

Urban Form and Sustainable Development: The Case of Urmia City

Omid Mobaraki¹, Jamal Mohammadi¹ & Asghar Zarabi¹

¹ Department of Geography and Urban Planning, Isfahan University, Isfahan, Iran

Correspondence: Omid Mobaraki, Department of Geography and Urban Planning, Isfahan University, Isfahan, Iran. Tel: 98-914-922-5609. E-mail: m_mobaraki_6@yahoo.com

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Abstract

The importance of urban form on sustainable development has been recognized in recent years. Since the late 20th century, a number of countries have adopted urban form policies in environmental planning. Urban form directly affects habitat, ecosystems, endangered species, and water quality through consumption, fragmentation, and or replacement of the natural cover with an impervious surface. The current research aims at identifying the urban model of Urmia City so to achieve a sustainable form. This study is applied and utilizes both descriptive and analytical methods. To measure the model of urban growth, Holdern, Shannon's entropy, Moran and Geary's coefficients were employed. The findings indicate that the model of urban growth is sprawl and this may leads to ecological, social and economical and urban form that is unsustainable. Regarding the consequences of sprawl growth and the movement toward achieving a sustainable development and sustainable urban form, it appears that the decentralized centralization method (changing one central city into multicentre one based on centralization and multiplication of activities in sub centers) with the emphasis on principles and strategies of urban smart growth is the best model for achieving sustainable form in the future.

Keywords: urban form, sustainable development, sustainable form, sprawl growth, Urmia city

1. Introduction

Sustainable development as a concept has been gaining popularity across various sectors including the land use research area, since the publication of Brunt land Commission Report (WCED, 1987). After the Brunt land Report, consequent debates pointed out that economic interests and environmental considerations are not opposed to development discourse. Also order to secure intergenerational equity, these sides should meet some agreed consensus (Holden, Roseland, Ferguson, & Perl, 2008). The applicability of sustainable development to real settings has been one of the most discussed issues in conferences and the literature. For example, Habitat 1976 officially launched the worldwide dialogue on the topic of urban cities at the nation level. The major formal outcome of Habitat II was the Habitat Agenda, a "global call to action" for adequate shelter and sustainable human settlements for all (UN Habitat, 1996). A new sustainability framework, triple bottom line approach (TBL), was first put forward at the corporate level to measure and report corporate performance against economic, social and environmental parameters (Elkington, 1980; Suggett & Goodsir, 2002).

After that, the United Nations 2005 World Summit Outcome Document refers to the "interdependent and mutually reinforcing pillars" of sustainable development as economic development, social development, and environmental protection (United Nations, 2008). Urbanization emerges as the result of the increasing number of people who move from rural to urban areas. However, rapid urbanization often comes at the expense of agricultural land to satisfy increasing urban demands. Natural and agricultural landscapes have been modified into urban landscapes. This is a tendency that has been rapidly experienced in recent years and is expected to continue and increase during the coming decades (United Nations, 2008). In this context, if the current and future urban areas continue with the same land use conversion practices without regarding the future needs, environmental, social and economic problems are inevitable (Daily, 1997; Millennium Ecosystem Assessment, 2003). Growth form and spatial development of cities should not be forgotten in this process. Land is, one of the most limited resources available for men. Consequently, a city's growth model is an important topic in urban planning and one of basic criteria in urban sustainable development. The investigation of growth stages and formal development of cities all over the world indicates that recent technological changes, especially those in transportation, contribute to the rapid physical growth of cities and the change in their patterns (Gharkhlu & Zanganeh Shahraki, 2009).

After (1961-1971), in Iran, having increased population of cities, because of both high natural growth and large scale immigration of villagers to cities, the growth of urban form and construction did not happen based on needs but land mongering. This led to an unorganized urban land market, especially within urban limits and the negative distribution of cities' sprawl and horizontal expansion (Athari, 2000). In this paper the case of the city of Urmia, is presented which is located in western Azarbaijan province. Both Urmia and Iran as a whole are interesting and relevant cases of explosive urban growth. According to the first Iranian census, in 1956, the number of Iranian cities was 199 and the proportion of urban population was 31% of the total. In 2006, the number of cities had increased to 1012 and the proportion of urban population exceeded 70% of the total (Farhoudi et al., 2009; Iranian Statistic Center, 2009). Urban population in Iran will reach 80% in 2020 according to the United Nations. Large urban centers such as Tehran (Zanganeh, 2007), Mashhad (Hosseini, 2008) and Isfahan (Ghiumi Mohammadi, 2001) are experiencing transitional urban growth processes from compact to dispersed forms and sprawling rapidly. Middle size and even small cities tend to sprawl as well perhaps at a greater pace.

The city of Urmia is one of these medium sized cities undergoing rapid physical growth and change of land covers and uses. Since the definition of cities and urban hierarchies vary among countries, in this paper we use the Iranian urban hierarchy on the basis of population size. According to the definition of the Ministry of Housing and Urban Development (2008) and the Iranian Statistic Center (2009), cities in Iran are divided into six categories: rural-urban cities (population less than 25,000); small cities (population between 25,000 and 100,000); medium cities (population between 100,000 and 500,000); large cities (population between 500,000 and 1,000,000); metropolis (population between 1 million and 5 million); and, finally, megalopolis (population more than 5 million). Therefore, Yazd can be considered as a medium sized city. The recent urban history of Yazd encapsulates many of the dimensions mentioned at the beginning of the paper. Yet it also presents some distinctive features that offer interesting insights into the nature of urban growth in small and medium sized cities of the developing world.

Following the pattern of other large cities of Iran in recent years, Urmia City has had rapid and unorganized growth. Because of population natural growth, immigration, spread of services, the allocation of official-political identity to this city as a province capital, land grant by different governmental organizations within this city, state's construction plans, state's socioeconomic and political changes and or ultimately, appropriate natural environment, this city has witnessed much so many population and form changes. This city's population has increased from 67,605 in 1956 to 583,255 in 2006. Also, in accordance with the calculations of consultant engineers, in a twenty-year interval (1986-2006), urban area has increased from 5939 to 8577 hectares in this city. This in turn has added 95% to the initial urban area during this period (West Azerbaijan's Organization for Housing and Urban Planning, 2008).

Furthermore, these factors have resulted in the lack of land and housing, the split of urban texture, the disorganization of urban visage, the crowdedness of urban transportation (the congestion of urban traffic, especially in the city center), the conversion of appropriate agricultural lands into residential and industrial spaces, thoughtless urban constructions and the termination of natural capabilities and services, endangered urban environment and contributed to the city instability. In such conditions, it is important to improve the consequences of thoughtless sprawl. However, few solutions have been suggested to mitigate the consequences of this phenomenon, i.e. population growth. Strategies such as smart growth, smart management, green belts and planning of land use have been proposed and implemented in other locations as possible solutions for reducing the negative impact sprawl.

2. Types of Urban Forms

Urban form is defined as the spatial distribution model of human activities in a certain juncture of time (Anderson, 1996). The growth of every city is in the form of a dual process of external expansion and physical growth or of internal growth and reorganization. Every one of these methods may create different and distinct physical form. External expansion appears in the form of increase in the city limits or so called "sprawl expansions" and internal growth emerges in the form of urban population inner and the model of compact city growth (Rahnama, 2006). Being aware of spatial form and city physical form could play an important role in the success of urban planners and help them improve urban spaces. Therefore, the models of urban growth are briefly explained.

2.1 Sprawl Growth

This expression dates back to the middle of the twentieth century when development of urban spaces in US flourished because of much use of private cars and the development of highway systems (Hess, 2001). This

meant irregular land use, continuous and ongoing development, abrupt and rapid development and inefficient land use (Piser, 2006). Its causes could be attributed to population growth, land abundance, lack of employment centralization, housing priorities (separate and secure housings, suburb neighborhoods with grasslands beside and one or two cars for commutation), the termination of city center (as a result of traffic congestion, environmental devastation, the dull market of housing, the low quality of public schools, crime, the lack of access to open spaces and the destruction of infrastructures), transportation advancement, and or the general politics of governments (tax policies, depreciation funds, zoning regulations, additional financial supports and so on). The urban sprawl has various aspects that low values may indicate more sprawl development in every aspect: density, consistency, centralization, clustering (grouping), centrality (between's), polarity, synthetic use, and neighborhood. The urban sprawl development may result in one of more of the following consequences: 1) energy misuse, 2) the decrease in open regional space, 3) the much extension of city toward outskirts, 4) urban nodal (inconsistent and abrupt) development, 5) the increase in inner-city trips, 6) the domination of private vehicles in transportation, 7) decentralized planning or the control of land uses, 8) high tax differences among different urban locations, 9) the devastation of agricultural lands, 10) the contamination of lakes and gulfs ecologically and so on (Johnson et al., 2001).

2.2 Compact City

A compact city has high population density and synthetic uses and enjoys a suitable public transportation system that encourages walking and biking. This kind of thinking is rooted in the form of traditional European cities (Burton, 2000). The compact city should have a form and a scale suitable for walking and biking and its public transportation should have a level of compactness that encourages social interactions. In the form of the compact city, the emphasis is placed not only on the growth of available city centers and recycled lands but on the avoidance of extension and expansion of city in its outskirts (Richards & Rogers, 1999). Also, social justice could be obviously seen in such cities in a way that all citizens have access to civic services and the access to public services is not subject to the possession of private vehicles. The compact city is built based on different land uses and with the compactness of 4 to 5 floors and this type of urban compact form reduces 70% of urban trips based on on-foot trips. The advocates of compact city theory belong mostly to European countries. And such cities as Barcelona, Paris, Amsterdam, and London have the highest rate of vivacity, the participation in civic activities and social interactions and tourists appeal whereas having the lowest rate of fossil fuels use for the consumption of motor vehicles compared with American Canadian and Australian cities (Jenks et al., 1996).

Ultimately, the designers of compact cities claim following advantages for these cities: 1) The centralization of development may result in decreasing physical expansions and as a consequence, in using less land and resources; 2) High housing densities allow the residence of high numbers of people in a limited region, contributing to the increase in social interactions; 3) The access to civic services in relation to equality in access to civic services; 4) The acceptability of mixed land uses because of highness of population's general density, the decrease in trip distances because of mixed land uses and the high compactness of biking and walking populations as the most efficient way of economy in energy use in order to access to local facilities and less dependence on cars; 5) The reduction in heating costs in the result of more dense in addition to less energy use and less pollution; and 6) The centralization of local activities in local communities and consequently, elevation of life quality, more security and more active environment as well as the protection of jobs and services, which means creating an environment for flourishing economical and commercial activities (Hillman, 1996).

2.3 Smart Growth

The American Planning Association defines smart grow as follows: planning, designing, developing and renovating, promoting location sense, preserving natural and cultural resources and delivering development advantages and disadvantages fairly (SGN, 2002). Smart growth network accepts following ten principles as principles of urban smart growth: 1) Mix land uses; 2) Take advantage of compact building design; 3) Create a range of housing opportunities and choices; 4) Create walk able neighborhoods; 5) Foster distinctive, attractive communities with a strong sense of place; 6) Preserve open space, farmland, natural beauty, and critical environmental areas; 7) Strengthen and direct development towards existing communities; 8) Provide a variety of transportation choices (Ghorbani & Noshad, 2008); 9) Make development decisions predictable, fair and cost effective; 10) Encourage community and stakeholder collaboration in development decisions. The smart growth has negative and positive results presented briefly in the following table.

Every one of these three cities may have identical population but in sprawl growth, the direction of growth is toward the outside of city limits; in smart growth, growth is in the form of clusters; and in compact growth, growth takes place within city limits. In the following part, the ideas of some of urban planners on urban sustainable form are represented.

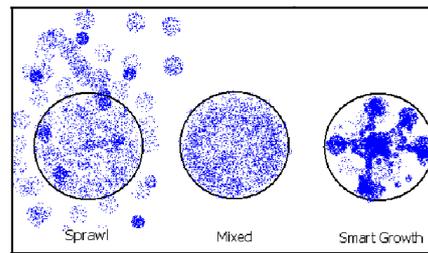


Figure 1. Urban density and compactness in three models of urban growth (Littman, 2004)

Table 1. The viewpoints of urban planners on how to achieve urban sustainable form (Williams et al., 2001)

The Studied Urban Form		Conclusions
Breton	Compression (City)	The effects of compression on the social justice were investigated. 41 indices were used and it was determined that urban compression and compactness had the most influence on the social justice such as the access to super markets, the access to green spaces, more space for walking and biking, more employment opportunities for less skilled individuals, better access to facilities. Also, it had following consequences: the decrease in housing inner space, lack of acceptable housing, and higher death rate because of respiratory diseases. Ultimately, Breton concluded that the positive effects of compression on the social justice were more than negative ones.
Williams	The Increase in Urban Compactness (Intensification of Land Uses)	The effects of increase in housing density on ecology, economy and quality of life of English people were investigated and it was determined that its advantages were the sustainable use of lands, the increase in dynamism and some economic advantages. Also, some of the most important policies of increase in urban compactness were investigated and its most important outcomes were as follow: the decrease in traffic extent and social advantages were unknown. In addition, important disadvantages such as bad neighbors, social conflict and the decrease in the quality of living environment were seen. Finally, Williams concluded that the increase in housing density in urban central parts using mixed land uses is more beneficial than suburbs.
Masnavi	Compactness and Traffic of Land Use in Neighborhood Unit Scale	The effects of housing density and mixed land uses on the trip pattern, facilities availability and social topics such as regional security, appeal and beauty were investigated. It was determined that regions that had high housing density and used mixed land uses were more appropriate in terms of access to facilities, but regions that had low housing density were better in terms of living environment. Furthermore, regions that had compact texture and only one type of land use (housing) were the best in terms of social exchange and security. It is said that compact city could decrease car use up to 70% and urban trip (no related to occupations and commuting to workplaces) up to 75%, but it could not satisfy the need to private car for special cases.
Newman	Compactness (Density)	It was determined that there was a relationship between housing density (compactness) and dependence to cars in all cities and it was proved that between housing density (compactness) was a main variable for the extent of energy use. In addition, the higher the housing density, the lower the costs related to urban transportation. Therefore, some strategies including compacted nodes (points) and corridors, the increase in the movement of urban central parts, the increase in the housing density of regions around railroads, general transportation development and the restriction of urban sprawl growth and their combination with the creation of new villages in suburbs will be advantageous.

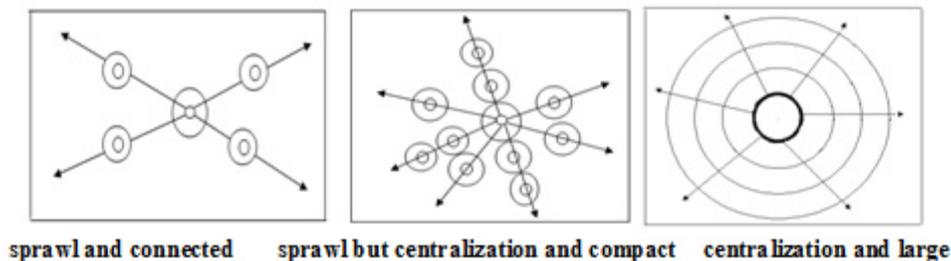


Figure 2. The form of sustainable urban (Haughton & Hunter, 1994)

3. Method

This study is applied and the method of its investigation is both descriptive and analytical. To identify the model of urban growth, the quantitative models of urban planning were employed (Holdern, Shannon's entropy, Moran, and Geary coefficients). Required data was collected through library research, field operation, master plans and different organization, the data was analyzed by Mat- lab and Excel.

4. Study Area

The city of Urmia, one of the more ancient cities of Iran, is the capital of the western Azarbaijan province. Urmia is located in a mountain environment with an annual precipitation of 42-78 mm. The most important economic activities in Urmia are light industries (textiles, foodstuffs, and paper and furniture) occupying about 45% of the active population, and tourism which benefits from the desert architecture and the historical heritage of the city. Both activities alongside with the administrative functions derived from the condition of province capital serve as a factor of attraction for many immigrants not only from the province of western Azarbaijan but also from all Iran. Therefore, the city has experienced very rapid growth to the point that, among the Iranian cities with a population bigger than 100,000 inhabitants, Urmia had the largest growth in urban land development.

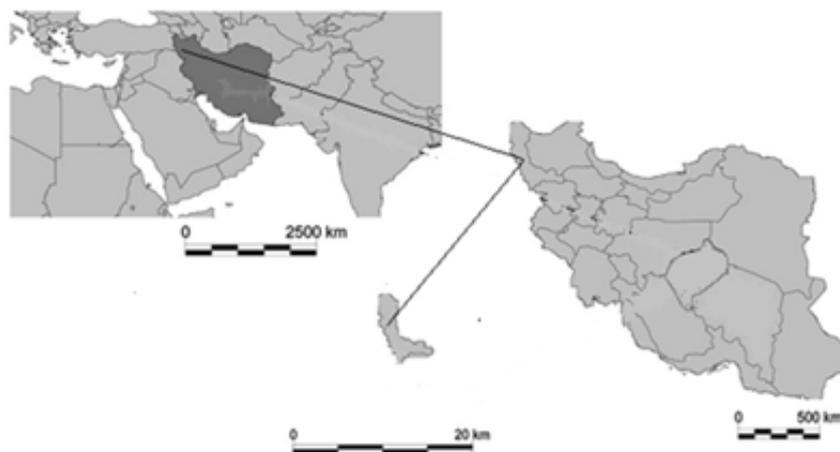


Figure 3. Location of study area



Figure 4. Urmia city zones

5. Population Growth and Urban Sprawl in Urmia

According to the first official census (1956) the population of Urmia was 67,605. During the 1960s and early 1970s, land reform and other agricultural policies in Iran resulted in mass migration from villages to cities. Hence, at the time of the second official census (1981), the population of the city reached 164419 people. The Islamic revolution of 1979 followed by the Iran-Iraq war one year later increased further rural migration to cities. Between 1975 and 1987, the annual rate of population growth in Urmia was 5.1%. In 2000, the population reached 435200 people with an annual growth rate of 3.4%. In the most recent official report (2010), the population of Urmia attained 604000 persons (Urmia Municipality, 2010).

As shown in Figures 5, 6 and Table 2, the rate of population change is high although smaller than the increase in urban land. Employment in industrial sector is mentioned as the major reason for migrating to Urmia. As it is often the case, lack of urban planning forced immigrants to settle in the periphery of the city where land and accommodation prices are much lower than in the city center. The economic factor or the differential land rents thus appears as a major driver of urban sprawl in Urmia. Finally, in the last studied period, Urmia presented the largest growth in built-up area. The expansion of urban land between 2000 and 2010 almost equals all urban land developed during Urmia 2000 year history. In 2009, urban uses occupied 5943.12 ha of land, and the population density had decreased to 32.78 persons per hectare. This form of development shows a disordered pattern that, among other impacts, reduced spatial solidarities. Since 1981, and in addition to rapid expansion, urban growth has remained disproportional, scattered and leapfrogged.

Table 2. Population, area and their percentage increase in study area

Year	Population	Percentage increase n population (%)	Built-up area (ha)	Percentage increase n built-up area (%)
1981	164419	-	1643.94	-
1991	300746	54.67	2935.37	56.00452
2000	435200	69.10	3761.54	78.03639
2010	604000	72.05	5943.12	63.29234

Source: Iranian Statistic Center (2010), Urmia Municipality (2010)

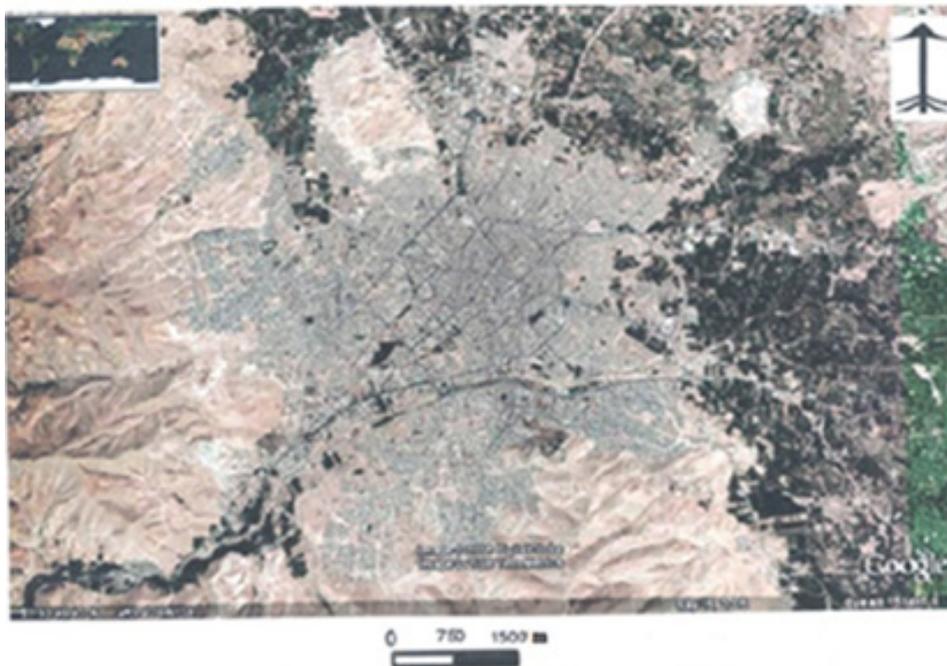


Figure 5. Urban growth and sprawl in Urmia city

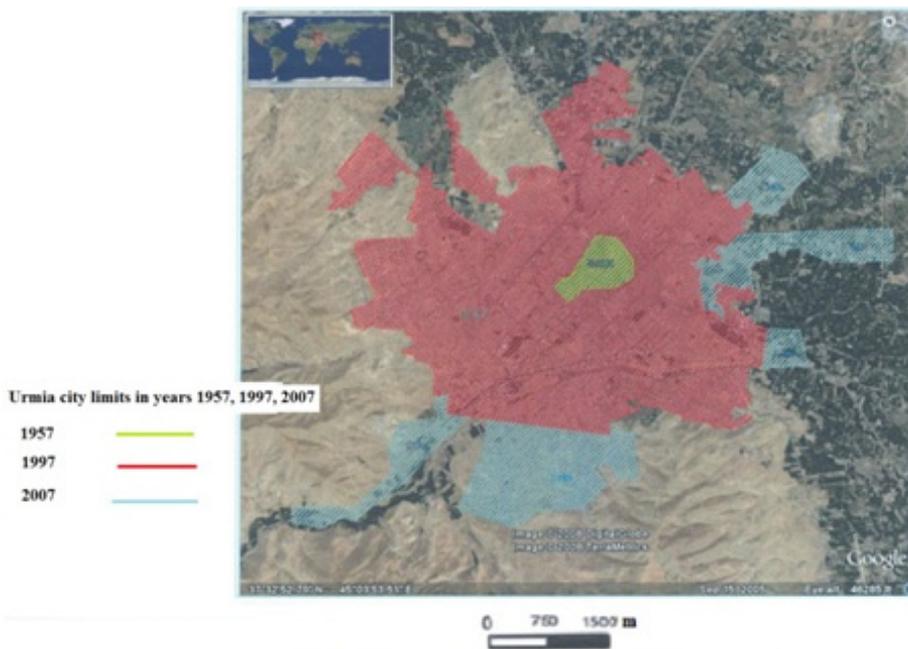


Figure 6. Urban growth in years 1957, 1997 & 2007 in Urmia city

6. Results and Discussion

6.1 The Application of the Models to Determine the Type of Urban Form

6.1.1 Holdern Method

One of the principal methods for determining urban sprawl growth is the use of Holdern Method. Apportioning shares of sprawl or the rate of sprawl between rising per capita land consumption (declining population density) and population growth can also be accomplished by means of applying a more mathematically rigorous method

first described and partially developed by Harvard physicist John Holdren, internationally honored in 2000 for his achievements in environmental science. In 1991, John Holdren applied a method for determining urban sprawl growth and population growth. The Holdren method can also help us understand how much of the sprawl rate is related to declining population density, or rising per capita land use, and how much should be attributed to population growth. As in the case of national energy consumption, the question here is how much of the increased total consumption of rural land (Overall Sprawl) is related to per capita change in land consumption (per capita sprawl) and how much is related to increase in the number of land consumers (population growth). Using this method, it could be specified that what extent of urban growth is in the result of population growth and what extent in the result of urban unorganized growth. He employed land gross per capita formula (Hekmatnia & Mousavi, 2006).

$$\begin{aligned} & \ln\left(\frac{\text{population at the end of period}}{\text{population at the beginning of period}}\right) + \ln\left(\frac{\text{land gross per capita at the end of period}}{\text{land gross per capita at the beginning of period}}\right) \\ &= \ln\left(\frac{\text{urban area at the end of period}}{\text{urban area at the beginning of period}}\right) \end{aligned}$$

In the other words, the natural logarithm (Ln) of ratio of population at the end of period to that value at the beginning of period plus the natural logarithm of ratio of land gross per capita at the end of period to that value at the beginning of period equals the natural logarithm of ratio of urban area at the end of period to that value at the beginning of period.

$$\begin{aligned} & \ln\left(\frac{577307}{344521}\right) + \ln\left(\frac{47.59}{33.73}\right) = \ln\left(\frac{8577}{6183}\right) \\ & \ln(1.9756) + \ln(1.4109) = \ln(1.3871) \\ & 0.6809 + 0.3442 = 1.0251 \\ & \frac{0.3442}{0.8604} + \frac{0.5162}{0.8604} = \frac{0.8604}{0.8604} \\ & 0.59 + 0.41 = 1 \end{aligned}$$

Therefore, the physical growth in the Urmia City since 1989 till 2007 is 59% as a result of population growth and 41% as a result of unorganized urban growth which is related to urban sprawl and horizontal growth, which result in decreasing population’s gross density and increasing urban land gross per capita.

6.1.2 Shannon’s Entropy Model

This model is used for analyzing and determining the extent of urban sprawl growth phenomenon. The general structure of this model is as follow:

$$H = -\sum_{i=1}^n P_i \times \ln(P_i)$$

Where, H is the value of Shannon’s entropy, P_i the ratio of constructed zones area (total housing density) to the total sum of zones area and n the total sum of zones.

Table 3. Calculating Shannon’s Entropy for 1989 in Urmia City

Zones	Constructed area (Hectare)	P _i	Ln(P _i)	P _i ×Ln(P _i)
1	745.16	0.2303	- 1.4683	- 0.3381
2	634.12	0.1959	- 1.6301	- 0.3193
3	921.36	0.2847	- 1.2536	-0.3569
4	934.73	0.2889	- 1.2416	- 0.3587
Total	3235.37	1	- 5.5964	- 1.3738

H = 1.3738

Table 4. Calculating Shannon's Entropy for 2007 in Urmia City

Zones	Constructed area (Hectare)	Pi	Ln(Pi)	Pi×Ln(Pi)
1	2110.87	0.3701	- 0.9939	- 0.3678
2	940.88	0.1649	- 1.8019	- 0.2972
3	1714.45	0.3006	- 1.2019	- 0.3613
4	936.95	0.1642	- 1.8061	- 0.2967
Total	5703.15	1	- 5.8039	- 1.3231

H = 1.3231

The value of the Shannon's Entropy is between 0 and Ln(n). 0 means very compact (dense) urban physical development whereas Ln(n) shows sprawl urban physical growth. When the value of entropy is more than Ln(n), urban sprawl growth takes place. Tables 2 and 3 indicate that the value of entropy is 1.3738 in 1989 while the maximum value is Ln (4) = 1.3862. The closeness of entropy value to the maximum value suggests urban sprawl physical development. The entropy value is 1.3231 in 2007, indicating that over 20 years, physical growth has been in sprawl and incompact form.

6.1.3 Aggregation Degree

This dimension determines the degree of population and employment aggregation or the ratio of compactness and sprawl based on spatial construction. Moran and Geary's coefficients are used for measuring a city's aggregation degree.

6.1.3.1 The Moran's Coefficient

$$Moran = \frac{N \sum_{i=1}^N \sum_{j=1}^N w_{ij}(x_i - \bar{x})(x_j - \bar{x})}{\sum_{i=1}^N [\sum_{j=1}^N w_{ij}(x_i - \bar{x})^2]}$$

Where N is the number of zones, X_i zone j's population or occupation, \bar{X} average population or employment and W_{ij} the weight between zone i and j. In the calculation of weighted value between two zones that have a direct relationship or common weight, weight coefficient is considered 0 (zero). The Moran coefficient has a range between -1 and +1. A coefficient of +1 indicates totally monopole model, 0 shows random or multi polar aggregation model and -1 suggests the checker model of development. The higher the value of this coefficient, the higher the aggregation while the lower the value of this coefficient the lower the aggregation (higher sprawl) (Cliff, 1981).

6.1.3.2 The Geary's Coefficient

This coefficient is like the Moran's coefficient. However, instead of placing emphasis on the mean deviation, it estimates the difference of each zone in the relationship with another zone. The coefficient is as follows:

$$Geary = \frac{(N - 1) [\sum_{i=1}^N \sum_{j=1}^N w_{ij}(x_i - x_j)^2]}{2 (\sum_{i=1}^N \sum_{j=1}^N w_{ij}) \sum_{i=1}^N (x_i - \bar{x})^2}$$

Where N is the number of zones, X_i zone j's population or occupation, \bar{X} average population or employment and W_{ij} the weight between zones i and j. This coefficient has a range between 0 and 2, which lower value means higher aggregation and higher value means higher urban sprawl.

Table 5. The Calculation of Moran and Geary's Coefficients for Urmia City's population and employment in 2007

Coefficients	Population	Employments
Moran	- 0.16	0.01
Geary	1.4	0.94

6.2 The Effective Factors on Sprawl and Unsustainable Development of the Urmia City

From the height point of view, the Urmia City is a short-figure city and from the perspective of intensity of urban physical loadings is an open city whose main part composes of regions with dominant aspect of one- or two-floor buildings and land units with large and average sizes. Three- and four-floor buildings are gradually accepted as usual form of construction in this city. According to available information, of all construction permits that were issued for this city in 2006, about 55.4% was for one to two-floor buildings, 38.7% for three or four-floor buildings and only 5.9% for five and more-floor buildings (consultant engineers of project and logistics, 2007).

Of effective factors on the Urmia City's development, these following cases could be shown: 1) Developments in the result of informal immigration (immigration residence) (Figure 7). (In this case, one could refer to the role of villages around cities in the reception of immigrants of villages); 2) Developments that are the result of population growth of the city; 3) After Islamic Revolution of Iran (1979), the lack of obvious policy in the gardens within the limits of the city was one of the obstacles that forced the city to occupy around the perimeter and to develop in the marginal regions; 4) Not being able to transfer some of land uses to the outer parts of the city and to construct some of urban facilities outside the urban boundaries are some of factors that encouraged the city to and breached urban boundaries; 5) Activities performed legally by some of offices and organizations for possessing and separating lands. Of these activities, one may name urban land offices and housing cooperatives which often meddle in urban affairs and get construction permits for the lands which have ownership issues within urban limits and authorities about this problem; 6) Available economic, natural and legal within urban boundaries contribute to land shortage and urban development beyond the boundaries of urban master plan; 7) The failure to change residence patterns and to grow the culture of apartment living have contributed to the occupation of spaces in a level beyond the prediction of urban master plan. Generally speaking, the city's social and economic disorganizations have led to disorganization in the city's physical development and the termination of natural process of development. Also, it is necessary to note that the specification of boundary for the-lack-of-control conditions in using urban lands have contributed to land prices increase and this was one of the main factors in developing the city beyond the boundary that is either planned and by the Organization for Urban land or unplanned (in the form of immigrant habitation) (Hampanejad, 2009); 8) Of the other important factors in the irregular expansion of Urmia City, one may refer to urban wandering assets which have illogically and irrationally led to land speculation and to the activities related to land trade. Besides the increase in land prices which have contributed to the emergence of new generation in the society, constructive activities which have mostly luxurious aspects, have expanded in the city; and 9) Ultimately, not paying attention to the city limits which itself is influenced by beyond-city systems, has entailed widespread margin living, the increase in housings without urban facilities, the sprawl growth of the city, towns and suburbs without urban qualities.

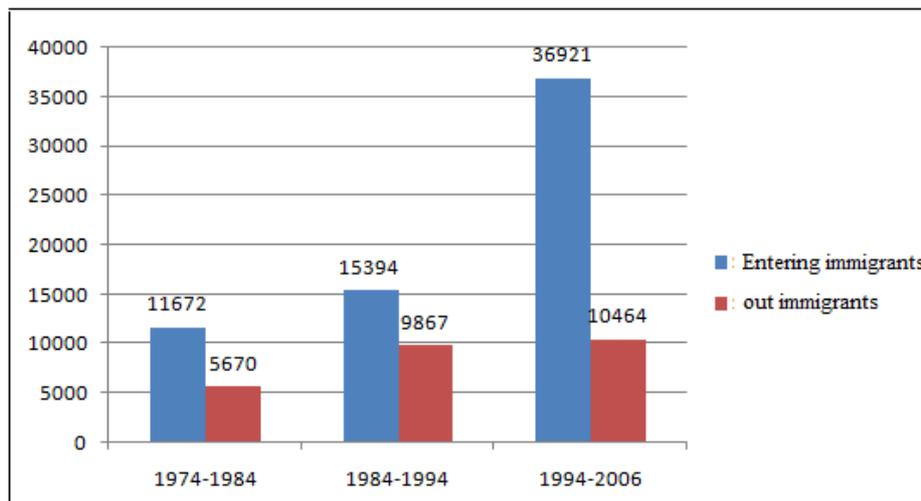


Figure 7. The number of entering immigrants and out immigrants the Urmia city

7. Conclusions

In recent years, because of so appropriate natural prerequisites (so desirable lands for agriculture and many water resources), the development of roads and housing construction beside them, immigration (which led to the approach of lands around the city to the city itself (these parts joined to the city boundary), cooperatives for town building, development and construction of disorganized settlements and urban margin living), and the issues of ownership, the Urmia City has had the rapid growth of population and urban area. As every city's model of physical development has a great influence on the sustainability of its development, urban managers and planners should have enough information on the existent models of urban physical and spatial expansion in order to conduct the model for urban sustainable development. In the present study, to investigate and analyze the Urmia City's model of physical growth, the models of Holderness, Shannon's Entropy, Moran and Geary's coefficients were employed.

By applying these models, these conclusions were drawn: 1) findings resulted from Holderness Model indicate that only 59% of urban growth has been in the result of urban growth and 41% of urban growth is related to urban sprawl and horizontal growth which contribute to the gross density of population and the increase in urban gross land per capita; 2) the value of Shannon's Entropy is 1.3738 for 1989 whereas the maximum value is $\ln(4) = 1.3862$. The closeness of the entropy value to the maximum value shows the sprawl growth of urban physical development. The Shannon's Entropy is 1.3231 for 2007, suggesting that during twenty years, physical growth has been in a sprawl and incompact manner; 3) the resulted Moran's coefficient is -0.16 for population and -0.01 for employment and the Geary's coefficient is 1.4 for population and 0.94 for occupation. The resulted coefficients for population suggest urban sprawl and for employment show random or multi polar aggregation pattern. From the analysis of findings, it may be concluded that Urmia City's growth has been one of sprawl and this is one of the important reasons of urban in sustainability. Regarding that findings of this study on this kind of urban unsustainable growth model have had many consequences in different economic, social and biological divisions including the termination of agricultural lands around the city, the devastation and contamination of water and soil resources, the increase in the cost of delivering civic services, the increase in the time and length of inner city trips and as a result, the increase in the consumption of fossil fuels like petroleum, social segregation, lack of care about land use or irregular use of this important resource and so on and with respect to the direction of urban development toward more sustainability, the necessity of its change and the enjoyment of strategies for more compactness of the city should be considered.

8. Recommendations

To achieve the optimal model of urban development (sustainable form), following approaches have been experienced all over the world: 1) the first approach formed under the influence of the Modernism thinking in the Eastern Asia has paid attention to measures such as high rise construction, high densities, short trips to workplaces, easy access to services and facilities and widespread use of public transportation in the city, and it has taken steps toward socioeconomic sustainability; 2) the second approach is decentralized centralization within cities, which has been well accepted all over the world. In this method, it is attempted to change unicentral city into multicentre city based on compact construction and the multiplication of activities in selected sub centers in relation to transportation and development pivots; 3) the third approach, perhaps the most important method of compact construction in the recent years, is "transition development or basic transportation development". In this approach, the restoration of transportation system structure is based on changing vehicle, discouraging the need to trip and limiting car use and urban growth is directed toward certain nodes and pivots equipped with transit routes; 4) the fourth method is the reconstruction of cities for compact construction of empty and compact spaces of cities. In this approach, compact construction process is used for the renovation of historical centers, lands and unused spaces; 5) the fifth one is land sharing approach. In this approach, housings and lands under the ownership of governmental divisions and individuals are submitted to private sections in order to carry out high compacted housing projects and after reconstruction, a part of submitted land is allocated to communication and service networks and remaining part is submitted to previous settlers in the form of compacted and high quality housings and at the same time, investor's costs and benefits are satisfied. In order to achieve compact growth and avoid the sprawl growth of the Urmia City, the decentralized centralization (changing the one polar city into multicentre city based on compact construction and the multiplication of activities in selected sub centers) with the emphasis placed on urban smart growth strategies and principles is the best model for the future urban development. To achieve this model, following cases are recommended: 1) Decreasing the use of private vehicles, increasing the use of public transportation vehicles and encouraging walking trips through the appropriate design of urban and local walking pivots; 2) Making use of aggregation and compact (compress) model in new construction in order to avoid urban sprawl growth; 3) Encouraging settlement in small housing units; high housing densities allow settlement of high numbers of people as well as

the increase in social interactions; 4) Guaranteeing security and safety in urban environment (especially in districts 2 & 3) through the distribution of mixed land uses; 5) Managing the city in legal and smart manner (in order to continue urban development with competitive capability); 6) Centralizing local activities in local communities and as a result, elevating life quality, security and dynamism as well as supporting occupations and services, meaning the creation of environment for flourishing economic and commercial activities; 7) Providing a wide range of housing options for different classes of people; 8) Creating a connected network of connected and joint streets; 9) Encouraging citizens to participate in the decision regarding development

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