

Trend analysis of the changes in urban hierarchy of Khuzestan: a sustainable development perspective

Mohammad Ajza Shokouhi^{1*} and Jawad Bawi²

- 1- Associate Professor of Geography and Urban Planning at Ferdowsi University of Mashhad
- 2- PhD student in Geography and Urban Planning, International Branch of Ferdowsi University of Mashhad

Corresponding author: Mohammad Ajza Shokouhi

ABSTRACT: This paper deals with the changes in the urban hierarchy of Khuzestan during a period of 50 years (1956-2006) determining the extent of changes in urbanization and the potential spatial differences between the cities in this province from the perspective of sustainable development. Adopting a descriptive-analytic approach and employing various models such as tensile modulus, primate city indicators, urban concentration index (three-city and four-city), the rank-size rule, the present paper analyzes the factors influencing the urban networks in Khuzestan. It follows from the results of the study that the urban networks of the province, have been heavily affected by developments so that Abadan which used to have the first rank in Khuzestan has lost its rank to Ahwaz due to the administrative, political, and commercial centrality of Ahwaz. The imposed war (of Iraq against Iran) has also caused abrupt changes in the population and urban hierarchy. Therefore, urban networks of Khuzestan influenced by factors such as immigration do not have a spatial balance (and hence stability) currently. Interestingly, the results suggest that the spatial distance between the first city Ahwaz with other cities is growing exponentially. Finally, in order to achieve the optimal spatial urban hierarchy, the following measures are proposed: land use planning, development of mid-sized cities, creation and strengthening of new cities as well as small towns, and giving variety to activities and functional roles of cities.

Keywords: sustainable development, urban hierarchies, urban networks, Khuzestan.

INTRODUCTION

Statement of the problem

Cities, as complex and at the same time dynamic systems, have an increasingly important role in the development of economic, social, cultural and spatial structure of a country (Izadi, 1993: 58). Although urban centers in each country are classified quantitatively and qualitatively due to geographical conditions and economic, social and political dimensions (Beikmohammadi, 1996a), urban hierarchy is one of the best ways to organize space (Abedin Darkoosh, 2003). Put briefly, urban hierarchy can be defined as the classification of the cities of an urban network based on their importance (Farid, 1996). Different scholars have adopted different qualitative classifications of cities among which the evaluation of urban hierarchy in terms of employment or of facilities and space can be mentioned (Nazarian, 1994). Jefferson (1939), for example, proposed the Law of Primate City whereby the primate city in any country is believed to be the one which is large, independent and at the center of great attention, and the one which conveys a sense of strength and national proud (Behforooz, 1995). Jefferson believed that a primate city is created when its population is several times bigger than that of the next city in an urban network (Azimi, 2002). In the meantime, Arthur Smiles (cited in Mostofi Almmalk, 2001) believes that in a regular urban hierarchy, there is a reasonable relationship with regular increment between the number of cities and population groups. However, Pierre Georges believes that a hierarchy which is mapped onto the residents of a city or metropolitan area cannot give a completely clear picture of the urban hierarchy, and he recommends that the hierarchy should be specified based on

the functional nature of the city (Farid, 1996). George Zipf proposed the rank-size law for determining an urban hierarchy (Clark, 2000).

The theory of development of border areas is put forward in population distribution policies, but the motive behind the development of these areas is not usually to achieve equality in regional development, but this is done due to various reasons such as the importance of these areas from a national security point of view (Ziyari 2004).

In recent decades urban centers have expanded rapidly into metropolises (Nazarian, 1995). In 1970 (only) 37 percent of the world's population lived in cities while in 1995 (25 years later), this figure rose to 45%, and ten years later in 2005, the urban population of the world exceeded 50% (Masika & et, 1997). Not surprisingly, the world's urban population is expected to exceed 61% in 2025 (Nazarian, 2001). At the outset of the Industrial Revolution and the subsequent rapid expansion of cities, urban communities have faced much more difficulties. The most significant of these problems are the intense concentration of people and activities in one or more cities along with the failure of urban hierarchy system in most countries (Amy & Mark, 2005). Planners in most developing countries are dissatisfied with the spatial development of settlements and the regional distribution of population and economic activities therein (Zebardast, 2004). In fact, in most countries, migration from villages and small towns to the big cities and the growing focus on one or more cities is the main cause of failure in the urban hierarchy (Radstrom, BED, 2005). This is reflected in the concentration of population in large cities. This concentration in major metropolitan centers, often causes a rebound effect, and the cities around will be empty of capital, goods, and raw materials (Rondinelli, 1983).

One of the most obvious characteristics of urbanization in developing countries is the poor spatial distribution (Nazarian, 1993: 66). Due to several reasons, the spatial distribution of cities in Iran which is considered one of the developing countries also does not follow any order, and imbalance is its main characteristic (Zarrabi and Darki, 2006: 66). In fact, urbanization in Iran is not based on any hierarchical order, and cities, especially large ones, have grown with great many differences from small towns (Rakhshani Nasab and Beikmohammadi: 2007: 28). Especially in the last half a century, the development of capitalism in form of an oil-export-reliant economy has reduced the importance of agriculture and contributed to the rapid urban growth, and thus led to migration from the countryside to cities (Nazarian, 2000). Since the late 1976s onward, this country witnessed a more rapid growth of urbanity and urban population (Nazarian, 1994).

The development of capitalism in the context of Iran's oil-reliant economy stimulated the growth of large cities, preventing rural growth and eliminating galaxy-like network (Nazarian, 1995). Moreover, the transformation of a number of villages into cities and the physical development of cities and incorporating their surrounding villages contribute to a higher urban population (Rahnamaee and Shah-Hosseini, 2004). Accordingly, the overall pattern of spatial distribution of population and urban centers in the country is an indication of funding of and paying attention to urbanization, and especially the tendency to settle in large cities, which will bring about an uneven urban network. (Zarrabi and Rakhshani Nasab, 2006). It seems that Iranian urban networks do not follow any hierarchy and continue to be evolving in terms of centralization (Arjmandnia, 1995).

Research questions:

- Is there a balance in the spatial distribution of the urban networks of Khuzestan?
- What factors have influenced the development of the province's urban network?
- What are the prospects of Khuzestan's urban networks with regard to the stability of spatial distribution?

Review of literature

Any movement towards achieving a balanced and equitable regional development and sustainability goals calls for a thorough understanding and analysis of urban networks in any region. (Taghvaei and Goodarzi, 2009). The literature on urban planning is fraught with studies dealing with this very issue. Henderson and Wang, for example, estimated Zipf's model for the fourteen countries of America, Brazil, Mexico, England, France, Germany, Italy, Spain, Ukraine, Nigeria, India, China, Indonesia, Japan, in 1960 and 2000. The results showed that urban concentration is highest in Germany as compared with other countries (Akbari Asgari and Farahmand, 2006). Xie and Ward analyzed the urban system in West China (He-Xi Corridor), and arrived at the conclusion that natural and geographical factors are among the factors which influence that urban system (Xie and Ward, 2006). Tabuchy and Thisse examined the hinterlands of commercial cities and their impact on surrounding agricultural areas. They found that if commuting costs are moderate, central locations will grow endogenously (independently) (Tabuchi and Thisse, 2006).

Research objectives:

-Analysis of changes in Khuzestan's urban hierarchy of and its influencing factors using various methods over a course of 50 years (1956-2006)

-Identification of the factors influencing the potential spatial difference in Khuzestan's urban network over a course of 50 years (1956-2006)

Theoretical Framework

Peter Hall defines the concept of sustainable urban development as a form of modern development which can ensure the sustainable development of cities and urban communities of future generations (Hall, 1993). Urban planning requires a proper understanding of urban spaces which involves the majority of city people, its objectives and events. In the concept of sustainable development, there is an emphasis on improving and modifying the quality of life of urban residents (Moughtin, 2006). Regional inequalities in Iran is the result of several factors which overshadow economic, social, cultural, political, and social performance, spreading inequality throughout Iran (Feiz Mohammad ., 1998).

El-Shakhs enumerates the major impacts of the concentration of population in large cities as follows:

At a macro-level, the concentration of population in large cities reduces population growth in small cities and the countryside. Concentration leads to regional scattering and imbalance among social groups, which would generate instability. In fact, concentration causes the loss of arable lands for the sake of housing projects and horizontal urban development. At a micro-level, this concentration brings about shortages in social and cultural services and improper use of the land. (El-Shakhs, 1994).

The underlying assumptions of sustainable development are based on the idea that technology cannot make up for any reduction in natural resources (Kiani, 2004). Paying attention to (particularly large) cities as separate and discrete entities regardless of their relationship with other complex components forming the (urban) systems can neither be sustained nor contribute to the sustainability of urban systems or networks. Any intervention in the function of each component of the system components (cities) separately, regardless of its relationship with other components, would lead to malfunctions in other elements and finally the entire system. This is one of the outstanding characteristics of systems (Newman, 1999). Urban sustainability varies depending on the city's potentials in adaptation with the external factors. Urban systems and networks are connected to each other through trade communication, migration, capital, services and information flow, and this relationship means that cities are vulnerable to external factors over which they have little or no control. Therefore, they should be able to respond properly to any unexpected change or problem that may affect maintaining the stability of their inner workings. In fact, to remain in a stable condition, cities must constantly reproduce, adapt and evolve in a direction that is supposed to demonstrate their function in the urban hierarchy. In the meantime, the overgrowth of cities has led to spatial imbalance and loss of stability in the region while the cities themselves (in a parasitic manner) are attracting populations, immigrants, resources, facilities, and job opportunities. B. F. Hozlitz theorizes that a parasitic city will have dominance over the entire economic, social, and political activities of a region and exert negative effects upon them under different circumstances, which would cause imbalance in the spatial distribution of the region and in the urban hierarchy. (Shekvi, 2001). Walter Krystaler (1933), in developing his theory of central location, modeled the design of the spatial distribution of settlements in southern Germany and analyzed it within his theoretical framework. His theory is based on the idea that the distribution of a central locality in a regional space is in a way that any central locality at its particular level supplies the goods and services of its lower localities. In fact, his model relies on the marketing principle and the hierarchical relationships among the central localities (Azimi, 2002). In Krystaler's model, m is the class of the city, P_m is the size of the city in class m , H_m is the population to which the city provides service, and K is a constant whose value is between zero and one (Meyer, 1981). Jefferson (1939), proposed the law of primate city, and he believed that the concept of primate city in the region would make sense if there is no balanced system of urban hierarchy (Behforooz, 1995). According to Zipf's rank-size rule, a rank 2 city would have half the population of a country's largest city, a rank 3 city would have one-third the population of a country's largest city, and hence a rank n city would be one- n th the population of the largest city. (Clark, 2000). However, Pierre Georges believes that a hierarchy which is mapped onto the residents of a city or metropolitan area cannot give a completely clear picture of the urban hierarchy, and he recommends that the hierarchy should be specified based on the functional nature of the city (Farid, 1996: 488). Arthur Smiles (cited in Mostofi Almmalk, 2001) believes that in a regular urban hierarchy, there is a reasonable relationship with regular increment between the number of cities and population groups.

The UN's classification of world localities based on population (excluding production and service activities) is as follows: the rural town (under 25 thousand people), town (between 25 thousand to 50 thousand people), small-sized city (between 50 thousand to 100 thousand), mid-sized city (between 100 thousand to 250 thousand people), city (with 250 thousand to 500 thousand people), large cities (500 thousand to one million) and metropolis (over one million) (Habib, 1999).

Research Hypotheses

H1:

The spatial distribution of Khuzestan’s urban network is not balanced.

Pursuing growth pole policy, land reform, housing policies (after the Islamic Revolution), and events such as war and the failure of reconstruction policies and programs all have contributed to the spatial inequality in Khuzestan’s urban network. Khuzestan’s urban network is moving towards more concentration, spatial inequality and instability.

MATERIALS AND METHODS

With regard to the topic of this paper and the definitions given, a quantitative-analytic approach is adopted. Various models such as tensile modulus, primate city indicators, urban concentration index (three-city and four-city), and the rank-size rule are employed in this paper to analyze the factors influencing the urban network of Khuzestan.

RESULTS AND DISCUSSION

Population tensile modulus

This index represents the level of elasticity of urban centers in one region with proportion to the whole region (Kheyr Nejad, 2007: 38). This index increases as there is a rise in the migration towards urban centers while any lag in this process of migration leads to a decrease in this index. (Fani, 2003: 78). The following formula shows how to calculate the population tensile modulus.

$$E(t, t + 10) = \frac{Yu(t,t+10)}{r(t,t+10)}$$

If the tensile modulus approaches unity and above, then the center can attract the intended population. Otherwise, it does not have the capability to be home to that population.

tensile modulus of Khuzestan’s rural and urban population during 1986-96

$$E(t, t + 10) = \frac{4.82}{3.40} = 1.42$$

tensile modulus of Khuzestan’s rural and urban population during 1996-2006

$$E(t, t + 10) = \frac{1.97}{1.33} = 1.48$$

With regard to the tensile modulus of Khuzestan’s rural and urban population during 1986-2006, it follows that the province have the potential to attract population and that migration flows from rural areas to the cities.

Primate city indicators

This indicator was first introduced by Mark Jefferson in 1939 in a seminal and innovative paper entitled "Primate City". A primate city is the leading city in its country or region, disproportionately larger than any others in the urban hierarchy. Since this dominant city attracts the most economic and cultural resources of a country, it is introduced as a parasite because it prevents the development of other areas of the country (Shekvy, 2008: 485).

This index is obtained from the following formula.

$$\frac{P1}{P2} = \text{Primate City Indicator} \quad P1: \text{First City Population} \quad P2: \text{Second City Population}$$

Table 1. Indicators of primate city, three-city and four-city in Ahwaz during 1956-2006

subject		Time interval or the Census year					
		1956	1966	1976	1986	1996	2006
Primate city indicator of Ahwaz		0.53	0.76	1.15	3.83	3.91	4.18
Urban concentration indicator of Ahwaz	three-city	0.37	0.46	0.61	1.73	1.53	1.70
	four-city	0.33	0.40	0.53	1.43	1.27	1.40

Source:

Statistical Center of Iran. Census of Population and Housing in the respective years and calculations of the authors.

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During 1956-66, the rank of the population of Ahwaz was second in relation to the primate city (i.e., Abadan). This is the flourishing period of Abadan when was the largest port of oil, gas and petrochemical industries in the Middle East, hence making it the primate city in Khuzestan. .

However, due to its political centrality, the later establishment of offices and industrial companies, industrial factories such as Khuzestan Steel Company, Piping Company, Ahwaz had an exponential increase in population, becoming primate city, and in 1976 census, its population was recorded to be 1.15 times as that of Abadan. (Table and Figure 1). The city's population in the next census interval continues to grow more rapidly. From the year 1986 onwards, due to war, occupation and evacuation of the population of the city, Abadan lost its position to Dezful, making Dezful the second city of the province. Due to the migration flood from war-stricken and border areas to Ahwaz and the continued focus of administrative, political, population centrality of Ahwaz, it dominated more rapidly over other cities in Khuzestan.

Urban concentration index

In order to detect the order of the urban hierarchy of cities in one country, urban concentration index can be used which is obtained by dividing the population of the primate city into that of the second and the third (and the fourth) combined (Taghvaei, 2000: 53)

Three-city indicator

In the first three decades (1956-76), having a growing trend according to the three-city indicator, the proportion of Ahwaz's population as compared with the other three cities was 0.37, 0.46 and 0.61 respectively (Figure 1).

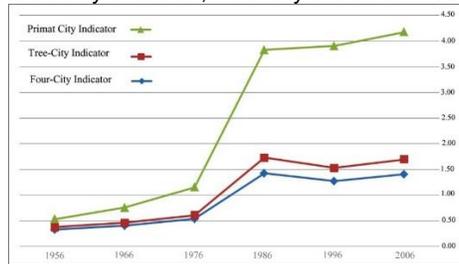
This seems to be due to the population increase of Ahwaz thanks to its administrative, commercial and industrial activities. However, due to the outbreak of war (in 1980), in 1986, the population of Ahwaz exceeded the total population of the other three cities and was 1.73 times as much as their total population.

During these ten years, hosting refugees from the war-affected regions in the province and being the administrative, commercial, industrial and military focus of the province contributed to this population increase. However, in 1996, the return of a part of the population of the formerly war-torn cities to their homelands led to the relatively large increase of population of the second and the third cities (i.e., Abadan and Khorramshahr). However, in 2006 again, imbalance and maximum urban dominance was given rise to.

Four-city indicator

Due to the increasing political and administrative centrality of Ahwaz and the increasing concentration of heavy and construction industries there, Ahwaz had a population of 0.33, 0.40 and 0.53 in the first three decades of the study respectively. However, in 1986 the population of Ahwaz exceeded the total population of its following cities (including Dezful, Masjed Soleiman, Behbahan and Bandar Mahshahr) and was 1.43 times as much as their total population. This can be attributed to its hosting of the refugees from war-torn cities, the concentration of commercial, industrial, service activities, and supplying other cities of the province. In the following period, by creating different reconstruction headquarters and development activities, the then governments tended to pave the way for the return of the refugees to their formerly war-stricken homelands. The relative size of the second and third cities (formerly war-torn) in 1996 approached 0.16, lowering the urban dominance rate to 1.43. However, in 2006, Ahwaz moved towards imbalance and more dominance. This could be due to the arrival of a new wave of immigrants from less developed cities across the province and perhaps the failure of some of reconstructions programs in war-affected areas (Table. 1)

Figure 1. Primate City indicator, Three City indicator, Four city indicator of Khozestan's Cities during 1956-2006



Source:

Statistical Center of Iran. Census of Population and Housing in the respective years and calculations of the authors

The rank-size rule

Zipf believes that in the case of city populations, the resulting distribution in a country, a region, or the world will be characterized by its largest city, with other cities decreasing in size respective to it, initially at a rapid rate and then more slowly. For example, a rank 3 city would have one-third the population of a country's largest city, a rank 4 city would have one-fourth the population of the largest city, and a rank n city would be one-nth the population of the largest city. He believes there is a linear correlation between the urban population and their rank (Taghvaei, 2000: 55)

$$P_n = P_1 / R^b$$

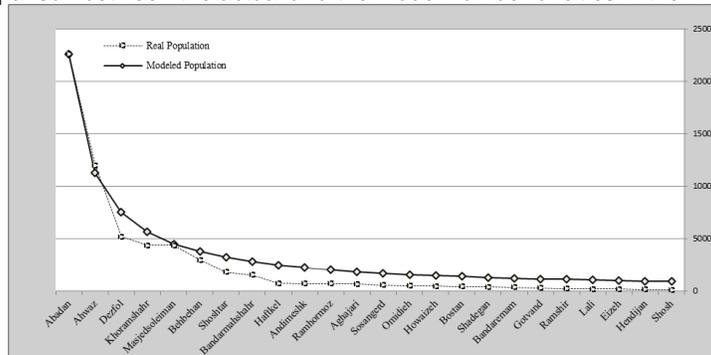
In this equation, the more the line is leaning towards 1 or -1, the more balanced the urban system is. The urban hierarchy is directed towards logarithmic normal distribution (Haggett, 1972, p. 282). To determine the coefficient b, the logarithmic relationship between rank and size is used. By inserting the logarithm of the rank-size in a linear equation the coefficient b is determined.

$$\text{Log}P_n = \text{Log}P_1 - b\text{Log}R(1)$$

$$y = a + bx' = \frac{\text{Log}P_1 - \text{Log}P_n}{\text{Log}R}$$

Since it clarifies the issue of urban establishment, this model can determine the (im)balanced ranking of cities. In 1956, the population of Abadan as the dominant city of the time to that of the second, the third and the fourth city was 1.9, 4.3 and 5.2 respectively. This concentration of urban population is due to the oil and petrochemical industry, pursuing growth pole policies, and the extreme rural and urban immigration from across the country (Figure 2).

Figure 2. Comparison between the actual and the model number of cities in the Khozestan in 1956



Source:

Statistical Center of Iran. Census of Population and Housing in the respective years and calculations of the authors.

Due to its political centrality in the province and south west of the country, Ahwaz often used to be placed in the second rank. In 1956, although Abadan still had the first rank, compared with the previous decade, its difference with the second city reduced, being about 1.1 times as much as the second city. In the same year, due to the concentration of political, economic and administrative activities in Ahwaz (as the political center of the province), welfare faded away from Abadan. The first city with 1.2 and 2 times decrease in population was 3 and 3.2 times as populous as the third and the fourth cities (Khorramshahr and Dezful) respectively. At this point, the growth rate of Ahwaz (5.6% per year) as compared with the first city (1.9% per year) is 3.7% higher. Factors contributing to the promotion of Dezful and Khorramshahr to the third and fourth ranks include the influence of Abadan (with respect to Khorramshahr), the spreading development of oil and gas, transportation, tourism, trade. In this decade, the population of Khorramshahr had a significant 7.3 % growth. Due to the administrative, political, and commercial centrality of Ahwaz and the increasing concentration of heavy and construction industries there, Abadan lost its position (as a first rank city in two consecutive decades) to Ahwaz. At this time the ratio of the first city's population (338,604 people) to that of the second city (294,068 people) was recorded to be 1.2. Ahwaz promoted to the first rank in terms of its population size, becoming 2.4, 2.8 and 4.4 times as populous as the third, fourth and fifth cities (cities of Khorramshahr, Dezful, and Masjed Soleiman) respectively. At this point, the growth rate of Ahwaz (5.1% per year) was proportionally faster than that of Abadan (2.7% per year). However, there was no change in the ranks of the third and the fourth cities.

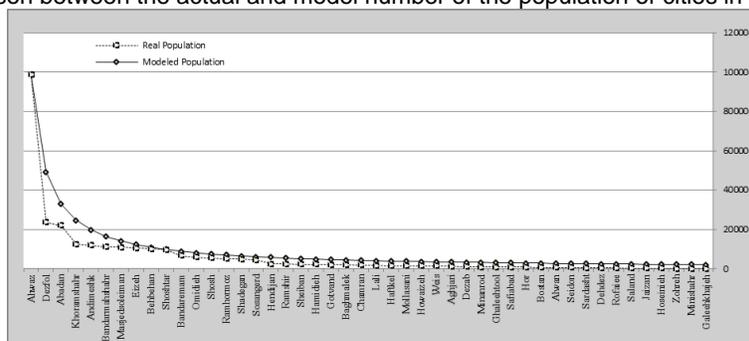
The relatively high population growth rate of Masjed Soleiman and the rural migration for deployment activities in the oil and gas industry and its related activities, led this city which used to hold the sixth rank in the former decade to promote to the position of Behbahan. Therefore, mid-sized cities had a relatively better position in this period, and in order to create balance in the urban network, strengthening small cities seems to be a good solution. Despite its relative decline in population and hence its demotion, Abadan was still higher than the model line. This is also true from the third to the fifth ranks. In the next ranks (from the sixth onwards), the urban population had a reversed order. During 1956-66, the most important changes in the hierarchy of Khuzestan province occurred whereby the first city lost its position. In fact, the 1956-66 period witnessed fundamental changes in political, economic and social policy, and consequently, coincided with the occurrence of important events such as war and economic sanctions. At this juncture, the Islamic Revolution, various costs resulting from the change in plans, the military conflict with the neighboring country Iraq, the border cities being target to missile attacks, the advancement of enemy troops and the consequent destruction of these cities all contributed to the chaos in the urban hierarchy of the province. This has caused Abadan which used to be the second city with 294 068 people population to have only 6 people. The populations of Khorramshahr (ranking third in 1956) and Bostan were recorded to be zero, with Hoveyzeh losing more than 60 percent of its population. On the other hand, Ahwaz, being the host to a large part of war-affected population and providing military and logistical coverage for the battlefield, maintained its position as the first city, and by a significant population growth of rate of 5.7% per year, it reached a population of half a million. In 1986, Dezful, Masjed Soleiman, Behbahan and Bandarmahshahr had the second to the fifth ranks respectively. Also, the proportion of the population of the first city to those of these cities was 3.8, 5.5, 7.4, and 8.1 respectively. Population distribution in urban areas of the province deviated from the designated (model) line compared with the previous decades. Note that due to the relatively large size of the first city, all other cities of the province are below the model line. During 1986-96, Ahwaz remained in first place keeping its distance from the second city (formerly Dezful and Abadan now). The government's extensive propaganda for starting reconstruction and development projects was influential in the rapid return of the formerly war torn population to their homelands. As a consequence, Abadan's population which was 6 in 1986 rose to 206 073, and by the same token, the zero population of Khorramshahr in the same year rocketed to 105,636 in 1996. In this decade (1986-96) despite its notable growth rate of 3.0% per year, Dezful relegated to the third place in favor of Abadan. Unlike Abadan which regained its former position, Khorramshahr, being in the third place in 1976, relegated to the sixth, after Masjed Soleiman and Andimeshk. In this period, the population growth rate of Ahwaz was 3.3 which is relatively high despite the departure of the population of the formerly war-torn cities. In 1996, the proportion of the population of Ahwaz as the dominant city to that of the second city was 1.9, while it was 4 and 6.9 in relation to the population of the third and fourth cities (Dezful and Masjed Soleiman) respectively. The concentration of this size of urban population of the province in the first city, the maintained even increasing distance between the first city and the following cities, all show the first city's move towards greater dominance, creating macrocephaly in the urban network of the province and hence more clutter.

During 1996-2006, with the failure of development plans, the incorrect and unplanned implementation of construction activities, the re-departure of the native population of the formerly war-torn cities from their homes toward Ahwaz, a new round of changes in the population of the formerly war-torn cities (such as Abadan, Khorramshahr, Hoveyzeh, Susangerd etc.) began. Abadan again relegated to the third place after Dezful, and Ahwaz as the center of population in Khuzestan province continued to maintain its position. In 1996, the proportion of the

population of Ahwaz as the dominant city to that of the second city was 4.2, while it was 4.5 and 7.8 in relation to the population of the third and fourth cities (Abadan and Khorramshahr) respectively (Figure 2).

Thus, the process of transformation of the urban hierarchy in the province was faster during 1996-2006, and the urban network moved toward more imbalances, violating the basic principles of urban planning or safety and seriously threatening the welfare, health and comfort in Ahwaz. (Hyraskar, JK. 1997: 84)

Figure 2. Comparison between the actual and model number of the population of cities in the province in 2006



Source:

Statistical Center of Iran. Census of Population and Housing in the respective years and calculations of the authors

Migration and population growth and anatomy of Ahwaz

During 1996-2006, 177,279 people migrated to or moved within the city of Ahwaz. In the same period, 121,135 people (4.37% from other provinces and 6.62% from other cities of Khuzestan) migrated to Ahwaz. Also, 54,602 individuals (86.30% of immigrants from other towns or villages surrounding Ahwaz mostly moved towards this city. It seems that Ahwaz did not have the capability to meet the different needs (housing, employment, leisure spaces etc.) of the extra population. As regards informal settlements, Ahwaz had the most critical situation compared with other metropolises in Iran. In 2009, the population of informal settlements in Ahwaz was estimated to be 400,000 which represents more than 35% of the total population. Among the areas marginalized in Ahwaz, Shelangabad and Sayyahi (population: 58,321 people), Ein Do (population: 13,288 people), Malaashieh (population: 26,094 people), Al-Safi (population 7717 people), Manba' Ab (population 18,944 people), Hasyrabad (population 26,795 people), Zergan (population 10,784 people), Zoovieh 1 and 2 (population 13,924 people), Koot Navaseri (population 5005) are officially known as informal settlement areas in Ahwaz. (Movahed, Ali and Zarifi, Kokab. 2009: 9 and Shahid Chamran University Research Council. 2006: 128)

According to the data in Table (2), Ahwaz has moved from being a multi-functional city towards a single-role (service) one.

Table 2. The percentage of the employment in major sectors of the economy in 1956 and 1996 in Ahwaz

Economy sector	Percentage of employment in 1956	Percentage of employment in 2006
Agriculture	4/19	9/1
Industry	1/34	8/37
Services	5/46	3/60

Source:

Statistical Center of Iran. Census of Population and Housing in the respective years

Testing the hypotheses:

The spatial distribution of Khuzestan’s urban population network according to the results obtained through the use of different models of hierarchical analysis is shown to be imbalanced, and Ahwaz is specified as a superior city.

The results show that not only does the population distribution of Khuzestan’s urban networks moves towards imbalance but also Ahwaz is extending its distance from other cities exponentially. In the past two decades, this has been evidently manifested by a simple comparison between different census sections.

- Human factors and pursuing growth pole policy, land reform, housing policies (after the Islamic Revolution), and events such as the imposed war and the failure of reconstruction policies and programs all have contributed to the

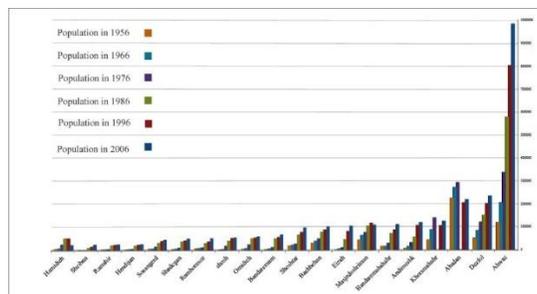
spatial inequality in Khuzestan's urban network, and natural geography has not had a considerable effect on it. Thus, modifications in the province's urban network planning can lead to balance or at least reduce the gap between cities.

It follows from the analysis of the mentioned factors that Khuzestan's urban network is unbalanced, and it does not have the necessary stability due to several reasons. In the period between the years 1956-66, plans such as the White Revolution and land reform led to the collapse of rural economic system on the one hand, and the splendid manifestation of income through oil and gas extraction and activities related to the global market and the large cities becoming single-product, on the other, caused the relative failure of their economic relationship with the mid- and small-sized cities and a change in their functionality. Thereafter, we are witnessing, the ecological segregation of cities and their dependence on the single-product and world-market-reliant economy and the change of function of small cities from that of producing food and agro-processing industries, to one exporting human labor force. With the orientation of the government's overall policy towards a growth pole in big cities, the share of the population rose in Abadan and Ahwaz. In this period, with the establishment of informal settlements in urban areas, their economic, social and security sustainability was challenged. The macrocephaly phenomenon and the emergence of Ahwaz as a dominant city became more observable, and due to the first and second cities' becoming single-product and their dependence on exogenous economy (oil and gas), the former stability, unity and harmony between the elements of the urban hierarchy system are considerably weakened.

It seems that the height of the chaos in urban network happened during the period between the years 1976-86. This period coincided with the course of the Islamic Revolution and the changes in the prevailing economic policies addressing rural and urban communities, along with the intense rural-urban migration, natural growth rate of population, forced migration, war, etc. during this period, the single-product, exogenous, and global-market-reliant economy of large cities of the province, the sanctions leveled against Iran, destruction (due to military confrontation) and unstable hierarchy of the components of the urban system all changed this instability into a crisis which plagued different cities of the province. However, in the period between the years 1986-96, despite extreme fluctuations in their populations, the cities moved towards balance. The year 1996, for example, coincided with the period of construction and population mobility of thousands of (formerly) war-affected people to their homelands. Of course, a large number of formerly war-affected people remained in the host cities (especially in Ahwaz). It seems that the method of construction and reconstruction programs brought about an economic boom and generated income for urban households.

According to official statistics, the process of the refugees' return to their homeland stopped and even reversed whereby they moved back to their host cities across the province or the country. Thus, the move towards equilibrium and redistribution of population was not stable and was suppressed at its very outset (see the section on migration and population growth, and anatomy of Ahwaz). In connection with the hypothesis tested in this paper, despite its mostly flat geographical landmarks, the appropriate distribution of the rivers flowing there, the relatively equal distribution of fertile lands, the relative balance of the facilities (or sometimes barriers) of urban development (which are all the features considered in the case study of Walter Krystalr who proposed the rank-size theory for Germany) Khuzestan does not have a sustainable and balanced population distribution and urban network. Influenced by the physical geography of the region, Khuzestan follows the general pattern of urban networks in Iran. In other words, in addition to natural factors, human factors such as the political centrality of Ahwaz, growth poles policies, positive events such as the destruction and evacuation of cities and economic sanctions during the years of war have all been effective in Khuzestan's urban networks. Figures (3 and 4) show the fluctuations and almost vertical rises or falls in the rankings of some large cities and population loci in different censuses and confirm the unstable status and hierarchy of the studied urban networks. It is worth noting that since the localities which became cities during the period between the years 1996 and 2006 and were not statistically significant were not included in this chart.

Figure 3. Comparison of the first 20 cities of the province in 2006 according to different census (1956-2006)



Source:

Statistical Center of Iran. Census of Population and Housing in the respective years

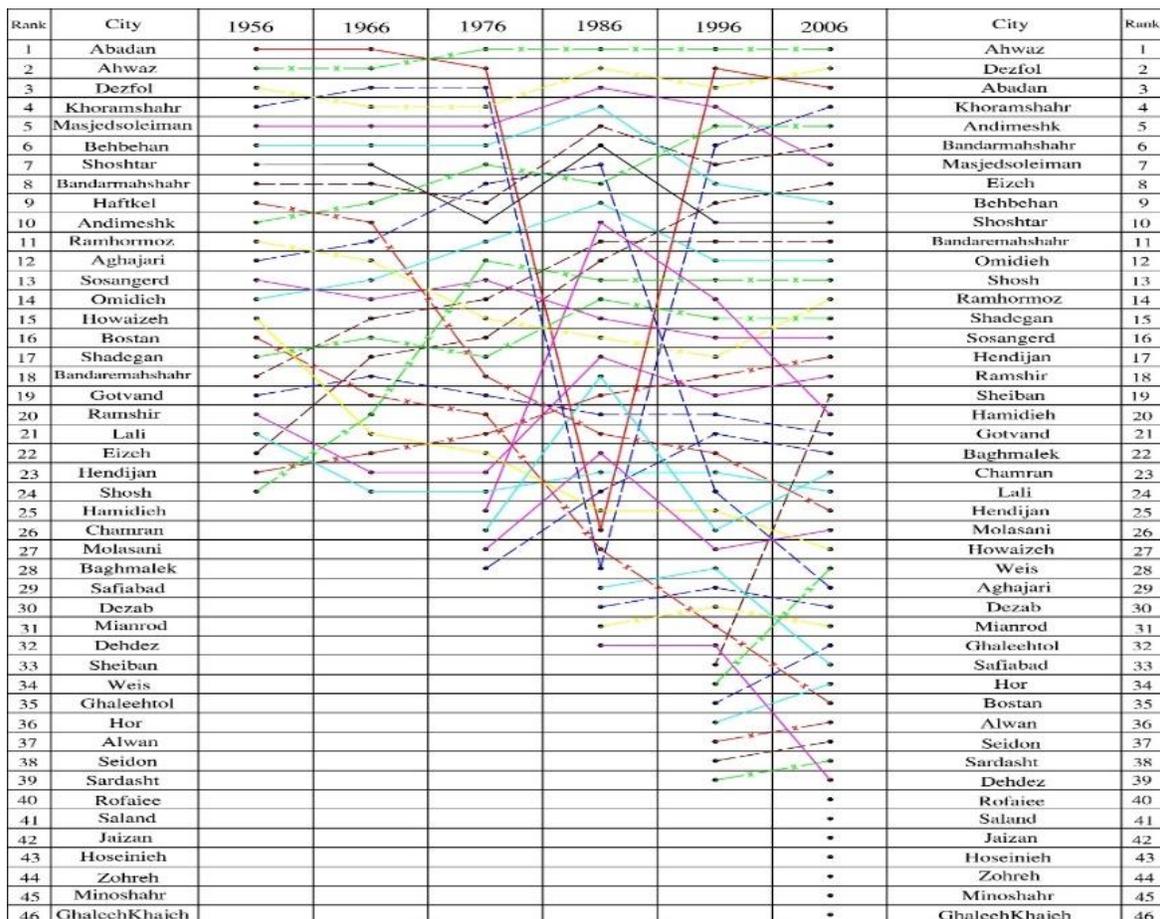


Figure 4. Schematic view of the changes in the rank of different cities in the province during the period of 1956-2006

Source:

Statistical Center of Iran. Census of Population and Housing in the respective years.

Guidelines:

Implementation of land use planning: the failure of the predicted projects brought about imbalance in different economic, social and environmental fields; thus, reorganizing the country's development, and broadly speaking land use planning as an essential activity for the sustainable development planning of the region should receive greater importance.

Development of intermediate cities: this can be done through providing more facilities and attractions and creating poles of growth.

For some investments and economic activities, a threshold of population concentration and manpower is essential since the creation of such threshold will lead to new poles of growth and development. Mid-sized cities, as the link between urban and rural areas, by regulating the relationships between the two and receiving services from large cities and supplying their hinterland and rural areas, would block the direct migration from rural areas to large cities block, and serve as a stimulant for the development of less developed regions, regulating the relations between the various components of the urban system and creating consistency therein.

Creating and strengthening new cities and towns: Although addressing the very poor state of new cities in Khuzestan province (e.g., Ramin, Shirin Shahr and Parsumash) is beyond the scope of this paper, it is important to deal with the barriers and problems, attract populations in the new towns of the province, construct and develop new towns outside the direct influence of Ahwaz and prevent any further extension of the radius of its functionality and spatial inequality in urban networks. Utilization of the potentials of geographic areas of undeveloped towns by

strengthening and development of agriculture, industry and services to attract more people seems useful for creating spatial balance.

Providing multiple roles for (particularly large) cities: The different trends and events happening during different periods and their effects on many cities in Khuzestan province as a unitary system or network consisting of components (cities and villages) clearly show its instability. The weak links in this system hierarchically affect the entire system, and as far as large cities of the system are concerned, single-product economy, disconnection with the local economy and dependence on global economy instead, environmental degradation, depletion of villages and small towns, and the reduction of population growth in small cities all have contributed to the unstable and parasitic growth of large cities. With regard to the rapid changes in the population of cities and the growing distance of the first cities from other cities, sharp fluctuations in the price of oil (as the major product of the large cities and an external factor influencing the urban system), the strategic position and the ongoing military threats to this part of Iran, urban planners, who look at things from a spatial and multidimensional point of view, should take advantage of all potentials to create variety in (particularly large) cities' functionality and activities.

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