Spatial-temporal Urban Growth Patterns in Iran

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Abstract: Urbanization processes in different parts of the world are the results of socio-economic, political, technological, geographical and cultural factors at local and global level. These processes are producing different urban patterns in different parts of the world, considering time and context. Current paper is the result of research about factors affecting urbanization, processes and patterns in Iran. Results show that urbanization process and urban growth in Iran has passed through two stages of concentration and de-concentration. Also, urban primacy pattern is observed and Tehran is the primate city. In 1980s, the problems of concentration in first rank cities ended in de-concentration. But this de-concentration has Polarization Reversal pattern. One example of the resulting spatial pattern can be observed in Tehran Metropolitan Region. Exploratory spatial data analysis shows the formation of center-periphery pattern in Iran’s urban network. At the national level, Tehran is considered as the center and other surrounding cities are considered as periphery. At regional level, similar center-periphery pattern is observed. Top rank cities are centers and other surrounding cities act as periphery.

Key words: Urbanization, concentration, de-concentration, polarization reversal, exploratory spatial data analysis, Iran.

1. Introduction

With the occurrence of industrial revolution in 18th century, most rapid changes and evolutions happened. Urbanization process and urban growth had impacts on all countries in the world. Urban population reached to 49 percent in 2005 compared to 13 percent in 1900. Recent forecasts show that in 2030, about 60 percent of world population will live in the cities [1]. Although, the urbanization and urban growth are global events, its impacts are more considerable in developing countries. High percentages of urbanization have occurred in developing countries compared with other parts of the. Although the pace of change has varied considerably between countries and regions, virtually every country of the developing world has been urbanizing rapidly. Evidence of a slowdown in the rate of growth of some of the largest cities and of polarization reversal or spatial de-concentration into polycentric metropolitan forms does not contradict the conclusion that the developing world is becoming increasingly urbanized [2].

Urbanization process in different parts of the world is the result of complex social, economic, political, technological, geographical, cultural factors at global and local levels. This process in different stages through the time, and according to the local context, is producing different patterns in different patterns of the world. In contrast to the centrifugal pattern of urban population change in advanced societies, the centripetal processes of urbanization and urban growth continue to dominate urban population dynamics in the developing world [2]. A high degree of concentration or the share of large metropolitan areas in total urban population characterizes the rapid urbanization in many developing countries today. That concentration is also reflected in urban primacy or the share of the largest city in national urban population. Urban primacy pattern involves megacities of unparalleled size, presenting major problems in health and quality of life, international industrial competitiveness, management and institution building, social cohesion and stability [3].
Although, urbanization is a global event, this event is considerably dynamic in Iran, so that a unique urban growth has happened in Iran in the past five decades. During the past 55 years, the urbanization level has increased from 31 percent in 1956, to more than 71 percent in 2011. Parallel to rapid urbanization level, the number of cities has also increased from 199 cities in 1956 to 1139 cities in 2011 [4]. In fact, urbanization in Iran, during the recent decades, similar to other developing countries has been increasing and the population has concentrated in urban areas. Despite high urbanization level and increase in the number of cities during the past 55 years, urban growth rate has not been consistent and different urban growth rates have changed the urban system substantially. Some cities have improved their status because of economic, political and environmental factors, while other cities have lost their status in urban hierarchy. To solve the problems of unbalanced urban system and its consequences, study of urban network, urban hierarchy, types of functions and their roles are necessary.

Urbanization and urban growth in Iran are affected by social, economical, political, technological, geographical, and cultural factors at global and local level and had numerous spatial-temporal changes. In each time section, because of the above mentioned factors, particular urban patterns have emerged. This paper is an attempt to answer following questions:

What have been the impacts of economic, social and political changes on Iran’s current urban growth?

What patterns are formed under the impact of economic, social and political factors?

Has urban growth distribution been the same considering spatial-temporal dimensions?

2. Literature Review and Conceptual Framework

Despite fundamental differences in urbanization and urban growth between developed and developing countries, processes and patterns of urbanization and urban growth pass through similar path. In all regions of the world, urbanization process and urban growth in its spatial-temporal dynamic are affected by social, economic, political, geographical and cultural factor at global and local level. But in general, urbanization process consists of two major stages of concentration and de-concentration. Each of these stages, considering the context has its particular urban pattern.

The stage of concentration happens at the early stages of urban growth and that is the time that urban growth in a country or a region has changed as the result of internal and external factors and has ascending trend. In this stage, large urban centers absorb population, resources and capitals from national or regional space. The concentration process causes convergence of population and activities within the urban borders. The formation of megapoles and urban primacy is a reflection of concentration in the different countries. In this stage, one or few cities grow in a rapid rate disproportionally and separate themselves from other cities.

The concentration process as a subsection of a mega process of urbanization and urban growth is replaced by de-concentration because of the impact of the internal and external factors. Lack of economies of scale beyond a point in megapoles, congestion, high land value, pollution, new opportunities for investments in other areas, and government policies to economic growth other areas, supersedes the concentration, and de-concentration starts. In this stage, the de-concentration causes the convergence of sectors of the population and related functions and causes changes in megapoles and urban areas, and multi-nuclei megapoles are formed. Richardson calls this stage the reversal concentration. Richardson believes that in this process, secondary cities in a region have higher growth. In other words, in this new stage, a number of cities and towns within a metropolitan region experience high population growth and are located in different distances from the major city [5].
When small and mid-size cities are growing, urban system is under the influence of centrifugal factors or de-concentration. On the opposite, when the largest cities are experiencing relative growth, urban system works under the influence of centripetal forces toward concentration or re-urbanization [6].

Geyer and Contuly (2008) present the concepts of differential urbanization and believe that differential urbanization can be defined as a sequence of urban development cycles [7]. In each cycle, phases of urbanization, polarization reversal and counter-urbanization can be observed. In urbanization phase, the major of flows of migration are toward the major city and then in second phase, mid-size cities grow in de-urbanization and finally in third phase, counter-urbanization, small cities will grow. But Geyer and Contuly believe that wherever, counter-urbanization occurs, related trend is dispersed concentration. Vining and Contuly wrote that in the process of de-concentration, people tend to concentrate in few small and mid-size cities in the periphery [7]. Building on core-periphery model and adding factors such as locational constant and economies of agglomeration, the space economy in which a country's urban system is embedded typically goes through three phases of development. First it goes through a phase of convergence when the urban system gains in primacy. The urban-industrial process of national development begins in one or two regions only, primarily because of the scarcity of investment resources this initial start becomes a cumulative causation process explained by increasing returns to scale and the consequent polarization of labor and any surplus capital from other regions. The core-periphery relationship is thus established where the core region consisting of the primate city and its hinterland dominates the rest of the space economy, called the periphery. This periphery is dominated by the core and dependent on it and its rate of development is controlled and distorted so as to further the core's economic interests [8]. At a more advanced stage of development, a spatial transformation begins to occur within the core region. The population and agglomeration of economic activities in the primate city become so large that a mono-centric spatial structure becomes inefficient and costly. Congestion costs and rising land values induce some economic activities to decentralize to satellite centers within the core region. These centers may intercept new migrants who are attracted by job opportunities expanding at a more rapid rate than in the primate city [9]. Subsequently, polarization forces start giving way to de-concentration forces and economic divergence sets in. These condition are probably associated with the generation of agglomeration economies and other scale economies at selected locations in the periphery, and these reflect the diffusion of technical knowledge from the core, rising population and incomes, expanding markets...the exploitation of local resources, lower input costs, improvements in communications, the build-up of infrastructure and other factors making economic expansion at these locations profitable. The dispersion process may be accelerated by obstacles to continued rapid expansion pressure on housing and infrastructure, and above-average rate of increase in living costs. However, the dispersion takes place very unevenly, with most of the growth outside the core region occurring at a limited set of relatively large urban centers. In a sense, the national concentration within the core region is replicated by regional concentration in major regional centers.

At this stage, spatially, the economy has become highly integrated with certain secondary and tertiary centers growing faster than primate cities. Interaction between the closest secondary and tertiary centers and the primate city may lead to the emerging of development axes. This phase corresponds with the advanced intermediate city and small city phases. The second phase is associated with the concept of polarization reversal and the final phase with counter-urbanization. Together these phases, have termed differential urbanization [8].
In general terms urban evolution seems to follow the same pattern all over the world. First there is a phase of urban settlement establishment at which time rural settlements are formed. The second phase could be called the urban differential phase when, as a result of improved mobility and the expansion and specialization of urban activities, larger urban settlements are formed, often at the expense of smaller ones. Early stages of this phase are often associated with the problem of premature urbanization resulting in over-urbanization. Finally, an urban system enters the urban stabilization phase when concentration forces start giving way to de-concentration. This phase is associated with the concepts of polarization reversal and eventually also counter-urbanization. Whereas urbanization is largely associated with developing countries, polarization reversal is largely linked to more advanced developing countries, and counter-urbanization to highly developed nations.

During the urbanization phase, indications are that production-oriented migration seems to be dominant, while environmentalism becomes more important during counter-urbanization [8]. Cuberes (2011) has done a modeling of concentration and de-concentration processes [10]. In this model, highest degree of growth and development is related to large cities. With the passage of time, growth is transferred to smaller cities with tidal waves pattern. This model has been tested in numerous parts of the world. In this model, the population of the few cities grows faster than the other cities in each time period. In other worlds there is a positive skewness in the urban growth rate during the transition period. Also, the model also predicts that, at each point in time, the fastest growing city is the biggest one, conditional on the fact that congestion costs are not too large in that city. This means that cities grow in a precise sequential order: after the largest city grows alone for a number of periods, the second-largest city takes the lead, then the third one, and so on [10].

Therefore, on the basis of theoretical review, urbanization and urban growth processes are affected by internal and external factors and two stages of concentration and de-concentration are observed. Considering the degree of the impacts of internal and external factors in each time period and in each particular location, different spatial pattern is observed. In first stage, concentration, urban primacy pattern has been dominant. Gradually, because of the problems of primate cities, second stage, de-concentration starts and urban metropolitan regions emerges. Fig. 1 presents the conceptual model.

3. Materials and Method

Cities above 10,000 population were spatial units studied from 1921-2011. To determine factors affecting urbanization and urban growth in different time periods, library and documental sources were used. Zipf model, urban primacy indicator, and urban sequential growth (Cuberes, 2011) [10] were used to examine the process. Spatial-temporal analysis of urban growth was implemented on the basis of
exploratory spatial data analysis. Among different techniques for the exploratory spatial data analysis, Getis – Ord $G^*_i$ technique was used. This technique is a measure for analyzing local spatial autocorrelation.

Getis – Ord $G^*_i$ is defined as:

$$G^*_i = \frac{\sum_j w_{ij} x_j}{\sum_j x_j}$$

Eq. 1

$G^*_i$ is standardized as:

$$Z(G^*_i) = \frac{G^*_i - E(G^*_i)}{SE(G^*_i)}$$

Eq. 2

Where $x_i$ is the attribute value of an observation $i$, $i = 1, 2, ..., n$; $w_{ij}$ is the spatial weight between observation $i$ and $j$; $E(G^*_i)$ is the expected value of $G^*_i$; $SE(G^*_i)$ represents the standard deviation of $G^*_i$; $Z(G^*_i)$ is the Z-score of $G^*_i$ [11].

Beside, to verify the results of the explorative analysis, DMPS satellite images were used. These images are taken at night and they show the lights at night.

4. Results and Discussion

4.1 Urbanization and Urban Growth in Iran

Different studies have been published about the history of the urbanization, urban growth and its evolution in Iran [12, 13]. Since 1920s, with the increase in capitalist socio-economic relations in Iran, the cities were a place for capitalist relations and started to have an important role. During these 100 years, roles of cities have evolved following the economic development pattern.

Hesamian (2008) and Nazarian (2009) have determined two distinguished stages in urbanization [12, 13]. First stage starts from 1920s and ends in 1960s. During this period, average urban population growth was 2.65 percent. Second stage was after land reform policy in 1960s and continues until 1976. During this period, urban population growth was 4.42 percent. In this classification, land reform in 1961 was an important factor to end traditional agricultural methods in rural areas and to cause rural-urban migration. The first stage of urbanization had slow rate and is called “slow urbanization”. The second stage has faster rate and more tangible impacts. The second stage is called “rapid urbanization”.

The period of “slow urbanization” is a stage where capitalist relation has started. In this stage, the traditional structure of economy has not changed and changes in urban areas are slow. In this condition, the production and social structure starts to change but these changes have not occurred in space and geographical location of the population. “Rapid urbanization” is the expression of urbanization at a stage that capitalist relation has expanded, and the traditional methods of the rural production were abandoned. Cities were the place where economic, social, and political evolutions were happening. City at this stage did not depend on rural areas but the opposite, rural areas were dependent on the cities [12].

The history of urbanization and urban growth in Iran shows that three stages of urbanization can be defined on the basis of urban growth rates (Fig. 2).

First stage: period of urban growth (1921-1956)
Second stage: Stage of rapid urban growth (1956-1991)

4.1.1. First Period: Urban Growth (1921-1956)

The start of Pahlavi kingdom was the start of changes in production method, pre-capitalist relations in Iran. The increasing integration of internal market, free market labor and changes in consumption patterns
are basic conditions for production in capitalist system. But because of the lack of industrial dynamics, the actions for integrating the internal market and modernization trend were implemented by government. Government accepted to do this through development of communication and economic infrastructure. Also, government initiated the industrial investments and established primary consumption industries. Length of Iran’s roads were doubled during 15 years and reached from 2,400 kilometer in 1926 to more than 24,000 kilometer in 1941, and total number of vehicles reached from 1,200 in 1921 to 31,000 in 1945. Public railroads were built in this period and communication systems such as post, telegraph, and telephone organizations were established in this period [12]. With the development of roads and increase in the numbers of vehicles, costs of transferring commodities, and passengers, decreased. Beside, industrialization was happening in Iran. Numbers of modern factories were increased 17 times. Numbers of people working in the large and small factories, railroad construction and building construction reached to 170,000. New class was created as labor class [14]. Share of industry in Gross Domestic production reached from 9.8 percent in 1937 to 18.4 in 1941.

Between 1921-1941, rural areas had a share of 80 percent in internal production and 72 percent of population. It was the major place for production and population. Cities were mainly the place for trade and government’s political center. Cities in this period had dominant trade role and exchanged the surplus rural agricultural production. With the expansion of the urban consumption market, especially large cities, cities were contact points with advanced capitalist countries and a place to import commodities and exchange industrial commodities. Surplus productions of agricultural products were used in the cities. Role of international trade was increasing. Traditional methods of production in rural areas were replaced with products that could be sold or even could be exported. Agricultural products were specialized and there was a tendency to grow products for export. Therefore, trade activities were developed in the cities. Expansion of communication infrastructure and political security helped. Cities and rural areas had mutual interaction. Between 1921- 1941, a balanced system of cities and rural areas existed [12]. During these 20 years, urban growth rate was about 1.63 percent and rural growth rate was 1.17 percent. This growth was mostly related to natural increase and migration did not have considerable role.

Between 1941- 1953, world war happened and there was a recession in international trade. In Iran, there was major reduction in international trade and export of agricultural products. The organized economic relation between cities and rural areas changed. Unemployment rate increased and a there was a recession in urban and rural areas [12]. This period was the start of rural-urban migration, but it is not considerable. Between 1953-1961, with the continuation of the modernization in a higher scale, there was an increase in role of oil export and a decrease in role of agricultural production. Agricultural activities were developed, but agricultural surplus is no longer a determinant of urbanization trend. Cities were relying on oil export and become the main location for evolutions. With the increasing expansion of international trade and investment and international loans, cities were the places for
international trade and economic investments, and became more dependent from rural areas. Gradually, cities became the major centers for employment and urban growth rate reached 4.7 percent per year, as a result of migration.

On this basis, there was a relative balance in population distribution between cities. Cities had their own hinterlands.


Land reform policies in 1961, along with rapid population growth and urban economic development caused fundamental changes in class structure in rural areas and land ownership [15]. There was a surplus of labor in rural areas. Role of agriculture was reduced and oil export replaced it [12]. Migration of people from rural areas increased. Iran’s population increased from 19 million in 1956 to 34 millions in 1976. Rapid population increase, pull factors in urban areas, push factors in rural areas caused an increase in rural-urban migration. Considerable migration happened between 1941 and 1951. Tehran’s population was 500,000, in 1940 and it was 1.5 millions in 1956 and 3 millions in 1966. Agricultural products had lower price than imported products and wages were higher for industrial labor. Therefore, investments in agricultural sector were reduced [15].

Between 1961-1971, employment in public sector was increased. Number of employees in urban public sector was half million, about one fifth of employees in urban areas in 1956 and it reached to 1.5 million, about one third of urban employees in mid 1960s. In mid 1971, more than 50 percent of GDP was produced by public sector and rest was produced through trade, construction activities and oil revenues. Therefore, government was the major investor that owned heavy industries, many industrial companies, transportation system and centers of “cultivation and industry” and banking system was controlled by government. Government was interested to replace exports with internal products and provided incentives for the producers of industrial commodities to establish new factories. Number of workshops with 10 employees changed from 1,400 units, 100,000 labors, in 1960 to 4,500 units, 400,000 labors in 1976. As a result of mega construction projects by government, expansion of internal markets, rapid population growth, and urban population increased [15].

After implementing land reform policies in Iran, second stage of industrialization of Iran started with replacing the exports by imports, and relative diversifying of Iran’s industry. Assembling industries were established too. With the increase in the pace of industrialization between 1965, 1966, number of labors in the industries increased from 70,000 to 400,000. In 1966, about 750,000 employees were working in mines and related industries and 500,000 were working in construction industries [15].

With the occurrence of Islamic revolution in 1970s, and Iran- Iraq war, and migration of people from fighting areas to other cities, provision of improved lands in cities, expansion of service sector, tendency to live in urban areas, the urbanization level increased until end of 1980s. Between 1976-1986, urbanization was at its highest level during the past 100 years. On the basis of the result of public census of population and housing in 1956, 31 percent of 19 millions of Iran’s population were living in 199 cities. In 1966, urbanization level increased to 39 percent and numbers of cities increased to 272 cities. Urban population growth rate between 1956-1966 was 5.1 percent. In this period, natural population growth was 3.1 percent. Comparison of urban population growth (5.1 percent) with natural population growth (3.1 percent) show that in this period, migration of rural population to urban areas had considerable impact on increase in urban population in Iran. High level of urbanization and rapid urbanization starts after 1966, when land reform policies showed their impacts and rapid growth of capitalist system was started, and as a result of that, migration to the cities increased [15]. In 1976, urbanization level increased to 47 percent, living in
373 cities. Urban population growth rate was 4.93 percent. In this period, natural population growth rate was 2.71 percent.

4.1.3 Third Period: Urban Saturation Growth (1991-2011)

As the war between Iran and Iraq was ended, and people who had migrated from the fighting areas returned to their cities, also new period of population birth control started and urbanization process and urban growth got closer to a stable stage. On the basis of public census in 1996, urbanization level reached to 61.3 percent and number of cities reached to 612. Urban growth rate was 3.21 between 1986-1996. In 2006, urbanization level reached to 69.6 and number of cities increased to 1012. Urban growth rate reduced to 2.74. In 2011, urban population growth rate was 2.14 percent and Iran’s urban population was 53646661, who were living in 1139 cities. Absolute urban population increase was 5386697, and urbanization level was more than 71 percent. Factors affecting the reduction in urban population growth were increase in the number of literate people, especially women, increase in level of urbanization, industrialization, higher costs of living, change of people’s views and tendency to have fewer children, high level of sanitation, lower level of child mortality, longer length of life. Factors affecting lower fertility in recent decade were birth control policies implemented by government at the end of 1980s, higher level of education especially for women, higher age level for marriage, high level of urbanization, women’s tendency to work and to be active out of home, changes in people’s views about marriage, and the importance of quality in raising children.

4.2 Iran’s Urban System

Iran’s urban system can be defined as a collection of large and small cities. Urban systems are constantly changing. National urban system changes and evolves with the social, economic, technological, and geographical changes [16]. Changes in urban system are continuous and happen in different spatial levels [17]. Iran’s urban network has been affected by economic, social, political factors at global and local level. Urban system has experienced important and significant changes. On the basis of first public census, in 1956, the number of cities was 199. Tehran city had 25.2 percent of population and was on the top of Iran’s urban hierarchy. There was no city with the population above 500,000, except Tehran. In 1956, more than 77 percent of cities had a population less than 25000(Table 1).

With the increase of 73 cities to urban system in 1966, total number of cities reached to 272. Growth rate in number of cities was 36.7 percent between 1956-1966. In this time period, share of Tehran population from total urban population increased from 25.2 in 1956 to 27.8 in 1966. Large and small cities experienced an increase in their size and their number. Cities with population between 100,000-500,000, placed more than 30 percent of the country’s urban population. In this time period, despite increase in number of small cities, there was a reduction in these cities’ share in urban population (Table 1).

In 1976, number of cities reached to 373. The absolute increase in number of cities between 1966-1976 was 101 cities and growth rate was 37.1 percent. The increase in share of Tehran from total population, increase in number and share of large and mid-size cities, increase in number of small cities and reduction in their share of urban population and emergence of three cities with the population more than 500,000, beside Tehran, are the most important characteristics of urban system in this time period (Table 1).

In 1986, with the increase of 123 cities to the urban system, total number of cities reached 496. Growth rate in number of cities was 33 percent. Share of Tehran from urban population decreased from 28.68 in 1976 to 22.53 percent in 1986. Mashad city in northeast of Tehran gained second rank after Tehran. Increase in the number and share of large cities,
increase in the number of mid-size cities and their stable share in urban population, and increase in number of cities with population below 25000, from 283 in 1976 to 343 in 1986, and reduction in share of small cities from 17.98 percent to 12.56 percent are important characteristics of this period (Table 1).

In 1996, number of cities reached 612. The absolute increase was 116 cities, between 1986-1996, and the increase in growth rate was 23.4 percent. Reduction in share of Tehran was from 22.53 in 1986 to 18.36 in 1986. Relative stability in number and share of large cities, increase in number and population of mid-size cities, finally, reduction in relative share of small cities despite the increase in their number are the most important characteristics of this period (Table 1).

In 2006, number of cities increased to 1012. In fact, between 1996-2006, 404 cities were added to the urban system. Rate of growth in number was 66 percent. Share of Tehran in total urban population reduced from 18.36 percent in 1996 to 16.6 in 2006. Four cities were added to the number of cities with a population higher than 500,000. Relative stability in the number and population of mid-size cities and severe reduction in number of small cities and increase in their share in urban population from 10.78 percent in 1996 to 12.3 percent in 2006 are characteristics of this period (Table 1).

In 2011, number of cities reached to 1139. Rate of urban growth was 12.5 percent and absolute increase in the number was 127 cities. In 2011, share of Tehran city in urban population had its descending trend, but no major change is observed in population classification of cities (Table 1).

4.3 Rank-size in Iran’s cities

Results of the research about the rank-size for Iran’s cities, with the population above 10,000, shows that in 1956, Iran’s urban system did not have balanced distributions. Tehran megapole was the primate city. There were few mid-size cities, with a large population difference and then a large number of small cities at the lowest level of Iran’s urban hierarchy. In 1966, Tehran had its continuous rapid growth and its balance with other cities was increased. Mid-size cities continued their growth, but Tehran had more considerable rapid growth and the gap still existed. At the lowest level of hierarchy, the number of small cities increased.

In 1970s, described situation continues. But in 1986, four large cities after Tehran (Mashhad, Tabriz, Isfahan, Shiraz), gained more population and their rank changed. The number of small cities increased. In 1996, there was a reduction in population differences between Tehran and large cities and still, Tehran was

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the primate city. Mid-size cities continued their rapid growth and number of small cities increased. Totally, the results of the examination of rank-size rule for Iran show that the most balanced distribution was related to 1956 and with the passage of time, more imbalanced distribution is observed and 2011 shows the most imbalanced distribution (Fig. 3).

4.4 Urban Primacy

Results of analysis of rank-size for Iran’s cities showed that one of major factors affecting imbalance in urban system is Tehran megapole. To know the status of Tehran in Iran’s urban system, urban primacy

![Graph showing rank-size rule for Iran's cities from 1956 to 2011.](image-url)
index was use. Urban primacy started in 1921, and increased between 1921-1976, and its peak was in 1976 (Fig. 4). To prevent rapid growth of urban primacy, policies and actions were implemented. Some of them are:

Establishing growth poles to attract large industries in fourth development plan (1967-1972) and fifth plan (1973-1978). No permission for establishing heavy industries in 120 kilometer around Tehran city (1967).

Tax waivers for the industries established in other provinces of Iran, and 12 years tax waivers for the industries that are transferred to the other provinces.

Giving priorities to provide educational, welfare, administrative, health facilities in important regional centers, in development plans.

Policies to control Tehran’s growth and to strengthen the role and status of mid-size and small cities.

Selecting and equipping some other large cities to encourage de-concentration.

4.5 Average Rank of the Fastest-growing Cities

As Cuberes model showed (2011), at the beginning of urbanization, largest city has the highest rate of growth. Gradually, rate of growth is reduced and secondary cities have higher growth rate and this process is transferred to smaller cities in an urban hierarchy in a country. Therefore, cities’ population grows in an order, and it is predicted that cities with highest rate of growth gain higher ranks in urban hierarchy.

Results of analysis show that average rank for cities with fastest-growth has increased from 1956 to 2011. In 1956, average rank for the cities with the highest rate of growth was 7 and in 2011, it was 27 (Fig. 5).

Therefore, Iran, similar to other countries has experienced two stages of concentration and de-concentration.

4.6 Spatial-temporal Changes of Urban Growth in Iran

Until 1956, there was indigenous development and Iran’s urban system had some relative balance. After 1956, with the changes in economic system from agriculture economy to oil economy, interferences of government in economic planning, to the advantage of cities, land reform, and changes in traditional production, urbanization had rapid rate. But urban growth rates have not been balanced, and different economic, political, environmental, technological changes affected urban hierarchy.

Iran’s urban growth rate was 5.1 between 1956-1966. In this period, more than 22 percent of cities with population above 10,000 experienced an urban growth rate higher than 5 percent. Highest yearly urban growth was experienced by Karaj city (11.78%), which is close to Tehran. Between 1966-1976, Iran’s urban growth rate reduced to 4.93. The number of cities with the population above
10,000, with an urban growth rate above 5 percent reached to 35 percent of total cities in Iran. Karaj city had 12.04% urban growth rate, which was highest growth rate in Iran. Between 1976-1986, Iran experienced the highest urban growth rate. Urban growth rate was 5.41 per year. More than 64 percent of cities with the population above 10,000 experienced an urban growth rate higher than 5 percent. More than 8 percent of these cities had urban growth rate of above 10 percent. Highest rate of urban growth rate happened in Gharchak city, 17.98 percent.

Between 1986-1996, urbanization level and urban growth rate started to decrease and it reached 3.21%. Only 13.5 percent of cities with the population above 10,000, had growth rate above 5 percent. Highest rate of urban growth happened in Baghestan city, 8.62 percent.

Between 1996-2006, Iran’s urban growth rate reached 2.14. In this period, only three cities with the population above 10,000 experienced an urban growth above 5 percent.

Results of spatial-temporal analysis of urban growth rate, rank- size, and urban primacy show the urban primacy pattern and center-periphery. Spatial analysis can be used to define these patterns and their changes through the time.

4.7 Formation of Urban Clusters and Center-periphery

Getis – Ord G’ was used to analyze the spatial-temporal changes of urban growth in Iran. Results show that between 1956- 1966, a significant cluster of cities with positive z-score are formed in North of Iran. This cluster consists of cities located along Caspian Sea (Gonbade Kavoos, Shahrood, Gorgan, Amol, Sari, Ghaem Shahr, Behshahr and Babol).

Between 1966-1976, no significant cluster is observed. Results of Getis – Ord G’, between 1976-1986, show that a significant cluster of cities, with the positive z-score was formed in the west of Iran, in four provinces, with high growth rates. Between 1986- 1996, the concentration and expansion of cities in Tehran metropolitan region are seen. This cluster includes not only Tehran’s province, but also provinces in north and north- central part of Iran (Mazandaran, Ghazvin, khom, and Markai). In Tehran province, the immigrated population, were settled down in four cities in this province (Karaj, Islam Shahr, Ghods, Gharchak and Pakdasht). Between 1996-2006, concentration of cities, with positive z-score increase in Tehran megapole and its surrounding is seen. Between 1996-2006, there is a reduction in the formation of cities around Tehran city and another cluster, with high z-score is observed in South of Iran, close to Persian Gulf (Fig. 6). Totally, during 55 years, 1956-2011, formation of center-periphery is observed. Tehran megapole and its surrounding cities have formed a cluster with positive z-scores. DMPS satellite images were used to present these clusters (Fig. 7).

5. Conclusion

Urbanization and urban growth a global event has affected all countries. The degrees of the effects are extreme in developing countries. Understanding urbanization and urban growth needs a framework that these two events are considered as causes and effects. Different internal and external forces have created urbanization in Iran. But in each decade particular patterns of urban growth is observed. At first, urbanization passed a process of concentration. Second stage was a process of de-concentration, ending in megopolitan regions.

Urbanization and urban growth passed a process of concentration beginning 1921. This process is reflected in the formation of Tehran, primate city. In 1976, more than one fourth of Iran’s population lived in Tehran. With the increase of problems of Tehran, as a primate city, policies were developed to confront this rapid growth. After 1976, urbanization and urban growth had dispersed clusters pattern.
Fig. 6  Spatial-Temporal Dynamics of urban growth in Iran (1956-2011).
De-concentration of population happened in close distance to Tehran megapole. The flows of migrations were from Tehran mid size and small cities. Formation of Tehran megopolitan region is the result of this polarization reversal.

Results of the research show that urban growth has been transferred to smaller cities. In fact, after a period of rapid urban growth in large cities, a period of growth has happened in mid-size and small cities. Spatial-Temporal Changes of urban growth in Iran presents important and interesting points. Until 1986, no significant cluster of urban growth is observed in Iran. In other words, regional pattern of urban growth is not distinguishable. Urban primate pattern is observed. After 1986, as a result of de-concentration policies, for the first time, significant clusters of urban growth are observed in Iran. The first cluster is observed around Tehran. Rapid growth of cities around Tehran occurs and Tehran megapole is formed. This cluster is stable and it radius is increased gradually. Therefore, center-periphery pattern is observed.

Reference

Spatial-temporal Urban Growth Patterns in Iran


