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SPATIAL ANALYSIS OF POPULATION DISTRIBUTION AND SERVICES IN SANANDAJ CITY

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Abstract
Today, cities have become arenas of social conflicts. And, achieving more services and benefits has substituted socio-economic differentiation for racial-ethnical one. Therefore, the issue of spatial inequalities in the cities and the necessity of establishing social justice in citizens' enjoyment from public services have become serious for urban managers and planning specialists. The current research aims at investigating spatially population distribution and service distribution in Snandaj. Research type is applied and research method is descriptive-analytical. To do spatial analysis of population distribution and service distribution, relative entropy efficient model, TOPSIS model and Spearman rank model have been used. Findings indicate that the extent of enjoyment from urban services and utilities is not balanced among five districts of Snandaj, which those factors have entailed such consequences as unnecessary movements in the city, the centralization of population and activities in some parts of the city, expansion of different urban problems and lack of equal enjoyment from public service among different urban districts.
Keywords: Urban Sustainable Development, Social Justice, TOPSIS Model, Sanandaj City.

1. INTRODUCTION

Social justice is a concept that originates in philosophical discourse but is widely used in both ordinary language and social science, often without being clearly defined. By synthesizing the common elements of various philosophical treatments (Elester, 1992; Feinberg, 1973; Miller, 1999) it is possible to offer a general definition of social justice as a state of affairs(either actual or ideal) in which (a) benefits and burdens in society are dispersed in accordance with some allocation principle(or set of principles); (b) procedures, norms, and rules that govern political and other forms of decision making preserve the basic rights, liberties, and entitlements of individuals and groups; and (c) human being (and perhaps other species) are treated with dignity and respect not only by authorities but also by other relevant social actors, including fellow citizens. Unequal and unbalanced spatial distribution among residents of different parts of the cities is not considered a new phenomenon in any cities all over the world. However, in developing countries, because of gross socio-economic discrepancies and unequal and unbalanced deliverance of urban services, spatial differences have been intensified (Abdi Daneshpoor, 1988) because urban spatial structure includes elements, having mutual interactions, whose non-sustainability will affect whole structure (Sawah & Ward, 2001, p. 90). In the investigations of urban problems in the framework

of sustainable development, it is supposed that if any cost is paid to develop urban infrastructures, facilities and services, ignoring equality mechanisms, this itself intensifies inequalities among different groups of urban population (Bolary et al., 2005). In industrial countries, all basic welfare facilities are available for urban residents. On the other hand, in developing countries, most of the citizens have no proper access to basic services. In most parts of the third world countries having rapid urbanization growth, the requests for public services are much higher than public section capacity and private section facilities to cover Therefore, it could be argued that in some cities, critical situations are rapidly occurring, which result not only from resources scarcity, but also from unplanned growth and improper pattern of service distribution (Damiere & Takahashi, 1999). Urban social justice means fair spatial distribution of services and resources among different urban districts and citizens' equal access to those elements (Sharifi, 2006). Therefore, the most important mission of urban managers and planners (people who must analyze who achieve to what where and how (Tsou, et al., 2005)) is to make efforts to achieve to "equal opportunities" of access to urban services among different groups of urban population and to root out conflicts in supplying educational, health, service and other opportunities. For so doing, observing equality principle and equal access to urban living opportunities will be of basic preferences (Hataminejad, et al., 2008, p.88). Hence, one of the most important factors should be observed in order to execute social-spatial justice in urban planning is proper distribution of urban services and correct use of urban spaces. In this regard, urban services and land uses are among factors which could establish spatial, cultural, economic and social justice in urban regions if done more just through population needs satisfaction, public benefits enhancement and consideration of individuals' merits. On the other hand, lack of proper distribution of public services and lack of establishment of urban plans (master plan, detailed plan and so on), among effective factors on inequality all over the city, not only result in shattering population balance in the cities, but also problematize the access of citizens to facilities and services and form some non-sustainability all over the city (Warty et al., 2007).

Sanandaj is the capital of Kurdistan province in terms of population. According to the 2011 Iranian people and housing census data, its population was 373987 and its annual population growth rate was 1.04. It covers area of 4950 hectares, meaning 72 individuals per hectare as mean gross density. Studies indicate that the extent of enjoyment from urban facilities and services is not balanced among Sanandaj urban districts. It has entailed in unnecessary movements in the city, population and activities centralization in some parts of the city, spread of different urban problems and lack of similar enjoyment from public services among different urban districts. Those factors have caused Snanandaj's spatial structure to face fundamental challenges and unsustainability because sustainable development takes place when there will be rational compatibility and coordination between population distribution and service distribution in the cities. For so doing, the current research aims at investigating how urban sustainable development indexes have distributed in the Sanandaj city. Ultimately, some solutions will be recommended in order to achieve rational compatibility and coordination among the distribution of sustainability indexes in the city.

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2. METODOLOGY

Our research was done through descriptive analytical method, involving collecting data, library and document research, sites, calendars, articles, theses and dissertations. We analyzed data's, and employed Topsis model, Entropy models.

2.1. TOPSIS MODEL

TOPSIS (Technique of Order Preference by Similarity to Ideal Solution) method was originally introduced by Hwang and Yoon (1981) and received praise from surveyors and operators. TOPSIS is a decision making technique for finding the alternative that is closest to the ideal solution. In this method, options are graded based on ideal solution similarity. If an option is more similar to an ideal solution, it has a higher grade. Ideal solution is a solution that is the best from any aspect that does not exist practically and we try to approximate it. Basically, for measuring similarity of a design (or option) to ideal level and non-ideal, we consider distance of that design from ideal and non-ideal solution.

Step 1: Determine the decision matrix:

$$\begin{bmatrix} X_{11} & X_{12} & \dots & X_{1m} \\ X_{21} & X_{22} & \dots & X_{2m} \\ \dots & \dots & X_{ij} & \dots \\ X_{n1} & X_{n2} & \dots & X_{nm} \end{bmatrix}$$

where xij is the performance of $iitth$ alternative with respect to the $jjtth$ criteria. Here m is the number of alternatives and n is the number of criteria.

Step 2: Construct normalized decision matrix. This step transforms various attribute dimensions into non-dimensional attributes, which helps comparisons across criteria. Normalize scores or data as follows,

$$r_{ij} = \frac{x_{ij}}{\sum_{i=1}^{n} x_{ij}^2}$$

Step 3: Construct the weighted normalized decision matrix by multiplying the normalized decision matrix by its associated weights. The weighted normalized value vij is calculated as:

vij = wjxij for j=1,2,…,n where wjis the weight of the criteria j . This weight or priority is determined by ANP as discussed above.

Step 4: Determine the positive ideal and negative ideal solution.

Positive ideal solution:

$$A^*=\{v_1^*, \ldots\ldots, v_2^*\} \text{ where, } v_j^*=\max(v_{ij}) \text{if } j \in J^+ \text{ or, } \min(v_{ij}) \text{if } j \in J^-$$

Negative ideal solution:

$$A'=\{v_1', \ldots\ldots, v_2'\} \text{ where } v_j'=\min(v_{ij}) \text{if } j \in J^+ \text{ or, } \max(v_{ij}) \text{if } j \in J^-$$

Where J+ is associated with beneficial criteria and J− is associated with non-beneficial criteria.

Step 5: Calculate the separation measure:

Separation from positive ideal one:

$$S^+=\sqrt{\sum_{j=1}^{n}(v_{ij}-v_j^*)^2}$$

Separation from negative ideal solution:

$$S_i^-=\sqrt{\sum_{j=1}^{n}(v_{ij}-v_j')^2}$$

Step 6: Relative closeness to the alternative can be determined as:

$$C_i^*=S_i^-/(S_i^+ + S_i^-)$$

Step 7: Select an alternative with maximum$CCii*$ or alternative in the descending order based on the value of $CCii*$.

2.2. ENTROPY COEFFICIENT

In order to analyze the characteristics of the spatial distribution of the population in five urban districts of Sanandaj, relative entropy coefficient has been used. In fact, it indicates the influence of population index on the establishment of each form of studied balance or centralization. The idea behind this method is that the more the scattering in the values of an index, the more important is the index mentioned (Taghvaei & Saberi, 2010, p.61). Through using this model, one could specify the extent of the spatial balance of the population placement and the number of cities in the level of urban, provincial, regional and national networks (Chen, 2008, p.14).

The formula for the entropy efficient is as following:

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$H = \sum PiLnPi$

Where H is total frequency in the Naperian logarithm frequency, Pi relative frequency, LnPi relative Naperian logarithm, K number of ranks and G is entropy value. The entropy coefficient has the value of 0 to 1. The closer the value to 1, the fairer is the distribution whereas the closer the value to 0, the more unbalanced is the population distribution (Tasi, 2005, p. 145).The entropy coefficient obtained on 2011 was 0.9666, indicating relatively balanced population distribution in Snandaj.

3. INDEXES USED IN THE STUDY

According to the explanations above, sustainability criteria and indexes are defined in the following fields: physical and land use, educational and cultural, urban facilities and equipment and health and treatment. The indexes are selected based on index preparation programs in national and international levels and data obtained from relative offices and institutions and census results.

TABLE 1- INDEXES USED IN THE STUDY

Physical and Land Use	Residential land use per capita, educational land use per capita, Higher education land use per capita, equipped green space land use per capita, treatment land use per capita, healthcare land use per capita, Commercial land use per capita, administrative land use per capita, urban facilities land use per capita, cultural land use per capita, religious land use per capita, protected green space land use per capita, military land use per capita, passages land use per capita, tourism and guest reception land use, proportion of region area to city and population gross density
Educational and Cultural	Number of schools for children with disabilities per 10,000 citizens, number of kindergartens per 10,000 citizens, number of schools per 10,000 citizens, number of middle schools per 10,000 citizens, number of high schools per 10,000 citizens, number of technical-vocational schools per 10,000 citizens, number of higher education centers per 10,000 citizens, number of cultural complexes per 10,000 citizens, number of libraries per 10,000 citizens
Facilities and Equipment	Number of fire stations per 10,000 citizens, number of warehouses per 10,000 citizens, number of parking lots per 10,000 citizens, number of slaughterhouses per 10,000 citizens, number of fruit and vegetable markets per 10,000 citizens, number of hotels per 10,000 citizens, number of garbage trucks per 10,000 citizens, number of public toilets per 10,000 citizens
Health and Treatment	number of healthcare centers per 10,000 citizens, number of welfare centers per 10,000 citizens, number of medical centers per 10,000 citizens, number of hospitals per 10,000 citizens, number of drugstores per 10,000 citizens, number of laboratories per 10,000 citizens

Reference: Authors

4. STUDY AREA

Sanandaj is centre of Kurdistan province with 3688.6 acre area and it is located in west of Iran and south of Kurdistan province. Its geographic coordinate system is 14-degree, 35 northern latitude and 46-degree eastern longitude. And the height of sea level is between 1450 to 1538 meters in different parts of the city (Habibi, 2008). Sanandaj is surrounded by mountains such as: Abidar, Koochsar Ttoosnozar, so the growth of the city has been

limited from the south-west and north–east. Many parts of Sanandaj are located on the hills. Topological situation of the city and the mountains have caused the city to be surrounded by a flat valley. Also the form of networks and streets are according to the slope of the land and some parts of the city have very steep slopes. Many alleys are narrow and tortuous except for new neighborhoods. Gheshlagh River with a length of 95 kilometers passes through three kilometers east of Sanandaj. Today volume of river water has decreased dramatically due to lack of rain and snow and physical expansion of the city. The mountains that have surrounded Sanandaj are: Abider, Koochsar, Sheikh Maroof, Masjed Mirza, Mlakavoo, Charkhlan, and Serajeddin. Sanandaj is 512 kilometers away from Tehran. Also Sanandaj is 140Km away from the borderline in Marivan (http://www.sanandaj.gov.ir).

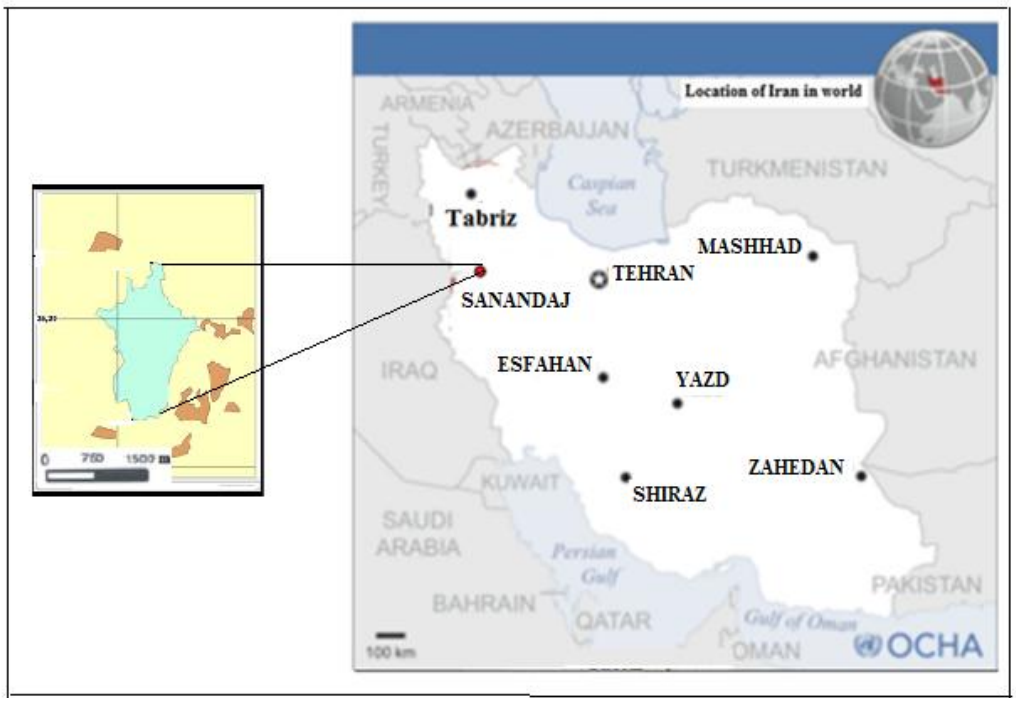

FIGURE 1- THE MAP OF LOCATION SANANDAJ CITY IN IRAN

5. POPULATION DISTRIBUTION IN SANANDAJ'S URBAN ZONES

In order to analyze the characteristics of the spatial distribution of the population in five urban districts of Sanandaj, relative entropy coefficient has been used. In fact, it indicates the influence of population index on the establishment of each form of studied balance or centralization. The entropy coefficient obtained on 1996 was 0.9, increased to 0.93 on 2006. The trend indicates the expansion of balance and equality in the population distribution of Sanandaj's urban districts.One of the suitable criteria for the identification of urban districts' facilities, resources and shortages is their categorization based on standardized scores and into three balanced, semi-balanced and unbalanced levels. Totally speaking, from among five urban districts, none of them has balance and equality, two of them are semi-balanced and three of them are unbalanced.

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6. THE EVALUTION OF SERVICE DISTRIBUTION AMONG SANANDAJ'S URBAN ZONES

Empirical investigations reveal that the distinguished feature of urbanization in the third world is lack of balance and justice. It leads to the spread of socio-economic differences among citizens, the formation of informal settlements and social disorders. Therefore, today, in plans and programs, much attention has been paid to the distribution of public services, social justice and welfare of the citizens (Gharehnejad, 1997, p. 92). Social justice theories are based on the fact that societies' socio-economic inequalities affect their spatial structure and any change in their spatial structure and socio-economic ties affects directly their income distribution among residents. From the viewpoint of urban planning, social justice includes such concepts as the proper distribution of services and functions, proper access to service-delivering centers and activities without any prejudice and difference among citizens (Habibi, et al., 2011, p. 104). In order to evaluate the distribution of services in Sanandaj, TOPSIS model has been used. Initially, five urban districts have formed one matrix using 40 indexes. Then, using Shannon entropy, those indexes are dedicated weights. Ultimately, through performing six stages of TOPSIS method, those districts have been ranked.

TABLE 2 - RANKING OF URBAN DISTRICTS USING TOPSIS

Districts	Positive Distances	Negative Distances	TOPSIS	Rank
1	0.094	0.041	0.303	3
2	0.094	0.041	0.303	3
3	0.100	0.024	0.197	4
4	0.051	0.097	0.652	1
5	0.077	0.065	0.456	2

Reference: Authors' Calculations

One of the suitable criteria for the identification of urban districts' facilities, resources and shortages is their categorization based on standardized scores and into three balanced, semi-balanced and unbalanced levels. Totally speaking, from among five urban districts, none of them has balance and equality, two of them are semi-balanced and three of them are unbalanced.

TABLE 3 - RATING OF URBAN ZONES BASED ON THE RESULTS OBTAINED FROM TOPSIS

TOPSIS Score	No of Districts	Frequency Percentage	Districts
Between 0.7-1 balanced and equal	0	0	-
Between 0.4-0.7 semi-balanced	2	1.1	4 & 5
Less than 0.4 unbalanced and unequal	3	0.80	1, 2 & 3

Reference: Authors' Calculations

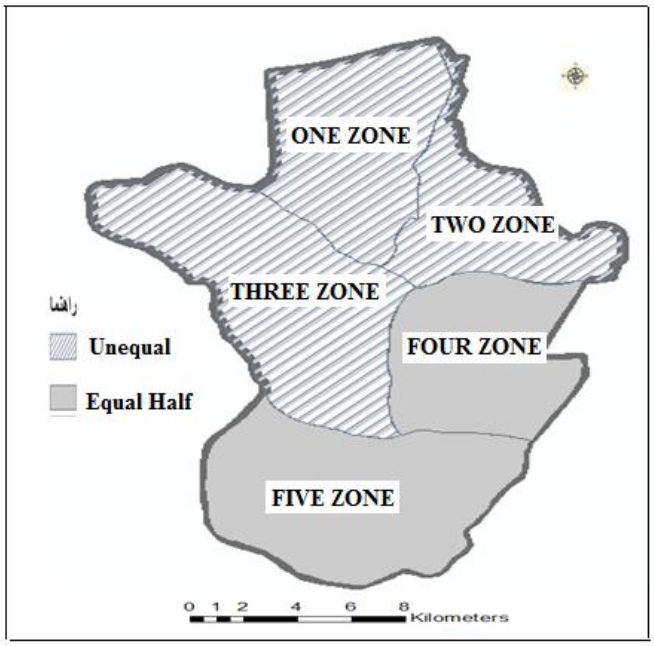

FIGURE 2- THE MAP OF UNEQUAL AND EQUAL HALF SANANDAJ ZONES

7. THE RELATIONSHIP BETWEEN POPULATION DISTRIBUTION AND SERVICES

As fair distribution of public services is done in urban districts in order to facilitate service deliverance, and proper and optimal access of citizens to those services, if the distribution of urban services and resources are not based on correct criteria, services are not delivered easily and citizens' needed services are not delivered in the cities in a balanced manner. In such condition, it is possible to see lack of balance between population distribution and needed service spaces (Hadipoor, et al., 2006, p. 101). In the current research, using spearman coefficient, the relationship between population distribution and service distribution has been investigated. Findings indicate that there is little relationship between population distribution and service distribution among Sanandaj districts. Obtained Spearman coefficient value was 0.073, showing a week relationship between population distribution and service distribution among Sanandaj districts. Here, it is aimed at presenting logical relationship between population distribution and service distribution. Table 6 reveals that all Sanandaj districts have not enjoyed urban services and resources in balanced and similar manner and services have not been delivered according to population distribution. Therefore, it is necessary to establish correct and rational relationship between population distribution and service distribution among Sanandaj districts because logical relationship and balance between population and service distribution facilitates service deliverance to great extent and helps solve lack of balance considerably.

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8. CONCLUSIONS

As results obtained from TOPSIS model and the distribution of sustainable development indexes in Sanandaj reveal, lack of balance could be seen in all five urban districts. According to the research findings and available statistic data, district 4 has the highest enjoyment. With population density of 30 individuals in each hectare, it has low density and with higher land per capita comparing other districts, it shows highest balance. However, the distribution of services and sustainable development indexes are yet unbalanced. With highest deal of recent and planned construction in the city, district 5 is at the second place. With population density of 58 citizens in each hectare, it enjoys suitable density. Semi-constructed residential areas in the district enjoy highest life quality and are considerable regarding access to services and public tariffs. Also, prestigious and high class citizens have special inclination toward living in this district. Leaning toward investment and construction in this district is among reasons of more welfare in the same district and in turn, it enjoys more development indexes. Also, because of Kurdistan University, Medical Sciences University and Payam-e-Noor University1 in the district, district 3 is on third place and it is unbalanced. It is the new kernel of some old neighborhoods in the city. The centralization of services and land uses in the district results in population absorption in the recent decades in the extent that it has been identified as new kernel. Also, locating beside Abidar Mountain and enjoying pleasant view have absorbed more population and rich classes to the district. However, although the development indexes mentioned for the district 3, it never enjoys proper spatial distribution in such a way that most of the service centers of the district are located around Azadi Square, Shebly Avenue and Abidar Street and other parts of the district have merely residential land use. Districts 1 and 2 are placed in the same category in terms of enjoyment. Those are located in the Northwest and Northeast margin of the city. Main center of those districts include the city's old kernel and its around neighborhoods. Also, excessive non-smoothness of the land of those districts has caused more compression in the area and most of the neighborhoods do not enjoy acceptable quality. Also, the distribution of sustainable development indexes is not balanced considering their population. As mentioned before, most of the centralization is located around old kernel and other neighborhoods purchase their needed items from the city's old market and kernel. Also, there is considerable lack of balance in the texture of the area. With gross density of 69 individuals per each hectare, district 2 has low density and because most of its neighborhoods are merely residential, it is spatially unbalanced and it could be told that it has lowest enjoyment from service deliverance centers. City bus terminal, city chain highway and Toos Park, which occupy main area of the region, cause citizens to flee from the districts. Most of the neighborhoods are marginal and poverty-stricken. The unbalanced distribution of development indexes in the area is easily visible.

[1] Payame Noor University is a public university and one of the largest universities in Iran

RECOMMENDATIONS

- Redistribution of public services with attention paid to needs principle; the distribution of services should be in the manner that deprived districts receive more services delivered and could take themselves to the level of enjoyed districts so that they could compete fairly with those districts.
- revision in inner-city divisions; because there is not logical relationship between the population of different districts in the city and their enjoyment from services and some districts have more population comparing others and it could result in the lack of control of authorities on their urban districts and limit their capabilities in planning for the population settled.
- As population distribution is unbalanced in Sanandaj districts, so budget allocation and planning should be done by urban planners and managers with more care.
- It is necessary that some part of the income received from rich districts be spent in deprived districts so that the city could be naturally reformed structurally and could inherently remove its lack of balance.
- Using tariff mechanisms for the optimal allocation of resources in the city through persuasion and exemptions
- positioning, distribution and allocation of budgets for urban services should be based on current and future needs of citizens in such a manner that citizens' enjoyment level will be compatible with their needs level.

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