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Analysis, Measurement, and Evaluation of Sustainable Development in Aleshtar City using AHP-Fuzzy and TOPSIS Models

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Abstract

The sustainable development denotes the balanced status among various dimensions of development that aims to improve conditions of quality of life for the human. Urban sustainable development is deemed as the ideal objective for the planners and urban development directors in order to exploit suitably from the resources and to establish balanced relationship among human and community and nature. The present research mainly aims to extract and measure parameters of urban sustainable development in 4 regions in Aleshtar city (Lorestan Province- Iran). This study is an applied research in terms of goal and descriptive- analytical type in terms of methodology and based on librarian and field studies. The selected parameters were collected at two phases by study on backgrounds (research projects, statistical newsletters and books) and employing votes and comments from experts (using Delphi technique and extraction from comments of academic theorists and directors of relevant organizations) and they were merged together using Delphi technique. Parameters were weighted and analyzed by means of two models (TOPSIS and AHP-Fuzzy) after extraction and they were interpolated by GIS software and using Semivariogram tool. The research findings show that Region-3 has the highest rank (weight value= 0.627). After this region, Regions 2, 4 and 1 have devoted subsequent preferences with weighted values of 0.602, 0.578 and 0.541, respectively. Some strategies

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are suggested in order to moderate parameters of urban sustainability throughout regions of Aleshtar city including rising awareness of city dwellers about urban sustainable development plans, making the inhabitants familiar with parameters of a suitable city and creation and developing of a dynamic transportation system and establishing healthy housing in Regions 1, 2 and 4, increasing area of green space, establishing healthcare administration in Aleshtar Municipality and creating healthcare-medical institutes and centers etc.

Keywords: Extraction, Measurement, Parameter, Sustainable development, Aleshtar.
2010 MSC: 03B52

1. Introduction

Although development idea has been always addressed by humans as a concept for improvement of individual or collective living statuses and conditions and over the history, the new and planned meaning of this concept was related to contemporary time i.e. after the end of World War II and various theories were proposed in this regard [1]. Regardless of cities and urbanism, discussion about stability and sustainable development will be surely meaningless. Cities are assumed as the main factors for creating instability in the world [2] since the characteristics of our time include urbanism, rising population of cities and thus development of small and big-size cities. Consequently, population of urban areas will grow about 3.3 billion of people during 1990-2030 out of which 90% will inhabit in urban areas in Developing Nations [3]. In 2011, 73% of European population will dwell in urban areas and this figure will reach 83% by 2050. World population will be approximately 9.3 billion in 2050 out of which two-third will live in urban regions. Thus, it is necessary to create sustainable urban area [4]. In addition, the reality of accelerating growth of urbanism (city-dwelling) in today world and continuity of this trend in the future; on the one hand, and amazing noticeable macro growth of cities, especially in the southern countries and their hazardous consequences for inhabitants in these areas; on the other hands, are considered as the foremost concerns that require for pondering and have drawn serious attention by experts and urban planners toward concept of urban sustainable development [5]. Consuming of over 75% of world resources and producing 80% of greenhouse gases (CO2) that occur in these cities may be assumed as one of such consequences [4]. The concept of sustainable development has been so far employed within the various frameworks of concepts by different methods [6], but the most pivotal idea is presented by World and Environment Development Commission in 1987. According to this definition, development may be sustainable if it can meet the needs for the present generations without sacrificing of capability of the post generations to fulfill their requirements [7]. Many principals were agreed during this conference where these principles are composed some part of concept of sustainable [8]. According to idea of some experts, this definition of sustainable development may include ambiguity that has been led to challenge and confusion about sustainable development [9]. Luke implies this definition has failed to refer to needs of individual at present and this fact if they are assumed as requirements or wishes and or where and how development could meet these needs [10].

The accelerating process of development without environmental planning and considerations are visible in urban centers in Iran through exploitation from the resources, destruction of outskirt lands, gardens, forests, creation of incompatible uses and finally by water, air and soil pollutions etc. in the landscapes of urban environments at wide scale the has disturbed balance of natural ecosystems. Under the conditions when all efforts should be focused on preserving health of environment within process of sustainable development, overlooking of environmental considerations has led to several crises in urban areas in planning processes [11]. Alternately, quick growth in urbanism and tendency toward settlement in metropolises have caused several problems for giving public and infrastructural

services [12]. As a consequence, housing was proposed as a challenge in urban planning since 1960s. Therefore housing and related planning was taken in to consideration in line with urban sustainable development with framework of national, regional and urban planning processes [13].
For this reason Aleshtar city has been selected as the domain for the current study where according to the existing statistics and information in various effective fields in urban sustainability, it is noticeably far from the world standards. On the one hand, rising rate of population (more than 8 times) during years (1956-2016) within recent decades along with natural increase in population has exposed this city to several social, formative, environmental, housing and transportation problems etc.; and on the other hand, inappropriate and excessive exploitation from natural resources, change and destruction of natural ecosystems, changing land uses and creation of unequal urban areas within the city, environmental pollution caused by unsuitable wastewater disposal, lack of interaction between different transportation sectors, giving low quality services and high density population that could be assumed as an important factor for urban development have led this city to encounter serious challenges relating to urban sustainable development.

2. Theoretical bases

3. Urban sustainable development

Lexically development denotes extension and wideness and this terms has been defined in Webster Dictionary as process of natural growth, division and transformation of a system during subsequent changes from incomplete to more complete status [14]. This concept is one of the major and challenging concepts for the humanity where the competitive aspect of this concept has appeared to acquire life standard criteria since twentieth century and achieved special position in scientific, economic, social, and national fields and international relations and issues after World War II [15]. Sustainable development does not only refer to environmental protection. But in comprises of a new meaning of economic growth that has selected justice and life facilities for world people not a little group of individuals [16]. Sustainable development is based on three main principles: 1- Ecological stability: This principle emphasizes in implementation of development while preserving basic environmental processes, diversity of biological species and environmental protection. 2- Sociocultural stability: This principle is focused on public control over their own fate within development trend. 3- Economic stability: This principle emphasizes in optimal use of resources and suitable managing of them so that the post generations not to encounter problems as well [17]. Urban stability is a concept that was proposed following to sustainable development project as a new paradigm in the world [18]. It includes interaction between environmental, economic, social, cultural and formative factors [19]. Theory of urban sustainable development looks for sustainable development approach toward supporting from natural resources and presented to estimate dialogue of environmental adherents concerning problems of urban environment [20]. Urban stability denotes rate of resistance of formative elements against wearing and erosion and having ability to function for long time. In order to establish the given stability, It should be dealt with taking suitable strategies for way of distribution and division of spaces and uses throughout cities and urban regions and localities proportional to status quo at the given area and landscapes in addition to addressing design and architectural activities at the related scales [21]. Today, achieving of urban sustainable development is presented as a key tool in realizing sustainable development. The urban sustainable development is a comprehensive development and composed of various dimensions [2].

- Webster Dictionary

3.1. Parameters of urban stability

The urban sustainable development includes wide dimensions. Some of foremost related parameters are as follows: Economic, environmental, social and formative factors [20]. Environmental concern are going to increase during recent years so that the problems of urban sustainable development have been put at the agenda for leaders throughout the world [22]. During past decade, this stability has been assessed by several modeling parameters and techniques [23]. Accordingly, reliability of variables has been considered as logical techniques for determining relative stability level [24]. After welcoming widely to concept of urban sustainable development, finding a precise method for assessment and measurement of relative stability level for existing and future changes has been turned into an import problem [25]. There have been various studies that have proposed different techniques to assess stability [26]. There is common agreement among experts to assess stability parameters i.e. parameters should be functional and suitably and carefully selected [27]. In other words, they should improve development performance [28]. Ever-increasing growth of urbanism has created new and specific problems in life and human relations. Housing is one of these most major problems. Accordingly, high density of inhabitants in housing units, small numbers of room, building of housing by less-durable and non-standard materials, lack of the minimum living facilities and requirements in housing units are some of problematic dimensions in housing phenomenon at poor urban areas [1]. Theorists of urban sustainable development since 1990s, including Peter Hall, Bahraini, Solomon, and Robert Allen etc. argued that environmental protection, optimal exploitation from natural resources in city for the present and future, adaptation to natural environment in urban development, reducing pollutions and wastes, providing economic welfare continually and constantly for the citizens, social justice in city for the present and future, prevention from destroying urban environment along coordination with technological changes and developing of dynamic and stable symbols in all urban dimensions and sectors should be considered with optimal productivity in making policies for urban development by planners [11].

4. Methodology

This study is an applied research in terms of goal and descriptive-analytical study in terms of method and based on librarian and field studies. The selected parameters were collected by study on research projects, statistical newsletters, existing books and papers, and urban projects and finally merged using Delphi technique. Weights of parameters were obtained by means of TOPSIS model after extraction of parameters. Then, location analysis will be done by means of GIS software and Semivariogram tool including geostatistical analyst tools. Table 2 shows the given parameters in this study.

5. Research findings

Then, the final weight existing in any sector was determined using derived statistics in all 4 regions of Aleshtar city and by means of ranking model of weight in TOPSIS section where the results are given in Table 2-4:

Weights of urban sustainable development were extracted using TOPSIS model and summary of decision-making matrix for environmental parameters is as follows: Region-2 has the highest weight (0.321) and Region-1 possesses the lowest weight (0.045) per capita in sector of green space per capita. In the mass working section, Region-2 has the highest weight (0.407) and Region-1 possesses the lowest weight (0.005) per capita. In sporting sector, Region-4 (0.312) and Region-2 (0.038)

Table 1: The most common variables used in the evaluation of banks' efficiency

Housing	Formative	Social	Transportation	environmental
Number of housing plots at age 10 years	Housing per capita	Family density	Length of pathways (km)	Green space per capita
Number of housing plots at age 10-20 years	Educational services per capita	Population density	Surface area of pathways	Mass working per capita
Number of housing plots at age 20-30 years	Administrative services per capita	Family dimension	Pedestrian surface area	Sporting services per capita
Number of housing plots at age of 30 years and older	Commercial services per capita	Population at age 0-4 years	Percentage of firefighting hydrants	Heavy industry per capita
Number of needed housing units	Medical services per capita	Disable population	Macadamized surface area	Light industry per capita
Number of housing plots built with concrete and metallic structures	Religious services per capita	Population at age 6 and older	Number of parking lots	Percentage of firefighting hydrants
Number of housing units without structure	Installations and equipment per capita	Gender population ratio	Crossroads with normal traffic light	Neighborhood park per capita
Number of housing plots	Cultural services per capita	Age mean	Crossroads with smart traffic light	Soil excavation (m^3)
Number of housing units	Military services per capita	Main age	Places with blinking lights	Soil-foundation (m^3)
Average number of inhabitant per a housing unit	Entertainment tourism services per capita	Active population	Number of imaging control cameras	Cutting trees

Table 2: Status of environmental parameters of sustainable development in all 4 regions at Aleshtar city

Regions	Tree-cutting	Soil-foundation	Soil-excavation	Percentage of firefighting hydrants	Neighborhood park per capita	Light industry per capita	Heavy industry per capita	Sporting services per capita	Mass working per capita	Green space per capita
Region-1	0.001	0.057	0.059	0.467	0.083	0.055	0.000	0.058	0.005	0.045
Region-2	0.031	0.045	0.027	0.200	0.137	0.017	0.000	0.038	0.407	0.321
Region-3	0.001	0.146	0.139	0.044	0.089	0.218	0.003	0.169	0.040	0.238
Region-4	0.456	0.071	0.226	0.111	0.072	0.030	0.084	0.312	0.050	0.062

have the highest and lowest weights per capita respectively. In heavy industry sector, Region-4 (0.084) has the highest weight and Regions 1 and 2 have the lowest weight (0.000) per capita. In light industry sector, Region-3 (0.218) and Region-2 (0.017) possess the highest and lowest weights per capita respectively. In section of neighborhood park area per capita, Region-2 (0.137) has the highest weight and Region-4 (0.072) possesses the lowest weight per capita. In section of firefighting hydrant, Region-1 (0.467) has the highest weight and Region-3 (0.44) possesses the lowest weight per capita. In section of soil excavation, Region-4 possesses the highest weight and Region-2 (0.027) has

Table 3: Status of transportation parameters of sustainable development in all 4 regions at Aleshtar city

Regions	Number of image control cameras	Places with blinking lights	Crossroads with smart traffic lights	Crossroads with ordinary traffic lights b	Public parking	Percentage of firefighting hydrants	Macadamized surface areas	Pedestrian surface area	Surface area of pathways	Length of pathways (km)
Region-1	0.316	0/136	0.176	0.467	0.318	0.240	0.076	0.087	0.040	0.059
Region-2	0.158	0.136	0.235	0.133	0.227	0.240	0.160	0.048	0.084	0.028
Region-3	0.070	0.185	0.000	0.133	0.045	0.080	0.109	0.080	0.071	0.206
Region-4	0.158	0.049	0.176	0.133	0.091	0.120	0.166	0.191	0.119	0.116

Table 4: Status of social parameters of sustainable development in all 4 regions at Aleshtar city

Regions	Active population	Age median	Age mean	Population gender ratio	Population at age 6 and older	Disable population	Population at age 0-4	Family dimension	Population density	Family density
Region-1	0.134	0.140	0.136	0.123	0.108	0.130	0.097	0.108	0.248	0.292
Region-2	0.141	0.136	0.130	0.130	0.077	0.053	0.066	0.113	0.061	0.063
Region-3	0.128	0.136	0.130	0.123	0.152	0.123	0.141	0.119	0.109	0.104
Region-4	0.117	0.125	0.123	0.123	0.169	0.142	0.162	0.127	0.102	0.094

Table 5: Status of formative parameters of sustainable development in all 4 regions at Aleshtar city

Regions	Entertainment tourism per capita	Military services per capita	Cultural services per capita	Installations and equipment per capita	Religious services per capita	Medical services per capita	Commercial services per capita	Administrative services per capita	Educational services per capita	Housing per capita
Region-1	0.086	0.000	0.187	0.023	0.316	0.071	0.349	0.047	0.118	0.112
Region-2	0.154	0.896	0.192	0.162	0.054	0.085	0.093	0.218	0.145	0.129
Region-3	0.645	0.025	0.106	0.188	0.182	0.261	0.057	0.144	0.157	0.152
Region-4	0.083	0.001	0.303	0.073	0.077	0.265	0.015	0.326	0.100	0.132

the lowest weight per capita. In section of soil-foundation, Region-3 (0.146) has the highest weight and Region-2 (0.045) possesses the lowest weight per capita. In tree-cutting unit, Region-4 (0.456) possesses the highest weight and Region-1 (0.001) has the lowest weight per capita.

Parameters of urban stability were extracted using TOPSIS model and summary of decision-making

Table 6: Status of housing parameters of sustainable development in all 4 regions at Aleshtar city

Regions	Average inhabitants per housing unit	Number of housing units	Number of housing plots	Concrete and metallic structures	Units without structures	Needed number of housing units	Units with age 30 years and older	Units with age 20-30	Units with age 10-20	Units up to age 10
Region-1	0.111	0.153	0.136	0.036	0.157	0.175	0.366	0.081	0.063	0.134
Region-2	0.108	0.098	0.057	0.089	0.047	0.038	0.000	0.101	0.035	0.055
Region-3	0.110	0.121	0.128	0.196	0.106	0.000	0.147	0.091	0.152	0.177
Region-4	0.132	0.117	0.154	0.259	0.119	0.142	0.090	0.037	0.326	0.235

matrix is presented for transportation parameters as follows: In section of length of pathways, Region-3 (0.206) has the highest weight and Region-1 (0.059) possesses the lowest weight per capita. In terms of surface area of pathways, Region 4 (0.119) possesses the highest weight and Region-1 has the lowest weight. Concerning surface area of pedestrian paths, Region-4 (0.191) and Region-2 (0.048) have the highest and lowest weight, respectively. In section of surface area of macadamized paths, Region-4 (0.166) has the highest weight and Region-1 (0.076) possesses the lowest weight.

Regarding firefighting vehicle, Region-1 (0.240) possesses the highest weight and Region-3 has the lowest weight. In the section of public parking lot per capita, Region-1 (0.467) possesses the highest weight and Region-3 (0.045) has the lowest weight. In terms of traffic light, Region-1 (0.467) possesses the highest weight and Region-3 (0.133) has the lowest weight. In section of smart light, Region-1 (0.467) has the highest weight and Region-3 (0.000) possesses the lowest weight. Concerning blinking light, Region-3 (0.185) and Region-4 (0.049) have the highest and lowest weights, respectively. In terms of control camera, Region-1 (0.316) has the highest weight and Region-3 (0.070) possesses the lowest weight.

Weights were extracted for parameters of urban sustainable development using TOPSIS model and summary of decision-making matrix is proposed for social parameters as follows: Concerning active population, Region-2 (0.141) possesses the highest weight and Region-4 (0.117) has the lowest weight. In terms of age median, Region-1 (0.140) possesses highest weight and Region-4 (0.125) has the lowest weight. Regarding age mean, Region-1 (0.136) and Region-4 (0.123) possess the highest and lowest weights, respectively. In terms of gender ratio, Region-2 (0.130) has the highest weight and Regionj-2 (0.121) possesses lowest weight. Concerning active population, Region-4 (0.169) has the highest weight and Region-2 (0.077) possesses the lowest weight. Regarding disable population, Region-4 (0.142) and Region-2 (0.053) have the highest and lowest weights, respectively. In terms of population rate (0-4), Region-4 (0.162) possesses the highest weight and Region-2 (0.066) has the lowest weight. In section of family dimension, Region-4 (0.127) and Region-1 (0.108) possess the highest and lowest weights, respectively. Concerning population density, Region-1 (0.248) possesses the highest rate and Region-2 (0.061) has the lowest weight. Regarding control of family density, Region-1 (0.292) has the highest weight and Region-2 (0.063) possesses the lowest weight.

The weights were extracted for parameters of urban sustainable development using TOPSIS model and summary of decision-making matrix is presented for formative parameters as follows: In tourism sector per capita, Region-3 (0.645) has the highest weight and Region-4 (0.083) possesses the lowest weight. Regarding military sector per capita, Region-2 (0.896) and Region-1 (0.000) have the highest and lowest weights, respectively. In terms of cultural sector, Region-4 (0.303) has the highest weight

and Region-3 (0.106) possesses the lowest weight. Concerning installation facilities, Region-3 (0.188) possesses the highest weight and Region-1 (0.023) has the lowest weight.
Regarding religious services sector, Region-1 (0.316) and Region-2 (0.054) possess the highest and lowest weights, respectively. In terms of medical services sector, Region-4 (0.265) has the highest weight and Region-1 (0.071) possesses the lowest weight. In sector of commercial services, Region-1 (0.349) has the highest weight and Region-4 (0.015) possesses the lowest weight. Concerning administrative services sector, Region-4 (0.326) possesses the highest weight and Region-1 (0.047) has the lowest weight. In terms of educational services per capita, Region-3 (0.157) possesses the highest weight and Region-4 (0.100) has the lowest weight. In the housing sector per capita, Region-3 (0.152) and Region-1 (0.112) possess the highest and lowest weights, respectively.
Parameters of urban stability were extracted by means of TOPSIS model and summary of decision-making matrix is proposed for housing parameters as follows: In terms of number of people per a housing unit, Region-4 (0.132) possesses the highest weight and Region-2 (0.108) has the lowest weight. Regarding quantity of housing units, Region-1 (0.153) possesses the highest weight and Region-2 (0.098) has the lowest weight. In terms of quantity of housing plots, Region-4 (0.259) and Region-1 (0.036) possess the highest and lowest weights, respectively. Regarding metallic and concrete structures, Region-3 (0.188) has the highest weight and Region-1 (0.023) possesses the lowest weight. Concerning housing without structure Region-1 (0.157) has the highest weight and Region-2 (0.047) possesses the lowest weight. In terms of quantity of needed housing unit(s), Region-1 (0.175) has the highest weight and Region-3 (0.000) possesses the lowest weight. Concerning housing units older than 30 years, Region-1 (0.366) possesses the highest weight, and Region-2 (0.015) has the lowest weight. In terms of housing units with ages (20-30years), Region-2 (0.101) has the highest weight and Region-4 (0.037) possesses the lowest weight. Concerning age of housing units (10-20 years), Region-4 (0.326) possesses the highest weight and Region-2 (0.035) has the lowest weight.
Regarding age of housing units less than 10 years, Region-4 (0.235) possesses the highest weight and Region-2 (0.055) has the lowest weight. The scale-less weighted ideal positive and negative matrices are calculated with ideal positive and negative interval between them and rate of proximity of any choice using an ideal solution. That interval varies among zero and one; the solution is better as this interval approaches more to the unity so one could determine rank for each of them. Choices are ranked according to the nearest distance from ideal positive response and the farthest distance from the ideal negative response. Table (7) shows the final ranking of urban areas of Aleshtar city using TOPSIS model.
Analysis on findings by using TOPSIS model may indicate weight value of parameters of urban sustainable development among studied choices: Region-3 (0.627) the highest rank and then Regions 2, 4 and 1 have possessed the subsequent preferences (.602,.578 and .541), respectively.

5.1. Weighting of parameters using AHP-Fuzzy technique

In order to extract weights of urban stability parameters by means of AHP-Fuzzy model, pairwise comparison table (Table 8) was formed and mean weight resulting from polling were put in it by means of Delphi technique.
Accordingly, value of $\sum_{i=1}^{n} \times \sum_{j}^{m} m_{gi}^{j}$ is derived for each of rows at this matrix as follows:
Environmental = (1+ 2+ 4+ 6+ 8), (1+ 3 +5 +7 +9), (10 +4 +6 + 8+10) = (21), (25), (29)
Transportation= (1.2+1+3 +5 +7), (1.3+1 +4 +6 +8), (1.4+ 1+5 +7 +9) = (17), (19), (22)
Social = (1.4+1.3 1+3+2), (1.5 +1.4 +1 +4+3), (1.6+1.5 +1+5+4) = (7), (8), (10)
Formative = (1.6+1.5 +1.3 +1+ 2), (1.7+1.6 +1.4 +1 +3), (1.8+1.7+1.5+1+4) = (4), (5), (5)
Housing = (1+1.2+1.2+1.7+1.8), (1+1.3+1.3+1.8+1.9), (1+1.4+1.4+1.9+1.10) = (2), (2), (2)
Then, the mathematical expression $\sum_{i=1}^{n} \times \sum_{j}^{m} m_{gi}^{j}$ has been utilized to calculate s_1 for each of rows:

Table 7: Final ranking of urban regions in Aleshtar city using TOPSIS.

Regions	Region-1	Region-2	Region-3	Region-4
Environmental	0.702	0.785	0.640	0.496
Rank	2	1	3	4
Transportation	0.751	0.452	0.250	0.411
Rank	1	2	4	3
Social	0.110	0.793	0.722	0.753
Rank	4	1	3	2
Formative	0.664	0.148	0.849	0.655
Rank	2	4	1	3
Housing	0.475	0.829	0.675	0.577
Rank	4	1	2	3
Final weight	0.541	0.602	0.627	0.578
Final rank	4	2	1	3

Table 8: Pairwise comparisons of parameters

	Environmental	**Transportation**	**Social**	**Formative**	**Housing**
Environmental	1, 1, 1	2, 3, 4	4, 5, 6	6, 7, 8	8, 9, 10
Transportation	1.1, 2.1, 3.4	1, 1, 1	3, 4, 5	5, 6, 7	7, 8, 9
Social	1.1, 4.1, 5.6	1.1, 3.1. 4.5	1, 1, 1	3, 4, 5	2, 3, 4
Formative	1.1, 6.1, 7.8	1.1, 5.1, 6.7	1.1, 3.1, 4.5	1, 1, 1	2, 3, 4
Housing	1.1, 8.1, 9.10	1.1, 7.1, 8.9	1.1, 2.1, 3.4	1.1, 2.1, 3.4	1, 1, 1

$\sum_{i=1}^{n} \times \sum_{j}^{m} m_{gi}^{j} \Rightarrow$ (21+17+7+4+2), (25+19+8+5+2), (29+ 22+ 10+ 5+ 2) = (50.051), (59.25), (68.80)

Therefore, amount of $\left(\sum_{i=1}^{n} + \sum_{j}^{m} m_{gi}^{j^{-1}}\right)$ is as follows after standardization:

$\left(\sum_{i=1}^{n} + \sum_{j}^{m} m_{gi}^{j^{j}}\right) \Rightarrow \left(\frac{1}{50.051} \cdot \frac{1}{59.25} \cdot \frac{1}{68.80}\right) = (0.020),(0.017),(0.015)$

Accordingly, s_1 value is as follows for each of rows in pairwise-comparisons matrix:

s_1 =(21, 25 ,29) * (0.020, 0.017, 0.015) = (0.420, 0.423, 0.421)

s_2 =(17, 19 ,22) * (0.020, 0.017, 0.015) =(0.330, 0.327, 0.323)

s_3 = (7, 8, 10) * (0.020, 0.017, 0.015) = (0.132, 0.143, 0.150)

s_4 = (4, 5, 5) * (0.020, 0.017, 0.015) = (0.074, 0.077, 0.079)

s_5 = (2, 2, 2) * (0.020, 0.017, 0.015) = (0.045, 0.032, 0.025)

Finally, magnitude degree is obtained of each of S-values in comparison with each other. Conducting analysis on findings by means of AHP-Fuzzy model may show that among studied choices, the highest weight value belongs to environmental parameters (0.341). Afterward, parameters of transportation, social, housing and formative indices have devoted the subsequent preferences with 0.172, 0.168,

0.167 and 0.151 respectively.

5.2. Position analysis using Semivariogram

Overall, those objects closer to each other are more similar than farther objects and this is a geographical principle. Semivariogram is a method to show this relationship that the closer pairs of objects possess smaller measurement difference than farther ones. The ratio of location originates with respect to patterns of distance and proximity of objects and other places in optimal positioning versus locations where this assumption is deemed proper and it can be analyzed in Semvariogram technique [29].

$$\varpi_{ij}\left(\mathrm{h}_k, \theta_{ij}^{(1)}\right) = \frac{n_{ij}\left(\mathrm{h}_k\right)}{\widehat{c}_{ij}\left(0, \theta_{ij}^{(1)}\right)\widehat{c}_{ij}\left(0, \theta_{ij}^{(1)}\right) + \widehat{c}_{ij}^{2}\left(\mathrm{h}_k, \theta_{ij}^{(1)}\right)} \tag{5.1}$$

Alternately, if we employ other Semivariogram models it is obvious these formulae are corrected. Finally, function of cross-covariance model is as follows:

$$\gamma_{ij}(\mathrm{h}) = \mathrm{s}_i^2\widehat{\gamma}_{ij}\left(\mathrm{h}, \theta_{ii}^{(4)}\right) \tag{5.2}$$

At the last step is the spatial- positional analysis on parameters of urban stability of Aleshtar city where Fig. 2 shows this spatial analysis.

The findings resulted from Table 9 indicate estimation of Semivariogram and its impact on rate of development of Aleshtar city. This variable may confirm highly the prediction model and it will be one of the foremost influential in development of this city.

Table 9: Estimation of Semivariogram model

	Environmental	**Transportation**	**Social**	**Formative**	**Housing**
Environmental	1, 1, 1	2, 3, 4	4, 5, 6	6, 7, 8	8, 9, 10
Transportation	1.1, 2.1, 3.4	1, 1, 1	3, 4, 5	5, 6, 7	7, 8, 9
Social	1.1, 4.1, 5.6	1.1, 3.1. 4.5	1, 1, 1	3, 4, 5	2, 3, 4
Formative	1.1, 6.1, 7.8	1.1, 5.1, 6.7	1.1, 3.1, 4.5	1, 1, 1	2, 3, 4
Housing	1.1, 8.1, 9.10	1.1, 7.1, 8.9	1.1, 2.1, 3.4	1.1, 2.1, 3.4	1, 1, 1

The trend of Semivariogram shows in determination of dispersion of spatial distribution of development parameters and their impact on development of Aleshtar city that the output of parameters of the model may approve the given prediction at high level. Here the most significant values belong to R2 and adjusted R2 where in fact this denotes quality and precision of the used model. If these values are closer to 1 this means descriptive variables could well explain variance of dependent variable. Among them, with respect to high R2- coefficient in the given parameters, it can be implied that with respect to the significance coefficient of parameters for urban development growth, social parameter (weight=0.94), environmental issues (0.91), formative parameter (0.90), transportation parameter (0.86), and finally housing parameter (0.78) have been ranked respectively.

Based on Fig. 2, the regions with the highest spectrum, have the maximum weight value in terms of aforesaid parameters in this study and inversely the regions at the lowest spectrum possess the minimum weight value with respect to the given parameters.

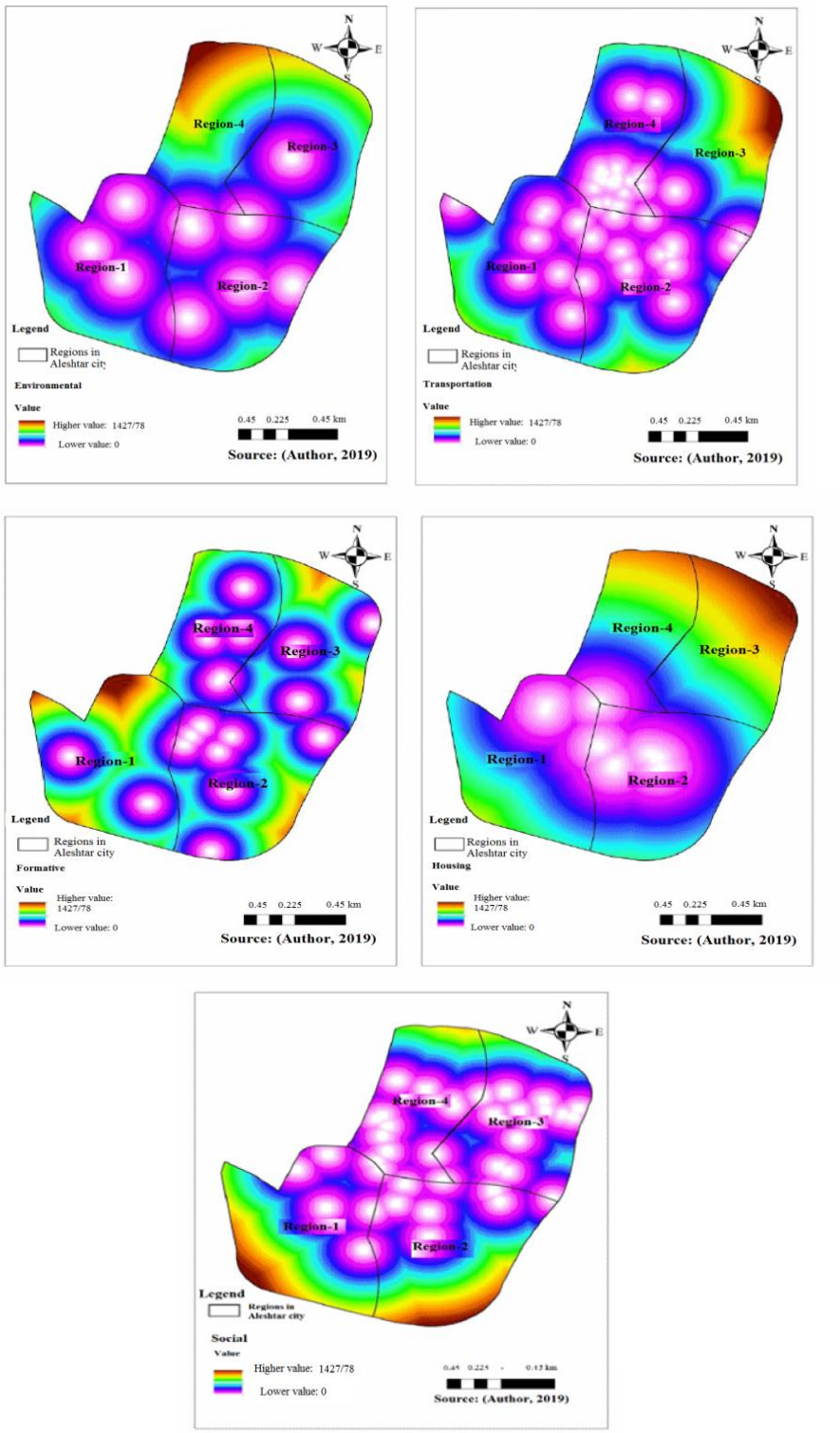

Figure 1: positional status for 5 parameters of sustainable development in Aleshtar city.

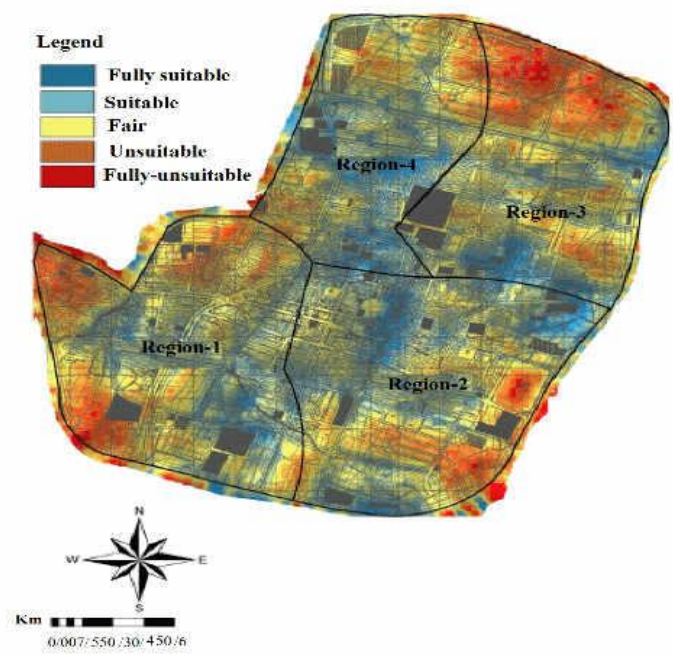

Figure 2: Spatial-positional status of parameters of sustainable development in Aleshtar city.

6. Findings

This study has extracted and analyzed 50 parameters of urban stability in five categories (environmental, transportation, social, housing and formative). The given results from Shannon's entropy weighting technique may denote that the weight value of sustainable development shows among research choices that Region-3 (0.627) has the highest rank and then Regions 2, 4 and 1 (0.602, 0.578 and 0.541) possess subsequent preferences, respectively.

References

[1] Naghdi, Asadollah, Sadeghi, Rasool (2006). Outskirt settlement: A challenge exposed to urban sustainable development by focusing on Hamedan city, Scientific- Research Quarterly of Social Welfare, 5^{th} year, vol. 20, pp. 213-233.
[2] Bezi, Khodarahm, Kiani, Akbar, Hawaheri, Abbas (2012). Evaluation of sustainability parameters in housing localities, Vase study: Mamooniyeh city- Markazi Province, Quarterly of geographic studies, 27^{th} year, vol. 4, winter, series No 107, pp. 225-245.
[3] Zarrabi, Asghar, Ghadami, Canaani, Mohammad Reza (2012). Evaluation of urban habitats by healthy city approach at Mazandaran Province, Scientific- Research Quarterly of Social Welfare, 12^{th} year, vol. 47, p. 132.
[4] Umberto Pisano, Katrin Lepuschitz & Gerald Berger, 2014,Urban Sustainable Development Approaches of Three Different Cities: Copenhagen, Newcastle, Vienna ESDN Case Study N°16 European Sustainable Development Network, pp 1-12.
[5] Rahnamaei, Mohammad Taghi, Poormousavi, Seyed Musa (2006). Analysis on security instabilities at Tehran megalopolis based on parameters of urban sustainable development, Journal geographic studies, vol. 57, Autumn, pp. 177-193.
[6] Mohammadi Dahcheshmeh, Mustafa (2014). Measurement of penetration potential of Karaj urban texture by core planning approach: A suggestion for urban sustainable development planning

at Tehran, Quarterly of strategy, 21^{st} year, vol. 64, Autumn, pp. 43-72.
[7] Ziari, Keramatollah (2004). Plan and regional planning schools, theories and models, University of Yazd, p. 22.
[8] Koen Hollander, Anneloes van Iwaarden, 2012, Activities of the European Union on sustainable urban development, Rein Zwart, Ries Kamphof LL.M, MA,September:pp1-15.
[9] Soltani, Ali, Namdarian, Ahmad Ali (2011). Analysis on role of urban space to achieve sustainable development at cities, interpretation of communication paradigm, Scientific- Research Quarterly of Bagh-e-Nazar architectural art and urbanism research center, vol. 18, 8^{th} year, Autumn, pp. 3-12.
[10] Luke, T. W.,2005, Neither sustainable nor development: Reconsidering sustainability in development. Sustainable Development,13:228:238.
[11] Rabieifar, Valiollah, Ziari, Keramtollah, Haghighat Naeini, Gholamreza (2013). Evaluation of sustainable development in Zanjan city from environmental aspect based on SWOT technique, Journal of urban and regional studies, 4^{th} year, vol. 16, spring, pp. 105-130.
[12] Rafieian, Mojtaba, Mahmoodi, Mehran (2012). Assessment of positioning pattern for new cities in urban region at Tehran using multivariate assessment technique, Journal of geography and development, vol. 36, Autumn, pp. 109-122.
[13] Hosseini, Mehdi, Barghchi, Masoumeh, Fahimeh, Siami, Ghadir (2015). Evaluation of environmental effects of inadvertent expansion of cities, Case study: Housing project of Torghabeh Mehrshahr city, Quarterly of regional planning, 5^{th} year, vol. 81, summer, pp. 43-58.
[14] Maleki, Saeed (2011). An introduction to urban sustainable development, 1^{st} ed., Publication center, Ahwaz University of Shahid Chamran, p. 36.
[15] Frazier,j.c.,1997, Sustainable Development: modern elixier or sack dress? Journal of Environmental Concervation, vol.24,pp.182- 193.
[16] Azkia, Mustafa, Gholamreza, Ghaffari (2003). Sociology of development, Tehran: Keyhan Pub, p. 59.
[17] Chadhari, Anis, Collin Craig, Patrick (2002). Planning and development policy, Trans: Ali Akbar Harani & Darius Hassanvand, Scientific Publication Center, Islamic Azad University, p. 85.
[18] Maleki, Saeed, Daman Bagh, Safiyeh (2013). Evaluation of urban sustainable development parameters by focusing on social, formative parameters and urban services (Case study: 8 regions of Ahwaz city), Quarterly of urban planning studies, 1^{st} year, vol. 3, Autumn, pp. 29-54.
[19] Taghvaei, Masoud, Safarabadi, Aazam (2011). Role of urban administration in achieving sustainable development for urban tourism, Case study: Kermanshah city, Journal of geographic studies on arid regions, 1^{st} year, vol. 4, summer, pp. 35-52.
[20] Ameri Siyahooei, Hamid Reza, Rostam Goorani, Ibrahim, Biranvand, Maryam (2010). Informal habitats, security and urban sustainable development, Case study: Bandar Abbas city, Quarterly of social securitization studies, pp. 38-60.
[21] Andalib, Alireza, Sabet Ghadam, Seyed Mohammad Ali (2009). Role of revenues of urban sustainable development in spatial-formative planning, Journal of city identity, 3^{rd} year, vol. 5, Autumn and winter, p. 88.
[22] Yigitcanlar, T.; Fabian, L.; Coiacetto, E. , 2008,Challenges to urban transport sustainability and smart transport in a tourist city: The Gold Coast, Australia. Open Transport. J, 1, 19-36.
[23] Teriman, S.; Yigitcanlar, T.; Mayere, S. Urban sustainability and growth management in South-East.
[24] Hemphill, L.; Berry, J.; McGreal, S. , 2004 An indicator-based approach to measuring sustainable urban regeneration performance. Urban Stud, 41, 725-755.
[25] Brandon, P. Foreword. , 2002, In Sustainable Urban Development: The Framework and Protocols for Environmental Assessment; Curwell, S., Deakin, M., Symes, M., Eds.; Routledge: New York, NY,

USA. P31.
[26] Foley, B.; Daniell, A.; Trevor, M.A. , 2004, Sustainability tool for intrasectoral and intersectoral water resources decision making. Aust. J. Water Resour8, 11-19.
[27] Brownhill, D.; Rao, S. A. , 2002, Sustainability Checklist for Developments: A Common Framework for Developers and Local Authorities; BRE Press: London, UK.
[28] Singh, R.K.; Murty, H.R.; Gupta, S.K.; Dikshit, A.K. An overview of sustainability assessment methodologies. Ecol. Indicat. 2009, 9, 189-212.
[29] Nasiri, Ismail (2002). Necessity of forming the healthy city, Sepehr (Sky) Journal, vol. 44, p. 191.