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Spatial distribution of public services and facilities in the Sahand new city of Iran

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Abstract

With the increasing growth of urbanization in the world, the cities that are developing, including Iran, with unequal services and population distribution. In this way, its instability is achieved in the form of spatial and social inequality, and it is based on it due to the deprivation of citizens from urban services and the increase of the gap. Therefore, in this research, the new city of Sahand has been investigated for the distribution of urban services and facilities using four indicators of population, electricity and energy, water, and green space. The information needed for the research has been prepared by document-library and field methods. The fuzzy method was used to describe the indicators, and then the mentioned indicators were analyzed in the ArcGIS software environment with Moran's spatial autocorrelation analysis. The results show that the Moran values of population, water, electricity, and green space are 0.17, 0.15, 0.15, and 0.03, respectively, so that the first three indicators follow a strong cluster pattern, while the green space index is scattered in the surface of the city is distributed.

1. Introduction

The rapid growth of the urban population in the last few decades is one of the most important aspects of global change (Xu et al,2007) Also, the rapid growth of the population has provided a prelude to extensive urban growth and development and has also created large changes in land use from local to global scale (Xu and Cho, 2007). Currently, one of the problems of all cities in Iran is the rapid growth of urbanization and the consequent imbalance of urban budgets. Among the most important factors that accelerate the physical-spatial development of cities are the excessive population growth caused by birth, migration, industrialization of cities, development and implementation of economic policies by governments (Sarafi, 2000). The lack of financial, technical and infrastructure facilities to create public and social uses of the city has caused a heterogeneity and imbalance in the distribution of various facilities in the city. It can be said that the population of the cities has increased, but the services that respond to their various needs are not adequately responding to the citizens (Sohel Rana, 2009).

Another important issue that humans face is how to view the use of available energy resources and the interaction between resources and how to exploit these resources (Hosam et al, 2016; Jafari et al, 2022). In this regard, it can be said; Paying attention to urban services and easy access to urban services is one of the basic strategies for establishing social justice in cities, and in order to achieve social justice in the city, these facilities and services must be provided in a way that benefits all classes and social groups of the society. In this regard, urban utilities and services are among the effective and useful factors that respond to the needs of the population, increase the public interest, and pay attention to the merits and merits of people, and can establish the dimensions of spatial, social, and economic justice with a fairer decision (Bezi et al, 2019; Maleki and Rezaei, 2023). In urban planning, these needs include all existing uses, including educational, health, medical, green space, sports, parking, residential, urban infrastructures, etc. are actually services that meet the basic needs in They are urban space. The existing limitations at the level of phases, in order to be successful in providing services at the level of the neighborhoods of the new city of Sahand, the cooperation of city officials and citizens seems to be a vital matter. In the present research, we discuss the spatial distribution of public services and the population of the new city of Sahand.

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2. Method

The information required for the research was collected by directly referring to the city institutions, such as New Sahand City Municipality, New Sahand City Development Company, Water and Sewerage Department, East Azerbaijan Power Distribution Company, etc., as well as studying documents and electronic library resources, and conducting field studies.

The statistical population of the present study included the citizens of the new city of Sahand. Due to the fact that the statistical blocks were not ready to be obtained in 2022 from the data of the previous years (2011-2016), the population of the city in 2022 was fulfilled. The Public service indicators studied in this research were population (population of 2017 and 2022), water (production and annual water consumption of the Sahand new city in 2022 in cubic meters), electricity (The total number of subscribers in terms of people and energy consumption in 2022) and green space (areas of parks and green spaces based on each phase and number of the existing parks). These 4 indicators were first descaled by the fuzzy method and then, the Moran's spatial autocorrelation were used to analyze the spatial distribution of the public service and population in the Arc GIS 10.8.1 software environment.

2.1. Research models

De-scaling is one of the important steps in multi-criteria decision making and is used to make the decision matrix non-dimensional (Asgharpur, 2016). There is a stochastic process called Moran's process, which describes the changes in the system assuming that the population is constant. Typically, biological systems in which two types of species are competing for expansion in the system are analyzed by this process. It is assumed that each species does not make any mistakes during the reproduction process and only produces its own similar species. In each time step, one person is randomly selected for reproduction and one person for death, and thus the size of the total population remains constant (Talabi Bram, 2013).

Table 1. Formula of models used in research

Model	Formula	Source
Fuzzy de-scaling	$nij = \dfrac{aij - Minaj}{Maxa\,j - Mina\,j}$ $nij = \dfrac{Maxa\,j - aij}{Maxa\,j - Mina\,j}$	(Asgharpur, 2016)
Moran	$I = \dfrac{n}{so} \dfrac{\sum_{i=1}^{n} \sum_{j=1}^{n} \omega ij(xi - \overline{x})(}{\sum_{j=1}^{n}(xi - \overline{x})}$	(Askari, 2011)

3. Study Area

The new city of Sahand is a newly established city in East Azerbaijan province of Iran, which is located 24 kilometers southwest of Tabriz, in the flow of the Tabriz-Azarshahr communication axis, and in the slopes of south of the Sahand mountain range was built (Sap, 2008).
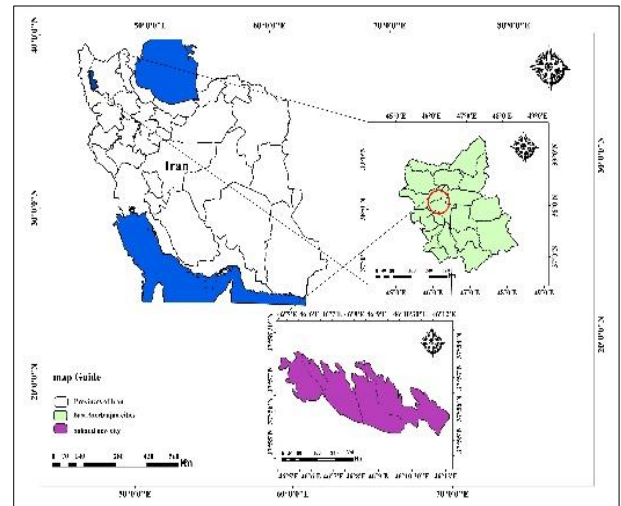

Figure 1. Map of the geographical location of the study area

4. Results

The expansion of the physical dimensions of the cities, the development of the city and the informal settlement of the new urban strata in the suburbs of the big cities of the country, and the increase in the price of land and housing in the area of the cities as well as the metropolis of Tabriz, practically make the provision of housing for the low-income or middle-income strata very difficult and even impossible. made it possible (Sahand New City Development Company, 2019). This has led to an increase in the population of the new city of Sahand, so that according to the population estimate in 2021, it has reached 275,472 people from 82,494 people (Iran Statistics Center, 2015).

Spatial autocorrelation analysis (Moran) has been used for the spatial distribution of the population. Moran's value is equal to 0.17, which shows the spatial distribution of the population of the new city of Sahand, which is distributed in phases two, three, one and four, respectively "Fig. 2".
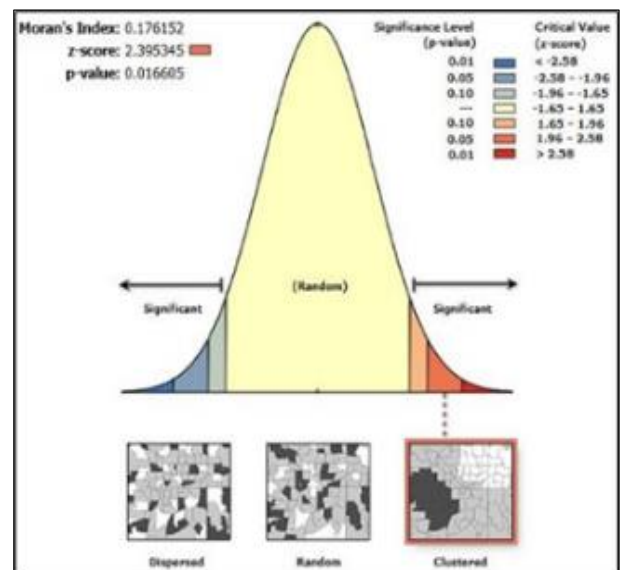

Figure 2. Sahand spatial distribution pattern based on population index

The results of Moran's spatial autocorrelation analysis for water index (production and consumption) showed that Moran's value is equal to 0.15. Considering that the Z calculated for the water index has a positive and large numerical value (2.29), the spatial distribution of this index follows a strong cluster pattern with a high confidence of 97% like the previous index "Fig. 3".
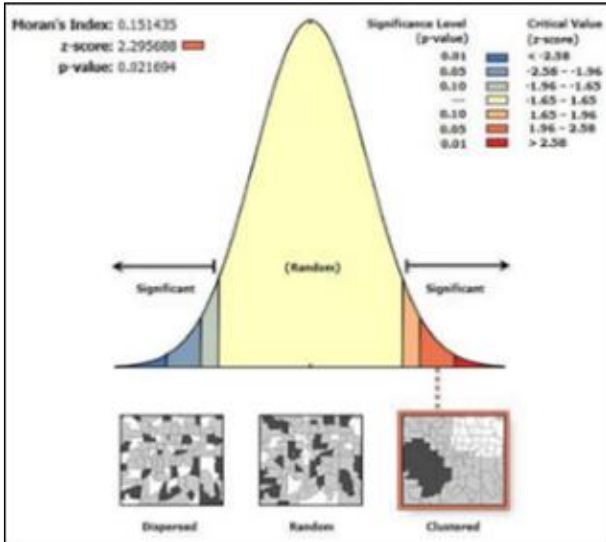

Figure 3. Sahand spatial distribution pattern based on water consumption index

The calculation results of Moran average index of total electricity consumption in New Sahand city show the cluster distribution of this index in the city level. Its Moran coefficient was equal to 0.15, the lowest amount of consumption was in phase four and phase one, and the highest amount was in phase two and three "Fig. 4".
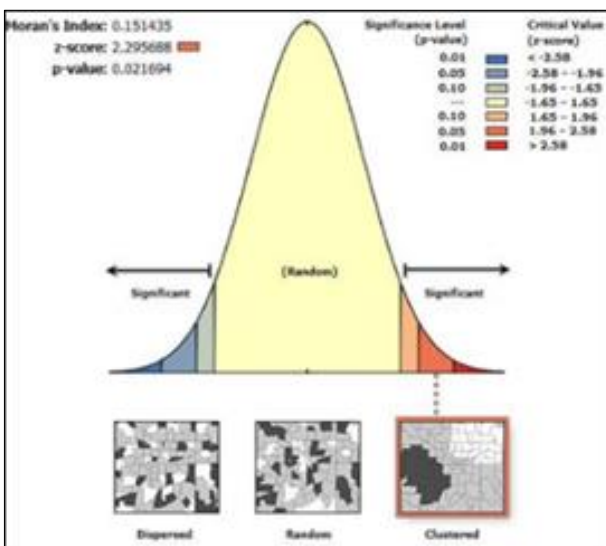

Figure 4. Sahand Spatial Distribution Pattern Based on Energy Consumption Index

The results of Moran's calculation of green space index is equal to 0.03, which indicates the scattered distribution of this use in the new city of Sahand. Also, the concentration of park use is in a part of the city, and as a result, more enjoyment in a certain area and less enjoyment in other areas and their deprivation of this facility "Fig. 5".
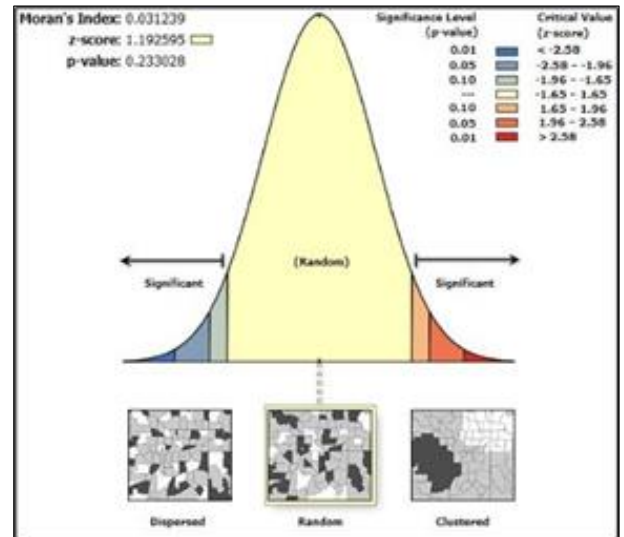

Figure 5. Sahand Spatial Distribution Pattern for Green Space Index

5. Discussion

Moran's spatial autocorrelation analysis is able to measure the spatial difference between all samples.

If the Moran value is close to a positive number of one, the data has spatial autocorrelation and has a cluster pattern, and if the Moran index value is close to a negative number of one, then the data are discrete and scattered. Therefore, this model is one of the best methods for evaluating public uses and services, which has shown us how to distribute them in the city level in the current research.

6. Conclusion

One of the basic problems of cities in recent decades is the unequal distribution of resources in different parts of the city. The disorganization of the distribution system of service centers in urban spaces has become the basis of social inequality of citizens in enjoying these services. Paying attention to the importance of distributing service users in urban areas and providing needed facilities and services is an important factor in improving the standard of living, social justice and sustainability of urban life.

Providing desirable and appropriate services is a suitable platform for social, economic and cultural activities and provides the grounds for citizens' well-being and satisfaction. The well-being and satisfaction of any society depends on making sure that all its members feel that they have a share in it. In this research, we have evaluated the distribution of services and the distribution of the population in the city, that the green space index follows a scattered and random pattern, and the water, electricity and population indices form a strong cluster pattern in phases two and three of the new city OF Sahand is distributed.

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