buildings to sectors to the streets and street patterns that define the structure of the city [3].

Hillier's study is one of the most important studies that dealt with the concept of urban morphology where the theory of space syntax was presented, which confirms that the space morphology means the total relationships of that space with other spaces within the urban structure of the city, and that the organizational characteristics of the spaces are the measure of the nature of the social interaction that takes place within them [4]. This paper is based on this theory because it provides a precise understanding of the measurement, description and analysis of the structure of the space system and can be adopted to study the most important changes in the city over time, by applying

it on the plans of the city in different historical stages.

III.KOYA CITY

A. Location and Importance

Koya city has a strategic location in Iraq; Kurdistan between three big cities Arbil, Kirkuk and Sulaymaniyah as shown in Fig. 1. It is located about 70 km from Arbil, capital of the Kurdistan Region, its height is approximately between 625-700 m from sea level. Koya is surrounded by the Mount Bawage which has 1260 m height and Mount Haibat Sultan with 1092 m height. The history of this city dates back to 2500 BC and is characterized by its ancient ruins. It contains more than 80 archaeological sites (Kharabah, Klishah, Qal'at Sheila and Aski Koya) [5].

In addition to its geographical and historical importance, Koya has a great cultural and scientific significance. The city has given birth to many writers and thinkers such as Mullah Al-Kabir, Haji Kader Koyi, Taher Tawfiq and others [6].



Fig 1. The location of Koya city in Kurdistan Region

B. The Morphology of Koya City

Despite the historical, geographical and cultural status of Koya city, but its development has been slow over time, where the study of (Tawfiq) mentioned the most important stages of the city's growth, this study divided the stages of the city's growth to eight phases starting from the first phase before the 1950's until the last phase between 2000-2008. Where the city in the first phase consisted of only four residential neighbourhoods with a traditional character and organic planning includes a lot of winding alleys, these neighbourhoods are Bafri Qandi, Qalat, Baizaga and Hawawan. During the first seven phases of the study, the growth of the city was relatively slow from one phase to the next by increasing one or two residential neighbourhoods at each phase around the city centre, but in the eighth phase, which included the establishment of Koya

University in 2003, the pace of growth of the city accelerated significantly [6].

The Engineering Department of the Municipality of Koya has identified six phases of the city's growth, each phase consists of ten years from 1940 to 2015, and it is also noted that the post-establishment of the Koya University is the only phase where there has been a change in the speed and direction of the growth of Koya city.

This paper focuses on studying and analysing the plans of Koya city in three important phases, the first is the old city phase in 1940 and the second in 2003 directly before the establishment of the university and the third phase is ten years after the university in 2013, in order to determine the effect of the University on the morphology of the city and Fig. 2, Fig. 3, and Fig. 3 show these phases.

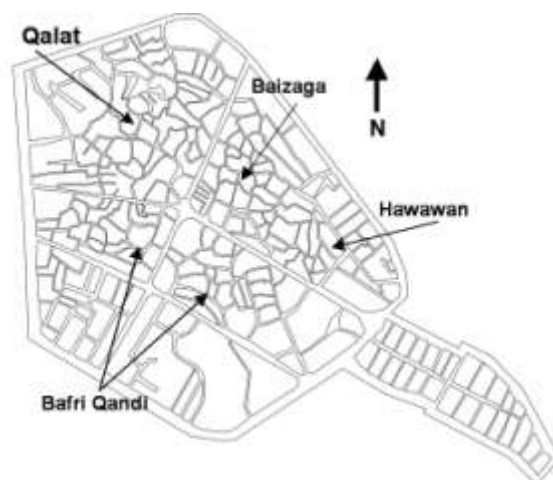


Fig 2. Phase 1 Koya city in 1940

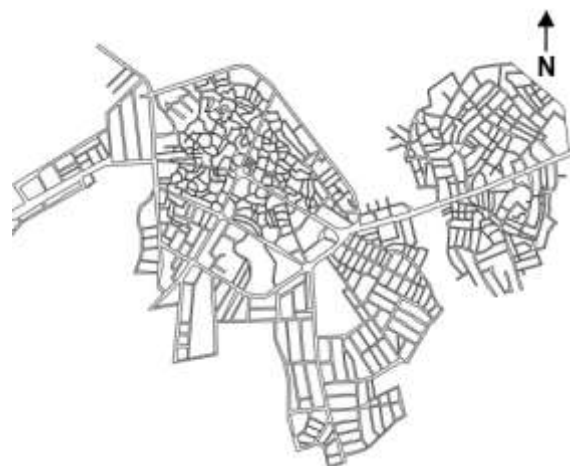


Fig 3. Phase 2 Koya city in 2003



Fig 4. Phase 2 Koya city in 2013

C. The Impact of Koya University on the City

Koya University was founded in October 2003 and currently has 4 faculties consisting of 25 departments. The University Complex is located at the foot of the Haibat Sultan Mountain, northeast of Koya, 3 km from the city centre [7]. As shown in Fig. 5, the University is surrounded by a rugged mountainous area from three sides, which means that the city can only grow in one direction.



Fig 5. The location of Koya University at the foot of the mountain

Many studies confirm the great impact of universities on the cities that host them at the social, economic and urban levels, so that the integration of the university with the urban boundaries of the city is a major factor in the urban development of the city, in addition to important effects at different levels such as job creation, housing, mobility, recreation and various consumer activities [8].

The university attracts large numbers of students, professors and staff from all over the city and neighbouring cities, leading to the following effects:

- Increase in population growth rate.
- The University attracts a large proportion of urban extensions towards it.
- Development of urban patterns around the university.
- High prices of land surrounding the university.

- Increased employment opportunities in the city.
- Increasing per capita services in the area around the university [9]

In addition to the previous influences, the establishment of Koya University led to the following:

- The growth of the city in the near part of the university to meet its different needs, which changed the pattern of city growth from central to linear towards the university Fig.5.
- As a result of the fact that the university is surrounded by rugged areas on three sides, there were no building elements around the university, and the growth was limited to one direction only, towards the southwest of the university (towards the centre of the city) Fig.5.
- The regional axis linking Koya city with Sulaymaniyah has developed in terms of services, population and land value, as it is the same axis leading to the university Fig.5.

IV. PRACTICAL STUDY AND ANALYSIS

This paper used the space syntax technique, which provides an objective way and a mathematical method for analysing the spatial configuration and a numerical expression of the strength of the relative relationship of each urban space within the total system in the city. Where the characteristics of the spatial configuration of Koya city were measured before and after the establishment of Koya University to reach the most important changes made by the university on the morphology of the city as a whole by following these steps:

- Choosing the stages of the study, which are three important phases, the first is the old city phase in 1940 and the second in 2003 directly before the establishment of the university and the third phase is ten years after the university in 2013.
- Preparing the city plans in these three phases, relying on the Engineering Division in the municipality of Koya, and the satellite images of the city using Google Earth and then redrawing them using Auto CAD program and saving them as a DXF files.
- Export the DXF files to UCL Depth Map program to draw Axial Map for each phase.
- Using UCL Depth Map to analyse space relations at each phase by examining the values of Integration, Mean Depth and connectivity. Where Integration, which also called availability or accessibility, is a variable that refers to how a space is connected to other spaces and counting how deep or shallow each space in the system. And the most integrated spaces are public spaces, but the isolated ones are the most private spaces within the system. Mean Depth represents the number of visual

steps in which basic space moves away from other spaces within the system. Connectivity also measures the number of neighbour spaces directly connected to a space within the system [4].

- Analyse and compare previous values before and after establishment of the university, and study the integration, Mean Depth and connectivity graph for each phase.

V. RESULTS AND DISCUSSION

A. Phase One, Koya City in 1940

The analysis of this phase shows that the integration node (the most integrated and less isolated spaces) is located in the center of the city represented by the main spaces linking the four neighborhoods with each other where the main market is located. While the isolation node (the less integrated and deeper spaces) was found in the center of each neighborhood represented by the more private residential areas. And Fig.6 represents the Integration graph, while Fig.7 represents the Mean Depth graph. The values are represented using gradients from red to blue, where red represents the highest values, while blue is the lowest value.



Fig.6 Integration graph of Koya city in 1940



Fig.7 Mean Depth graph of Koya city in 1940

The number of analyzed spaces was 552 spaces and Table I shows Integration, Connectivity and Mean Depth's values. A relative gradation of these values can be seen from the highest to the lowest and

this reflects the hierarchy of the spatial configuration in urban areas with traditional organic planning.

Attribute	Minimum	Maximum	Average
Integration	0.819479	2.73928	1.45608
Connectivity	1	46	7.78986
Mean Depth	3.38838	8.98367	5.74049

Table I Configuration values of Koya city in 1940

B. Phase Two, Koya City in 2003

At this phase, the city grew to the south as well as to the north-east along the road leading to Sulaymaniyah city, although more than 60 years have passed since the first phase, this growth has been relatively slow where the number of spaces analyzed was only 1004 spaces. At this phase, the integration node remained in the center of the city, and it extended to the north-east, while the isolation node remained in the residential areas inside the old neighborhoods. And Fig.8 represents the Integration graph, while Fig.9 represents the Mean Depth graph.



Fig.8 Integration graph of Koya city in 2003



Fig.9 Mean Depth graph of Koya city in 2003

Table II shows Integration, Connectivity and Mean Depth's values. These results are close to the results of the first phase. The hierarchy can also be seen in these values, and the depth of the space has increased in the middle of the old residential areas, which indicates that the city has maintained its traditional character.

Attribute	Minimum	Maximum	Average
Integration	0.644098	2.66811	1.42085
Connectivity	1	50	6.093
Mean Depth	3.77268	12.4855	6.093

Table II Configuration values of Koya city in 2003

C. Phase Three, Koya City in 2013

This phase is ten years after the establishment of Koya University. where the growth of the city has increased significantly in two main directions. One to the northeast of the city towards the university, and the other to the south, where another educational institution is located, which is the Koya Institute. The number of spaces at this stage reaches 2063 spaces. At this stage, although the integration node remained in the old city center, other high-integration spaces emerged outside the city center especially the axis leading to the university, as shown in Fig.10, which represents the Integration graph and the Fig.11, which represents the Mean Depth graph.



Fig.10 Integration graph of Koya city in 2013



Fig.11 Mean Depth graph of Koya city in 2013

The analysis of the city's plans at this phase showed convergence in the values of integration as well as the depth values, especially in the new areas on the north-eastern and southern axes. This indicates a regression of the hierarchy of spaces because of the grid system planning of the new areas that have emerged because of the university. It is also possible to see the difference between the nature of the spatial configuration of the old part of the city and the new areas. And Table III shows Integration, Connectivity and Mean Depth's values in this phase.

Attribute	Minimum	Maximum	Average
Integration	0.697022	2.23411	1.26559
Connectivity	1	70	6.93747
Mean Depth	4.778401	13.0965	7.95419

Table III Configuration values of Koya city in 2013

VI. CONCLUSION

- Koya city is one of the cities with relatively slow growth. And the establishment of Koya University has contributed to the acceleration of this growth.
- Establishment of Koya University in the north-eastern part of the city has changed the city's growth from central to linear towards the university.
- The analysis of Koya's plans in three phases showed that the city had a traditional organic planning with hierarchical integration values, but the establishment of the university led to convergence in these values, especially in the new areas with regression of the hierarchy of spaces because of the grid system planning of these areas.
- The establishment of the university led to the gradual withdrawal of the integration node from the city centre towards the northeast of the city.
- The old neighbourhoods with organic planning near the centre of the city had a high depth values and this made them enjoy high privacy, and the establishment of the university led to an increase in the depth of these areas and more privacy, and generating new public areas with grid planning and low depth values.
- The location of Koya University on the foot of Mount Hapt Sultan gave it a beautiful view, but at the same time that has led the expansion of the city to be in one direction only. Because the university is surrounded by rugged areas on three sides, and this makes this growth limited and cannot increase in this direction.

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REFERENCES

- [1] Perry, D., & Wiewel, W. *From campus to city: The university as developer*. In D. C. Perry & W. Wiewel (Eds.), *The university as urban developer: Case studies and analysis*, 2005.
- [2] Bentley, I. & Butina, G., in Gleave, S. [ed.], *Urban design, Architects Journal*, vol.192, no.17, pp.61-71, Oct.1990.
- [3] Kropt, P., *The handling characteristics of urban form, in Urban Morphology*, Urban Design, Winter, Issue 93, London, Urban Design Group, 2005.
- [4] Hillier, Bill, And Hanson, Julienne, *The Social Logic of Space*, Cambridge University Press, Cambridge, 1984.
- [5] (2017) The General Board of Tourism of Kurdistan – Iraq website. [Online]. Available: <http://bot.gov.krd/erbil-province/koysinjq>
- [6] Tofic, Hawar Taha, "Urban Built Problems in Koya City Center," MSc. thesis, Koya university, Koya, Iraq. 2010.
- [7] (2017) Koya University website. [Online]. Available: <http://koyauniversity.org>.
- [8] Wiewel, Wim, and David C. Perry. *Case Studies and Analysis*. Edited by Wim Wiewel and David C. Perry. New

York. Armonk, New York: Lincoln Institute of Land Policy. 2008.

- [9] Kamel. Maha Sami, “Approach of the impact of regional elements in the medium cities on urban growth guidance,” PhD thesis , Cairo University, Cairo, Egypt, 2001.