

Understanding the spatial and temporal patterns of urban growth using metric space-Case study Tehran

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Abstract

The city's growth pattern or a pattern of human space activities in a specific period of time defined. Rapid urbanization and growing urban complex problems, has created of countries, including Iran. . The aim of this study was to determine the pattern of time - a place in the metropolitan urban growth (megapole) in Tehran. This research can provide a background for more informed planning. This is a historical maps and satellite imagery to determine patterns of urban development for metropolitan has used for the period 2013-1921 in Tehran Appropriate research methodology, which has been used in this study, technique analytical - descriptive, which aims to describe the situation or phenomenon is studied, so that in order to achieve the purpose of the study, the pattern recognition and growth patterns in the study of metric space is multidimensional The results show that the rate of urban growth in the Metropolitan Tehran can be divided into three main periods: (1) rapid growth rate (1976-1921). 2. The very fast growth rate (1986-1976), 3. slow and steady growth rate (2013-1986). The results also show that urban growth pattern in Tehran, tidal waves and stages of development will follow. The tidal waves moving toward the outer edge of Tehran. This study is an attempt to use remote sensing for urban planning purposes, as well as an attempt to determine the pattern of urban growth in the metropolis of Tehran is not specified. In addition, with regard to the negative consequences of this model, in order to achieve sustainable urban development and sustainable urban growth policies should be used to control and change the type of growth.

Key words: Aspral urban landscape pattern, metropolitan areas, physical development, spatial metric.

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Introduction

Twentieth century with little more than one billion people, and 10% urban population began a little more than six billion people and 50 percent of urban terminated (sarafi, 3: 1381). From a sociological perspective, urbanization in the twentieth century is a global process, not only the industrial world, but the developing world is also increasingly drawn to it (Mahdzadeh, 4: 1382). Urban areas occupy a small part of the Earth's surface. But this small part due to the impact of the occupied land can not be ignored its considerable natural and human Drsystemhay (Kong et al., 2010). New urban growth patterns have emerged and large cities have emerged. Since 1950, with the establishment of the capitalist system in Iran, a new phase of urbanization and urban development in Iran, especially in Tehran, the development of rural land reform was carried out in 1962, resulting in changes the relationship between urban and rural areas has occurred. The rural population migrated to urban areas. The rapid rise in oil revenues, the need for municipal services, economic development and communication infrastructure, the rapid increase in industrial building and construction industries, the widespread growth of administrative organization, role and functioning of the capital Tehran as well as the new changes increase City of Tehran as the capital of their development is much faster than the natural rate Therefore, Tehran, expanded and became more complex. As Despite the rapid growth of population, area and size of the city also enjoyed rapid growth in recent decades The first step in the management, control and scientific intervention in the growing metropolis of Tehran, which is a comprehensive profile of the model when - where and the process of urban growth offers. Accordingly, the pattern of urban growth, climate change and the analysis of changes is required. Recent advances in science, such as remote sensing, GIS, spatial techniques and progress in other areas such as landscape ecology enables us to quantify, the modeling and prediction of urban growth has (Kong et al., 2012). Metric space useful tools for the production of maps and spatial characteristics of urban growth are quantity (Kong et al., 2012). Accordingly, the main purpose of this study, changes time - Tehran where growth between 1921-2013, using the metric space.

Statement of problem:

Urban growth, especially in the form of its adverse impact on the environment, natural resources, human health and cause some social and economic problems. The decrease in agricultural land, forests, wild and open spaces are considered as some of the negative effects. This change also impacts on ecosystems, wildlife, water and air quality and thus human health and quality of life. Changing spatial pattern of growth in urban areas, is very complex. Urban areas are spreading in rural areas and urban sprawl is taking place. Due to constant changes in the structure and pattern of urban growth, the region has been the focus of ongoing research (STO and Fragkias, 2005). Describe and understand the changing patterns of urban growth is very important, considering that urbanization is one of the major global environmental change in the foreseeable future is, will the physical .fraynd urban land use changes as a result of urbanization and study was investigated. Although urbanization is a global event, this event is very dynamic in Iran. Significant growth has occurred in the city in the past few decades. Over the past 55 years, the urbanization of 31% in

1956 to over 72% in 2013 has increased. Over the past five decades, urbanization has increased in Iran like other third world countries. Urbanization as a result of the migration of the rural population, natural increase of population and the incorporation of rural areas to urban areas has increased. In this study sought to understand the spatial and temporal patterns of urban growth using metric space in metropolitan Tehran.

Research questions:

To what extent, number of routes and urban sprawl in the region, after a rise in core urban growth continues? How big of Tehran in the process of urban development, with the expansion of urban sprawl?

Evaluation of Usage

Evaluation of various types of urban usage are conducted in two quantitative and qualitative forms in to ensure their logical establishment and observance of necessary measures of congruence.

A) Quantitative evaluation. This type of evaluation is conducted according to the comparison of existing capitations of usage with related standards or through the analysis of current or future needs of study region for space.

B) Qualitative evaluation. In this phase, the qualitative features are determined and their relationships with each other are studied according to the following matrices:

1) Compatibility matrix, 2) Suitability matrix, 3) Capacity matrix and 4) Dependency matrix (Pour Mohammadi 2010: 109). In this study, the three matrices of compatibility, suitability, and capacity were used to evaluate the land usage.

Compatibility Matrix

Any type of usage which is established in a region must not bother or hinder other existing activities. When we try to determine the level of compatibility or incompatibility of two types of usage, we, firstly, need to identify their various requirements for doing their routine activities; then we should compare such features and detect the instances of compatibility or incompatibility. The elements which can be examined in this way are land size and dimensions, land inclination, connecting network, facilities and equipment, subordinate usage, air quality, sound quality, light degree, smell, sight and sceneries. In addition, the requirements of each type of usage are identified according to quantitative and qualitative standards and are compared with each other. Finally, when the detected characteristics are the same or similar, the considered types of usage are compatible, and they become more and more incompatible with the decrease in similarities (Pour Mohammadi 2010: 110). With respect to the types of land usage in Ilam, the compatibility matrix of the City is as represented in Table 2. Based on this table, the compatibility layer or land priority was compiled (Map 2).

Table 2: Compatibility matrix of types of land usage compared with hospital

Component	Usage
Fully compatible	1. Offices 2. Empty lands 3. Gardens 4. Fire department
Relatively compatible	1. Medical centers 2. Health centers 3. Higher education institutes
No difference	1. Commercial 2. Farming 3. High school 4. Green space
Relatively incompatible	1. Historical 2. Religious 3. Cultural 4. Sports 5. Residential 6. Junior-high school
Fully incompatible	1. Urban facilities 2. Industry-workshop 3. Warehouse 4. Military 5. Police 6. Passenger terminals 7. Primary school 8. Nursery school

Capacity Matrix

Every type of urban activity (usage) has an allotted span. Since the structure of a town bears several physical levels, when two considered spans are compatible with each other, every type of usage would have a suitable performance and each level of the town would take advantage of services in an effective way. Nevertheless, when such spans are not compatible, various problems will rise for both phenomena. As an example, a medical-health activity has the following levels: General practitioner, general clinics, specialists, specialized clinics, general hospital, and specialized hospital. Furthermore, an educational type of usage can be divided into the following levels: Nursery school, primary school, junior-high school, high school, university faculty, college, and university. On the other hand, every level of urban spatial structure can only hold an appropriate level of activities. Therefore, spatial structure can be divided as follows: adjacent buildings, small neighborhood, neighborhood, town district, town.

Suitability Matrix

In this matrix, the compatibility of land usage with its location is evaluated. According to this matrix, we can state that any type of usage is suitable for a specific location after considering its characteristics, and every location needs a specific usage as well. In order to create this matrix, the characteristics and necessities of a given type of usage have to be in accordance to its location of establishment. The characteristics of a location may be land size and dimensions, position, slope, physical features (soil type, topography etc.), accessibility, facilities and equipment, sound, air, smell, and types of adjacent usage. Through comparing the mentioned factors it can be concluded that the location of any type of usage may be fully suitable, relatively suitable, or fully unsuitable, and the following decisions must be based on such observations. For examining this matrix in the present study, we considered slope, effective performance range, streams, and access to communication networks, and population density for hospitals.

Green space. Due to population increase and increasing pollution of urban environment, the vital role of green spaces become obvious day by day. As a natural filter, green space reduces environmental pollutions such as smoke and sound and relatively ensures the individual and societal health of urban residents and the comfort of the surrounding environment (Pour Mohammadi 2010: 38). The regional green space is the priority of this usage (Habibi and Masaeli

1999: 31). One of the problems that Ilam faces is the lack of green space in every level of its physique, especially regional green spaces. As a result, the neighborhood green spaces of the town are classified as the indifferent types of usage in relation to hospital usage.

Fire department. Today, human life is blended with various kinds of chemical substances such as oil, gas, electricity, radioactive material, and other types of dangerous substances. Consequently, the danger of fire and explosion has escalated. Urban safety is so critical that a second of ignorance would lead to disastrous environmental and social consequences (Specialized Center for Urban and Rural Studies and Services 2006: 27). In Table 3, the span of fire departments' compatibility is provided and the fire department layer is compiled based on this table (Map 3).

Military camps. Military lands are propounded only on the level of town and beyond including garrisons, camps, bases, shooting ranges, depots, military airports, and staff departments of armed forces. In a circular issued by Iran's Supreme Council for Urban Development and Architecture, the evacuation of all military lands, which were majorly training and military camps, was demanded, especially in Tehran (Razavian 2002: 180). Military centers, with the exception of staff departments, must be located at least five kilometers far from towns because of the noise they make. As a result, the researchers of this study have applied the current location of military lands relative to hospitals and have provided the recommended distance in Table 3 from which the military layer was compiled (Map 4).

Passenger terminals. In this day and age, the increasing growth of urban population and the necessity of intra-city and inter-city trips have highlighted the obvious role of passenger terminals in regulating urban traffic and, particularly, in creating facilities and accelerating service providing to passengers. Terminals play a significant role in transportation and deliverance of passengers to their destinations. In this study, suburban terminals have been analyzed (Map 5).

Slope. Slopes are among the most important factors of the change in Earth's roughness and, as a result, have direct and indirect effects on human life and their activities. The construction of each facility needs a certain degree of slope while it is highly influenced by the changes in slopes and unsteadiness of surfaces (Zomorodian 1997: 25). Evidence shows that Ilam is limited by mountains in every direction. Regarding its altitude, Ilam is in the range of 2150 meters in southern and south-western areas which goes down to 1550 meters in northern and north-eastern areas. Regarding its inclination, Ilam is located on slopes of zero to 15% while higher degrees of slope are due to the existence of higher lands (Ansari Lari, Najafi and Nourbakhsh 2010: 5). The appropriate slope for hospital spaces in Ilam was determined according to the known latitude sites in the city and interpolation operations followed by reducing error coefficient in GIS and finally the city's inclination was modeled (Map 6).

Water streams. Out-of-order changes in surface shape, damaging vegetation, and construction on natural streams have intensified the threat of floods (Bahraini 2011: 172). Rivers hinder different stages of a city's physical expansion. Among others, the construction of urban buildings out of rivers' vicinity is a vital factor in preventing river floods (Shia 2012: 238). Considering the relative roundness of Ilam's drainage basin, in times of heavy precipitation, such a feature causes the shortness of concentration time and together with impenetrable surface of the town ends in outburst of floods and waterlogging of passages and urban streams. Therefore, the limits of the position of hospitals on streams was applied (Map 7).

Communication network accessibility. First class arterial roads provide the fast connection between far regions in large cities as well as the connection between intra-city roads and inter-city roads. While first class arterial roads are used for short trips as well, the main role of such routes is the provision of fast transportation for far and relatively far trips (Organization for Planning and Preparing Regulations 1996: 1). The unwanted environmental effects caused by roads include pollution of air surrounding roads and in towns, increase in noise, pollution of underground water, pollution of agricultural soil, fracture of soil by water, reduction of the water capacity of streams and rivers etc. (Organization of Planning and Preparing Regulations 1995: 128). Being located on first class arterial roads is one of the general criteria for the positioning of hospitals (pour Mohammadi 2010: 61). The determination of the adequate vicinity for roads and preventing the establishment of sensitive types of usage around roadways is one of the techniques, from the viewpoint of urban development, which is capable of controlling or breaking the load of sound waves. Given that roads and streets the main sources of spreading noise pollution, the observance of the suitable distance from streets – at least 50 meters – is necessary (Mohammad Zadeh 1997: 9). The preparation of the information layer and the information related to the layer of accessibility was carried out after the detection of the method of access and weighing.

Population density. The estimation of the study area is the paramount data for every type of planning, especially land usage planning, because the required amount of the areas for housing, communication, industry, well-being facilities, and services are determined based on this estimation (Pour Mohammadi 2010: 21). In this study, the basis for weighing was in four classes based on which the density of individuals per hectare was resolved (Map 9).

Effective performance range. Accessibility is an indication of a good city. Accessibility has a close relationship with usage because the distribution of various types of usage is the antecedent of accessibility among them. Fast, secure and cost-effective accessibility to certain areas has become a very complicated and expensive issue due to the expansion of cities and scattering of usage types (Bahraini 2011: 203). A neighborhood is a physical embodiment of a place holding 700-1250 households with the accessibility range amplitude of 300-375 meters (4-5 minutes) which is characterized with mosques and a primary school as its manifestations (Habibi and Masaeli 1999: 13). In this study, the effective performance range of hospitals on urban scale was considered 1000 meters from residential neighborhoods (Map 10).

Distance from existing health centers. Consequently, when there is a consistency between the two mentioned scales, the desirable balance is achieved and activities are reflected on according to their capacities or both will be each other's obstacles. Complying with appropriate distance is necessary for avoiding such distractions among hospitals (Map 11).

Centrality in relation to the region. Zoning is a method by which urban lands would be used properly after considering the internal usage instances of cities. In this way, enough space is provided for different kinds of urban activities, urban development, and urban functions, and every important part of urban activities finds its place and works with regard to other functions and activities. In zoning, it is attempted to make urban services such as hospitals, schools, mosques, streets, and leisure sites as much accessible to people as possible (Shakooei 2008: 241). In this study, the municipality's zoning was utilized and the center of each region was determined. Then the centrality of each region was resolved by defining vicinities (Map 12).

Table 3: Utilized layers and priorities

components	fire department	terminals	population density	access to communication network	effective performance range	inclination	distance from existing health center	military/lands	centrality in relation to region	streams
Fully compatible	0-300	> 1500	>150	50-100	>3000	0-3	>1200	>200	0-500	>300
Relatively compatible	300-600	1000-1500	100-150	100-150	2000-3000	3-8	900-1200	1500-3000	500-1000	200-300
Indifferent	600-900	500-1000	---	150-250	1500-2000	8-12	600-900	1000-1500	1000-1500	150-200
Relatively incompatible	900-1200	200-500	50-100	250-400	1000-1500	12-15	300-600	500-1000	1500-2000	75-150
Fully incompatible	>1200	0-200	0-50	>400 and 0-50	0-1000	15-20	0-300	0-500	>2000	0-75

Guidelines and recommendations

1. a quiet habitat, healthy city, away from the urban problems of today's world, something that would not be possible if not impossible simply time, therefore it is necessary that the field of cooperation between authorities (planners), researchers and people to come up with a joint venture, concerning the welfare of citizens in the city.
- 2- Now it is necessary to coordinate with other land use residential development of the whole of Tehran in this regard will be compensated. This will contribute to balanced growth of the city.
- 3- Now it is necessary to coordinate with other land use residential development of the whole of Tehran in this regard will be compensated. This will contribute to balanced growth of the city

Resources

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