

## Ranking the Level of Social Sustainability of Yazd Neighborhoods Using Fuzzy TOPSIS

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Received 29 April 2021; Revised 8 July 2021; Accepted 2 August 2021

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### Abstract

Considering urban sprawl of Yazd, the aim of the current applied- developmental study is to measure social sustainability of Yazd neighborhoods by descriptive analytical method using fuzzy TOPSIS and correlation coefficient. The software utilized was SPSS, GIS and EXCELL. Because of the data sprawl, the research indicators were collected by a questionnaire using the detailed plan of 2016, the statistics center and field collection. Based on the theoretical foundations of the research, 4 main indicators were studied: population change, participation, security and quality of life. The statistical population consisted citizens of Yazd who were over 15 years old. According to the Cochran's formula, the sample size was 400 people; and sampling was done by simple random sampling method in proportion to the population of the neighborhoods by stratified random sampling in the neighborhoods. Overall Cronbach's alpha of the questionnaire was 0.893. The results showed a high correlation between quality of life index and social sustainability. Quality of life, security, participation indicators with correlation coefficients of 0.948, 0.721 and 0.673, respectively, were the most effective; and they had a significant relationship with social sustainability. Migration index was -0.217, therefore it had no significant relationship with social sustainability of Yazd neighborhoods. Among the neighborhoods, Safayyeh, Imam Shahr and Kooy-e Taleghani were the most sustainable and Eish Abad, Kheir Abad and Airport were the most unsustainable neighborhoods in terms of the social dimension.

**Keywords:** Sprawl, Social Sustainability, Quality of Life, Yazd City

### 1. Introduction

Today, sustainable development and sustainability (in general) are involved in various fields (Rezvani et al, 2004). Researchers have considered the relationship between different subjects and sustainability issues and evaluated the effects of diverse subjects on sustainability and the unsustainability of development.

In urban planning, attention to social issues is inevitable and an integral part of it. Social sustainability is one of the most important and key urban planning and policy-making tools (Nastaran, Ghasemi, and

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Hadizadeh, 2013). In Iran, as a developing country, urbanization has taken on new dimensions since the 1960s, and the exponential growth of real urbanization has started (Nazarian, 2006). Since then, the urban population has grown rapidly due to both natural growth and the phenomenon of rural-urban migration. As a result, it has completely reversed the population-settlement pattern. This trend, i.e., the dominance of the urban settlement pattern, has undergone many changes in Iranian society, especially during the last three decades (Hosseini, Aliabadi, and Hamidian, 2015). In addition, it has paved the way for urban instability in various aspects (especially social), emerging phenomena such as child labor, social crimes, theft, and extortion, particularly in metropolitan areas, loss of physical and intellectual capital, and intensification of urban problems and anomalies. (Mohammadi, Ta'ali Moghaddam, and Bastam, 2011). Therefore, the social dimension has not achieved its goals in terms of the development of the cities.

Over the past few decades, due to the increased population absorption of Yazd city and subsequently uncontrolled expansion in the desert, signs of instability have appeared in this city (Ghadiri, Zayyari, and Dasta, 2014). In recent years, the city of Yazd has experienced unbalanced and scattered development. The urban dispersion, horizontal expansion, and new constructions around the city have caused socio-economic damage and destruction of environmental resources in and around the city (Soleimani, Gheisari, and Ahar, 2014).

To the best of our knowledge, numerous studies have been conducted on the urban sprawl of Yazd. However, due to the importance of sustainable development and urban sustainability and the problems of instability in the city, this research aimed to assess the sustainability situation by examining social sustainability and unsustainability indicators in Yazd neighborhoods. Additionally, it is aimed to investigate the factors affecting the formation of levels of social unsustainability and to provide solutions to improve the level of sustainability of neighborhoods from the perspective of the social dimension.

Sustainability of the social system means improving the quality of lifestyle and development of human resources and, ultimately, the self-empowerment of local communities to overcome internal challenges and issues, react to external changes, and manage the preservation of values. In this sense, the social goals of sustainable development have been widely emphasized in terms of the following issues: equal opportunities (intergenerational and intragenerational), empowerment, improving the quality of life, dignity and human rights, poverty alleviation, cultural diversity, social solidarity, social participation, institutional capacity building, social security, responsibility, social welfare, and spatial belonging (Abdollahi and Fattahi, 2017).

Social sustainability is the ultimate dimension of sustainable development, while environmental and economic forms of sustainability are the two main goals of sustainability and the means to achieve it (Colantonio and Dixon, 2009).



**Figure 1.** The gradual increasing importance of social sustainability in international circles (Colantonio and Dixon, 2009)



**Figure 2.** The position of social sustainability in the structural dimensions of sustainable development (Keiner, 2003)

The beginning of these efforts can be traced back to the EU action in Lisbon in 2000, which defined social issues as an integral part of sustainable development models (Samuelsson et al, 2004). Significant research has been carried out on sustainable development and economic and environmental components. Nevertheless, few studies can be found that only consider social sustainability and investigate it in the urban environment. Experimental research has also been conducted in this field. Some of the most important of these studies are introduced in the following:

In a study entitled “Exploring Social Sustainability: Learning from Perspectives on Urban Development and Companies and Products”, Weingaertner and Moberg (2011) defined the concept of social sustainability by providing indicators of social sustainability. These indicators included access (with an emphasis on employment and open space), local services, social cohesion, social capital, social justice, local participation, sense of place, education, and housing. In his definition of social sustainability, Murphy refers to four main pillars: justice, participation, awareness of sustainability, and social solidarity (Murphy, 2012).

Saraii and Irajii (2014), in a study entitled “Investigating the spatial adaptation of socio-economic inequalities in the eight districts of Yazd”, investigated socio-economic inequalities in different regions of Yazd city and how they relate to each other. The results show a significant relationship between the two variables of the land value and social development in different areas of the city so that with increasing land value, social development increased.

Mousavi et al. (2018) analyzed the effects of the sprawl of the city on the urban livability of neighborhoods (Case study: Maragheh). For this purpose, they collected GIS information and sprawl indices by studying the comprehensive and detailed plan of the city. The results show that the accessibility index in multivariate regression and geographical weight had the highest positive coefficient in predicting the livability of neighborhoods. Hoseinpour, Zahiri, and Moosaii, (2010) evaluated social sustainability indicators in District 15 of Tehran using Analytic Network Process (ANP) network analysis and Technique for Order of Preference by Similarity to Ideal Solution (TOPSIS) method by studying three elements: security, quality of life and participation. Based on the findings, Moshirieh, Abouzar, and Khavar Shahr neighborhoods are ranked first to third in social sustainability, respectively, and social justice ranks first among the research sub-criteria. Melania Jelodar et al. (2020) believe that security and social action are the most important factors for social sustainability in Babylon city. Barbara (2017) analyzed the important role of the socio-economic factors in the urban development of Switzerland during 1980-2020 using a regression model. The results indicate residential density has a key role in the dispersal of urban development. Wei and Ewing, (2018) studied the growing urban population and the adverse effects of this growth on cities with a fair and sustainable development approach in the context of sustainable urban development. This author analyzed urban sprawl and its effects on spatial inequality in terms of various economic, social, and environmental dimensions. Eventually, the researcher concluded that the limitation in the earth’s vital resources is one of the key challenges worldwide.

**Table 1.** Common and new key issues in the context of social sustainability

Common	New
Basic needs (including: housing and environmental health)	Population changes (age, migration and mobility)
Training and skills	Social solidarity and cohesion
Occupation	Identity, Sense of place and culture
Equality	Ability, participation and accessibility
Human right and gender equality	Health, security
Poverty	Social capital
Social justice	Welfare, life quality and satisfaction

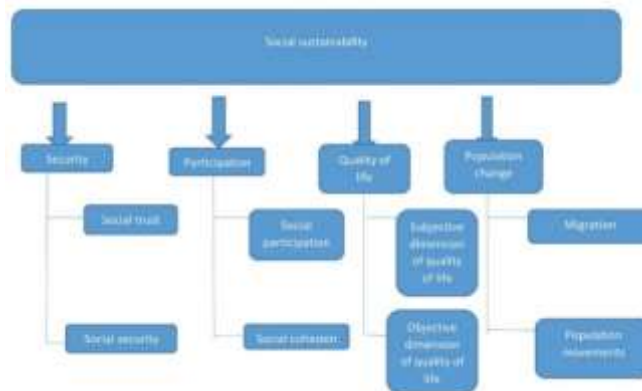
Reference: (Colantonio and Dixon, 2009)

In analyzing the interactions between social sustainability and urban form, sustainability depends on several aspects of social life and neighborhood, including social network interaction in the community, social participation, the sense of place, community sustainability, security (crime), and vitality (Sarvar and Amini, 2013).

In recent years, sustainable development has blamed the urban sprawl and reviewed this method of urbanization from environmental, economic, and social perspectives. Among these aspects, social sustainability is one of the main issues in the urban sprawl, while the social effects of urban sprawl are too difficult to investigate. There is ample evidence for unsustainability in this dimension, including the following: decreased social justice in the city, negative impact on health, the disappearance of local communities in the city center, social segregation, polarization, and inability to adapt to lifestyle changes. These instances show the urban sprawl effect on social unsustainability (Kelly-Schwartz et al., 2004). It is noteworthy that the above factors are more common in the urban sprawl of the third world and developing countries (Tavana and Noorian, 2017).

## 2. Conceptual Model of Research

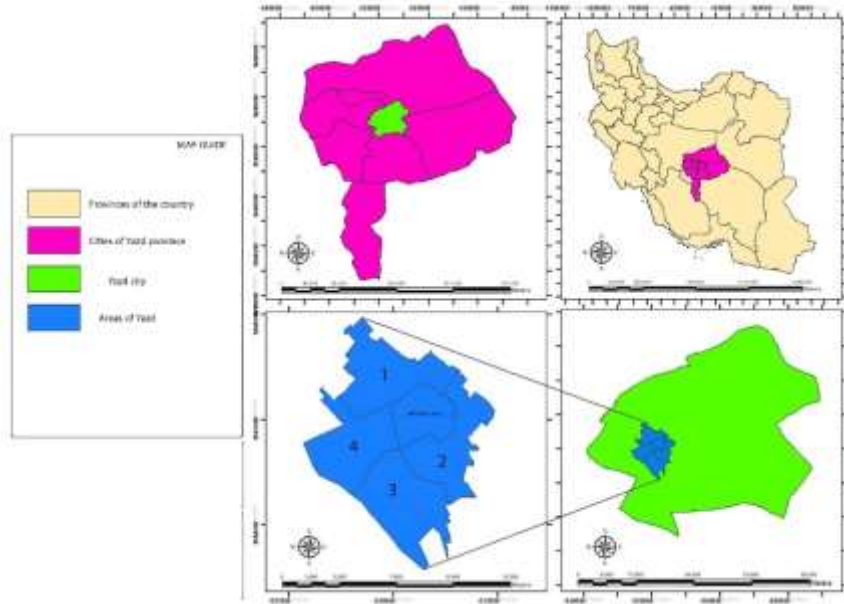
According to the theoretical foundations of this research, to provide a definition able to cover different aspects of social sustainability to some extent, four components (i.e., population change, participation, security, and quality of life) were examined to assess the social dimension of sustainable development.

**Figure 3.** Component, criteria and sub-criteria explaining social sustainability

## 3. Study Area

The study area is Yazd city in Yazd province (Iran). According to the last census in 2016, the population of Yazd County is 656,474 people, of which 529,673 live in Yazd city. The growth rate of

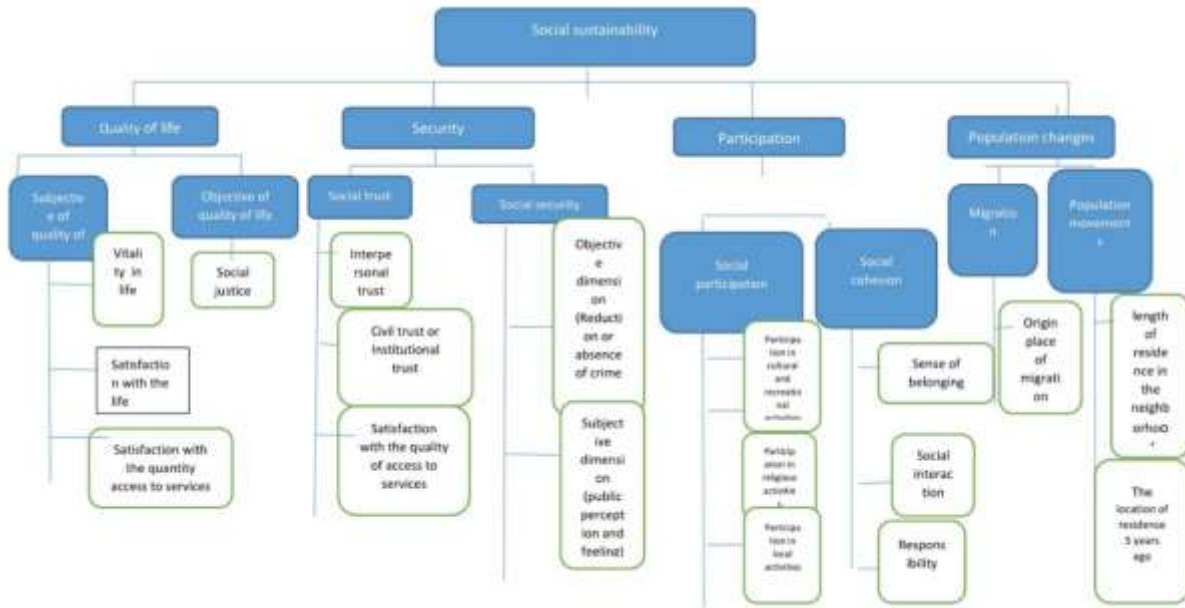
Yazd city during 2011- 016 has been 2.41%. Also, the number of emigrants leaving the province is 23,034 people, and immigrants entering the province are 40,389 people, of which 36,863 (equivalent to 7.1% of the resident population) live in Yazd (Statistical center of Iran, 2016).



**Figure 4.** Location of Yazd city in the country division. (Source: Authors)

#### 4. Materials and Methods

The present survey is an applied-developmental study with a descriptive-analytical method. Regarding the nature of the present study, the data collection was performed through desk and field studies. The paradigm related to the research topic (e.g., the development of urban sustainability from a social perspective) was used to understand the subject of research perfectly, gain the necessary theoretical insight, and extract variables and indicators. A questionnaire was used to collect social sustainability data. In addition, the Fuzzy TOPSIS method and correlation coefficient ( $R$ ) were used to evaluate and assess the stability of Yazd neighborhoods based on research variables. Finally, the social sustainability of neighborhoods was ranked using SPSS, EXCEL, and ArcGIS software packages.



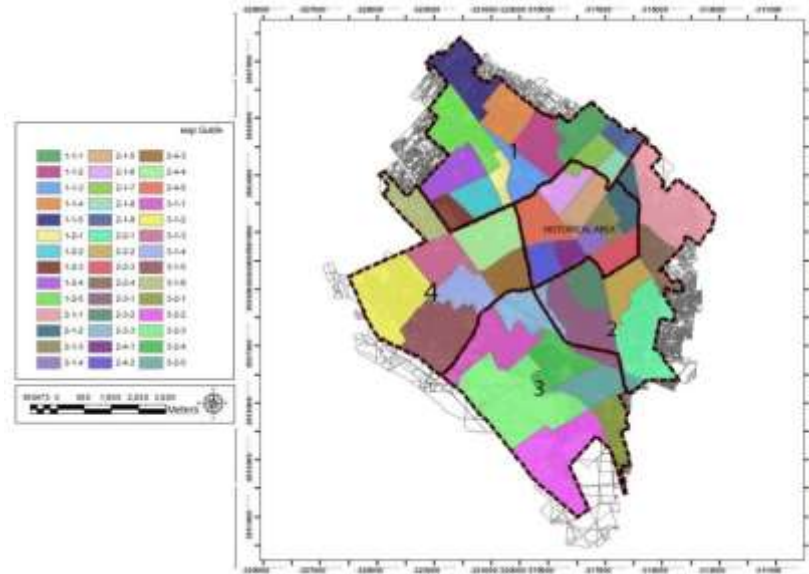
**Figure 5.** Components, criteria and sub- criteria of social sustainability (Source: research findings)

According to the census in 2016, the population of Yazd city is 529,673. The statistical population of interest in this research is all citizens over 15 years old in Yazd. According to Cochran’s formula, the sample size is 383 people, considered 400 people for higher quality. The measurement tool in the questionnaire was the Likert scale, which is from 1 to 5 items. To collect the questionnaires, first, 30 pre-questionnaires were filled out. Then, the items were assessed using Cronbach’s alpha test, and trivia questions were removed. Finally, 32 questions were selected to assess 4 research variables. Content validity was used to measure the items’ validity. To select the samples, first, the population of the neighborhoods was calculated based on the detailed plan approved in 1996. In the second stage, based on the city’s population, samples were randomly collected from 42 neighborhoods of the city. The obtained Cronbach’s alpha had the desired indicators, and the Cronbach’s alpha of the total questionnaire was 0.893.

**Table 2.** The level of reliability and validity of research variables based on Cronbach’s alpha

Variable	Cronbach’s alpha
0.716	Security
0.775	Participation
0.862	Quality of life
0.893	Total

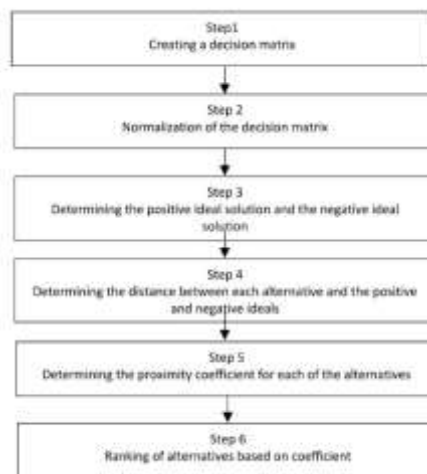
Source: Research findings



**Figure 6.** Location of Yazd neighborhoods (Source: Authors)

## 5. Research Findings

The TOPSIS technique, first introduced by Hwang and Yoon (1981), is one of the multi-criteria decision analysis methods. This technique can be used to rank and compare different alternatives and have the best choice. The steps in doing the TOPSIS technique are shown in Figure 7. Now, considering the mentioned steps, the Yazd neighborhoods were ranked based on the three criteria of participation, quality of life, and security. The first step in this method is to form a decision matrix. The decision matrix of this method includes a set of criteria and alternatives. In this matrix, the criteria are placed in columns, the alternatives are arranged in rows, and each matrix cell is evaluation of each alternative relative to each criterion.



**Figure 7.** Steps of using TOPSIS technique

**Table 3.** Decision Matrix

Row	Neighborhood name	Criteria		
		Security	Quality of life	Participation
1	Azadshahr	3.215	2.471	2.849
2	Azadshahr2	3.223	2.667	3.300
3	Gazorgah	3.756	2.986	3.422
4	Mojahedin	3.172	2.199	3.112
5	Emamshahr	3.056	2.049	2.620
6	Charkhab	3.334	3.283	2.491
7	Yazdbaf	3.453	2.814	3.189
8	Farhangian	3.479	2.751	3.399
9	Foroodgah	3.794	3.684	3.178
10	Eishabad	3.333	4.233	3.938
11	Kheirabad	3.658	3.655	3.506
12	Kooy-e- Afshar	2.965	2.822	2.914
13	Sar-e- Dorah	3.119	2.514	2.979
14	Aharestan &Jahanfar	3.015	2.885	2.998
15	Khorranshah	2.789	2.583	2.875
16	Kooy-e- Rahahan	2.886	3.415	3.211
17	Razmandegan Town	3.004	3.135	3.007
18	Siloo	3.072	2.755	2.930
19	Safayyeh	2.528	1.885	2.648
20	Kooy-e-Daneshgah	2.912	2.228	3.051
21	kaj	3.200	2.768	2.957
22	Mehravarani	3.339	2.842	3.104
23	Mehdiabad	3.139	2.685	2.862
24	Maskan	2.973	2.492	2.756
25	Lab- e-Khandagh	3.180	3.188	2.789
26	Atashkadeh	3.173	2.116	2.842
27	Naeemabad	2.982	2.748	2.538
28	Akbarabad	2.660	2.408	2.744
29	Mahmoodabad	3.510	3.615	3.103
30	Amirabad	3.326	3.151	3.000
31	Sajaddieh	3.500	3.344	3.270
32	Nasrabad	2.935	2.815	2.871
33	Seyed Sahra	3.168	2.712	3.172
34	Seyedoshohada	3.513	3.107	3.267
35	Sheykhdad	3.269	3.177	2.730
36	Fahadan	3.517	3.494	3.442
37	Kooy-e-Navab	3.298	2.587	2.810
38	Kooy-e-Taleghani	2.666	2.407	2.452
39	Maryamabad	3.266	3.195	2.903
40	Yaghoubi	3.282	3.645	3.132
41	Khajeh Khezr	3.115	3.304	3.278
42	Takht-e-Ostad	3.224	3.515	2.971

Source: Research findings

The aim here is to rank the neighborhoods of Yazd according to the three indicators of participation, quality of life, and security. Therefore, the alternatives are different neighborhoods in Yazd city, and the criteria include quality of life, participation, and security. To this end, after combining people's opinions and combining questions, a decision matrix is obtained (Table 3).



Normalization in the TOPSIS method is done using the norm method. For this purpose, each entry is divided by the square root of the sum of the entries of that standard column. In this way, the decision matrix becomes a dimensionless matrix, using the following equation:

$$r_{ij} = \frac{x_{ij}}{\sqrt{\sum_{i=1}^m x_{ij}^2}} \quad (1)$$

In the above relation  $i = m$  number of alternatives,  $j = n$  number of indicators,  $x_{ij}$  is the score value of alternative compared to index  $j$  and  $r_{ij}$  is the normalized value for the score  $x_{ij}$ . According to this, the normalized decision matrix for ranking the social unsustainability of Yazd neighborhoods is calculated based on the indicators of participation, quality of life and security, and is given in Table (4).

**Table 4.** The normalized decision matrix

Row	Neighborhood name	Criteria		
		Security	Quality of life	Participation
1	Azadshahr	0.1549	0.1290	0.1451
2	Azadshahr2	0.1553	0.1392	0.1681
3	Gazorgah	0.1810	0.1559	0.1744
4	Mojahedin	0.1528	0.1148	0.1585
5	Emamshahr	0.1472	0.1070	0.1335
6	Charkhab	0.1606	0.1714	0.1269
7	Yazdbaf	0.1664	0.1469	0.1625
8	Farhangian	0.1676	0.1436	0.1732
9	Foroodgah	0.1828	0.1923	0.1619
10	Eishabad	0.1606	0.2210	0.2006
11	Kheirabad	0.1763	0.1908	0.1786
12	Kooy-e- Afshar	0.1429	0.1473	0.1484
13	Sar-e- Dorah	0.1503	0.1312	0.1518
14	Aharestan &Jahanfar	0.1453	0.1506	0.1527
15	Khorranshah	0.1344	0.1348	0.1465
16	Kooy-e- Rahahan	0.1391	0.1783	0.1636
17	Razmandegan Town	0.1448	0.1637	0.1532
18	Siloo	0.1480	0.1438	0.1493
19	Safayyeh	0.1218	0.0984	0.1349
20	Kooy-e-Daneshgah	0.1403	0.1163	0.1554
21	kaj	0.1542	0.1445	0.1506
22	Mehravarani	0.1609	0.1483	0.1581
23	Mehdiabad	0.1513	0.1402	0.1458
24	Maskan	0.1433	0.1301	0.1404
25	Lab- e-Khandagh	0.1532	0.1664	0.1421
26	Atashkadeh	0.1529	0.1105	0.1448
27	Naemabad	0.1437	0.1434	0.1293
28	Akbarabad	0.1281	0.1257	0.1398
29	Mahmoodabad	0.1691	0.1887	0.1581
30	Amirabad	0.1602	0.1645	0.1528
31	Sajaddieh	0.1686	0.1745	0.1666
32	Nasrabad	0.1414	0.1470	0.1463
33	Seyed Saha	0.1526	0.1416	0.1616
34	Seyedoshohada	0.1693	0.1622	0.1664

35	Sheykhdad	0.1575	0.1658	0.1391
36	Fahadan	0.1695	0.1824	0.1754
37	Kooy-e-Navab	0.1589	0.1350	0.1432
38	Kooy-e-Taleghani	0.1285	0.1257	0.1249
39	Maryamabad	0.1574	0.1668	0.1479
40	Yaghoubi	0.1581	0.1903	0.1596
41	Khajeh Khezr	0.1501	0.1725	0.1670
42	Takht-e-Ostad	0.1553	0.1835	0.1514
Source: Research findings				

At the stage of determining the positive ideal solution and the negative ideal solution, the type of criteria is determined if they are positive or negative. Positive criteria are the ones that their increasing causes improving, and negative criteria do the opposite. For the criteria that have a positive dimension, the positive ideal is the maximum value of that criterion and the negative ideal is the minimum value of that criterion. For the criteria that have a negative aspect, the positive ideal is the minimum value of that criterion and the negative ideal is the maximum value of that criterion. According to the assessment of social unsustainability based on the indicators considered in this research, i.e. participation, quality of life and security, these indicators have a negative aspect, that means, the higher their value, the more unsustainable the neighborhood. In respect to this, the amount of positive and negative ideal solutions for all three criteria of participation, quality of life and security are presented in Table (5). After that, based on the following equations, the distance of each alternative to the positive ideal solution ( $d_i^+$ ) and the negative ideal solution ( $d_i^-$ ) are calculated, respectively.

**Table 5.** The amount of positive and negative ideal solutions for the criteria

Criterion	The mount of positive ideal	The amount of negative ideal
Participation	0.2006	0.1249
Quality of life	0.2210	0.0984
Security	0.1828	0.1218
Source: Research findings		

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

$$d_i^- = \sqrt{\sum_{j=1}^n (v_{ij} - v_j^-)^2} \tag{3}$$

Based on this, the amount of positive and negative ideal solution is given in table 6. Closeness coefficient or similarity index ( $c_i$ ) shows the final score of each alternative and is calculated based on the following equation. The closer this index is to the number 1, the better the criterion. This index is calculated as follows:

$$c_i = \frac{d_i^-}{d_i^- + d_i^+} \tag{4}$$

According to this equation, the closeness coefficient was calculated for all neighborhoods, and the results were shown in Table 6.

**Table 6.** The amount of positive ideal solution ( $d_i^+$ ) and negative ideal solution ( $d_i^-$ ) and closeness coefficient (ci)

Row	Neighborhood name	Closeness coefficient (ci)	Negative ideal solution $d_i^-$	Positive ideal solution $d_i^+$
1	Azadshahr	0.3080	0.0494	0.1110
2	Azadshahr2	0.4252	0.0682	0.0922
3	Gazorgah	0.5779	0.0962	0.0702
4	Mojahedin	0.2916	0.0486	0.1181
5	Emamshahr	0.1705	0.0282	0.1370
6	Charkhab	0.4745	0.0827	0.0916
7	Yazdbaf	0.4716	0.0758	0.0849
8	Farhangian	0.4907	0.0804	0.0835
9	Foroodgah	0.7100	0.1179	0.0482
10	Eishabad	0.8703	0.1492	0.0222
11	Kheirabad	0.7598	0.1199	0.0379
12	Kooy-e- Afshar	0.3710	0.0582	0.0987
13	Sar-e- Dorah	0.3227	0.0511	0.1072
14	Aharestan &Jahanfar	0.4062	0.0636	0.0930
15	Khorramshah	0.2816	0.0442	0.1127
16	Kooy-e- Rahahan	0.5584	0.0904	0.0715
17	Razmandegan Town	0.4721	0.0747	0.0836
18	Siloo	0.3687	0.0578	0.0990
19	Safayyeh	0.0619	0.0100	0.1519
20	Kooy-e-Daneshgah	0.2471	0.0399	0.1217
21	Kaj	0.3927	0.0619	0.0958
22	Mehravaran	0.4515	0.0716	0.0870
23	Mehdiabad	0.3498	0.0552	0.1026
24	Maskan	0.2624	0.0413	0.1160
25	Lab- e-Khandagh	0.4738	0.0768	0.0853
26	Atashkadeh	0.2336	0.0388	0.1274
27	Naeemabad	0.3090	0.0503	0.1124
28	Akbarabad	0.2018	0.0317	0.1255
29	Mahmoodabad	0.6605	0.1072	0.0551
30	Amirabad	0.5126	0.0814	0.0774
31	Sajaddieh	0.6245	0.0986	0.0593
32	Nasrabad	0.3596	0.0566	0.1007
33	Seyed Saha	0.4083	0.0645	0.0935
34	Seyedoshohada	0.5639	0.0897	0.0694
35	Sheykhdad	0.4731	0.0776	0.0864
36	Fahadan	0.6941	0.1089	0.0480
37	Kooy-e-Navab	0.3423	0.0552	0.1061
38	Kooy-e-Taleghani	0.1739	0.0281	0.1333
39	Maryamabad	0.5021	0.0804	0.0798
40	Yaghoubi	0.6480	0.1047	0.0569
41	Khajeh Khezr	0.5709	0.0898	0.0675
42	Takht-e-Ostad	0.5843	0.0952	0.0677

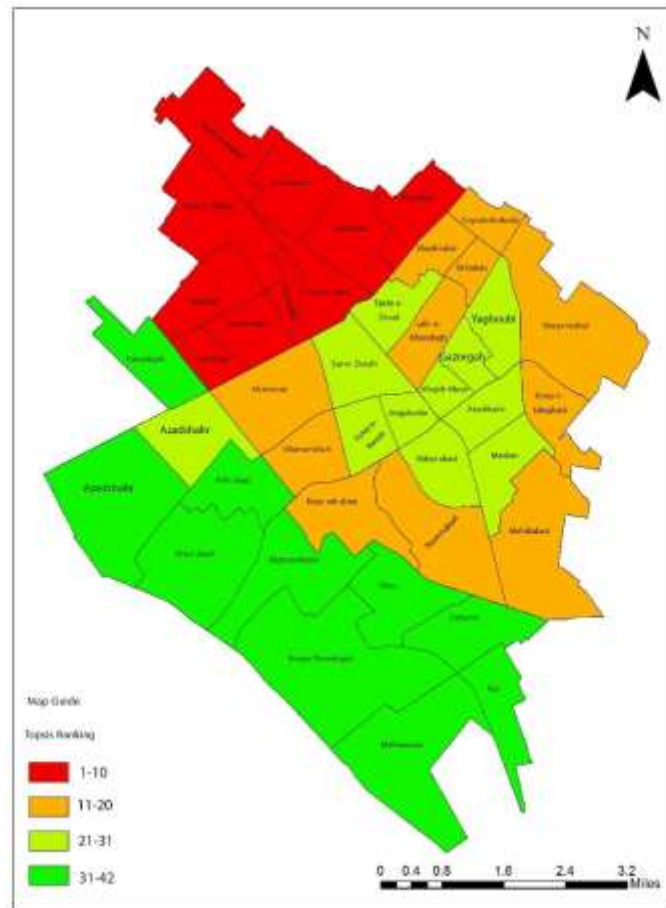
Source: Research findings

In the last neighborhood, the alternatives are ranked based on the obtained closeness coefficient or similarity index (ci). In this way, any alternative with a higher ci value will be ranked higher in terms of social unsustainability. Therefore, Yazd neighborhoods were ranked according to participation, quality of life, and security indicators (Table 7; Figure 8).

**Table 7.** Ranking of neighborhoods based on indicators individually and in general

Row	Neighborhood	Name	Participation	Quality of life	Security	Social sustainability rank
1	1-1-1	Nasrabad	14	21	7	15
2	1-1-2	Sajaddieh	35	34	36	36
3	1-1-3	Syed Sahra	30	15	18	20
4	1-1-4	Amirabad	23	28	30	30
5	1-1-5	Mahmoudabad	26	38	37	38
6	1-2-1	Farhangian	38	17	35	28
7	1-2-2	Emamshahr	4	2	13	2
8	1-2-3	Charkhab	2	32	32	26
9	1-2-4	Yazdbaf	32	20	34	23
10	1-2-5	Kooy -e-Afshar	17	22	8	29
11	2-1-1	Maryamabad	16	31	26	28
12	2-1-2	Yaghoubi	29	39	28	37
13	2-1-3	Gazorgah	39	25	41	34
14	2-1-4	Khajeh Khezzr	36	33	15	33
15	2-1-5	Lab- e-Khandagh	9	30	21	36
16	2-1-6	Takht- e- Ostad	20	37	25	35
17	2-1-7	Sheykhdad	6	29	27	25
18	2-1-8	Fahadan	40	36	39	39
19	2-1-9	Syedoshohada	34	26	38	32
20	2-2-1	Mehdiabad	13	14	17	14
21	2-2-2	Maskan	8	9	19	7
22	2-2-3	Atashkadeh	11	3	20	5
23	2-2-4	Kooy- e-Taleghani	1	6	3	3
24	2-3-1	Naeemabad	3	16	10	11
25	2-3-2	Akbarabad	7	7	2	4
26	2-3-3	Kooy- e-Rahahan	33	35	5	31
27	2-4-1	Mojahedin	28	4	19	9
28	2-4-2	Kooy- e-Navab	4	2	13	2
29	2-4-3	Khorranshah	15	11	4	8
30	2-4-4	Aharestan & Jahanfar	22	24	12	19
31	2-4-5	Sar- e-Dorah	21	10	16	12
32	3-1-1	Razmandegan Town	24	27	11	24
33	3-1-2	Azadshahr 2	37	13	24	21
34	3-1-3	Azadshahr	12	8	23	10
35	3-1-4	Eishabad	42	42	31	42
36	3-1-5	Kheirabad	41	40	40	41
37	3-1-6	Foroodgah	31	41	42	40
38	3-2-1	Kaj	19	19	22	18
39	3-2-2	Mehravaran	27	23	33	22
40	3-2-3	Kooy- e-Daneshgah	25	5	6	6
41	3-2-4	Siloo	18	18	4	16
42	3-2-5	Saffayyeh	5	1	1	1

Source: Research findings (authors)



**Figure 8.** Ranking the neighborhoods based on social sustainability

According to the research findings, Eishabad, Kheirabad, and Foroodgah are the most unsustainable neighborhoods in Yazd. The mentioned neighborhoods are not in a good situation regarding quality of life, participation, and security. Among the unsustainable neighborhoods, the Foroodgah neighborhood has the highest percentage of the immigrant population. The satisfaction level with access to financial centers (banks) and Automatic Teller Machines (ATMs), cultural, sports, recreation centers, shopping centers, green spaces and parks, and medical centers were studied to assess the quality of life. The results showed that 80% of the population dissatisfied with access to services, welfare, and entertainment lives in the Eishabad neighborhood. In the Kheirabad neighborhood, the average satisfaction with service, welfare, and entertainment facilities is 43%, with the highest level of satisfaction with access to medical and sports centers. In addition, in the Foroodgah neighborhood, more than 60% of the population is dissatisfied with access to services and welfare. In all three neighborhoods, the highest dissatisfaction is with access to green space, parks, and sports centers, in the order of their appearance.

**Table 8.** The most unsustainable neighborhoods in Yazd city

Neighborhood code	Neighborhood name	Sustainability rating	Participation index rating	Quality of life index rating	Security index rating	Percentage of immigrant population
3-1-4	Eishabad	42	42	42	31	3.8
3-1-5	Kheirabad	41	41	40	40	4.9
3-1-6	Foroodgah	40	31	41	42	10
2-1-8	Fahadan	39	40	36	39	2.4
1-1-5	Mahmoudabad	38	26	38	37	5.6
2-1-2	Yaghoubi	37	29	39	28	3
1-1-2	Sajaddieh	36	35	34	36	2.9
2-1-6	Takht- e- Ostad	35	20	37	25	24

Source: Research findings (authors)

Safayyeh, Emamshahr, and Kooy-e-Taleghani are the most sustainable neighborhoods. Safayyeh neighborhood is ranked first in security and quality of life. Also, in terms of distribution of services in District 2 of Region 3, among the most sustainable neighborhoods in social sustainability, the Kooy-e-Daneshgah neighborhood has the highest percentage of immigration and ranks 5th for the quality of life.

Eishabad, Keirabad, and Foroodgah neighborhoods in terms of physical divisions are located in District 1 of Zone 3, Safayyeh neighborhood in District 2 of Zone 3, Emamshahr in District 2 of Zone 1, and Kooy-e Taleghani in District 2 of Zone 2 of Yazd Municipality. Referring to the ranking results of Yazd city districts in the research of Esmailpoor and ShakibaManesh (2019), District 1 of Zone 3 has a critical and unfavorable situation and ranks 8th in the distribution of urban services in Yazd city. Also, in terms of priority for allocating service uses, it ranks 2nd among the Yazd districts.

**Table 9.** The most sustainable neighborhoods of Yazd city

Neighborhood code	Neighborhood name	Sustainability rating	Participation indicator rating	Quality of life indicator rating	Security Indicator rating	Percentage of immigrant population
3-2-5	Saffayyeh	1	5	1	1	5.7
1-2-2	Emamshahr	2	4	2	13	3.6
2-2-4	Kooy- e- aleghani	3	1	6	3	5.8
2-3-2	Akbarabad	4	7	7	2	3.4
2-2-3	Atashkadeh	5	11	3	20	2.7
3-2-3	Kooy- e- aneshgah	6	25	5	6	40
2-2-2	Maskan	7	8	9	19	3.9
2-4-3	Khorramshah	8	15	11	4	4.1

Source: Research findings (authors)

**Table 10.** Correlation coefficient of social sustainability and indicators of research

Social sustainability	Participation	Quality of life	Security	Migration
	0.710	0.948	0.721	0.217

Source: Research findings (authors)

## 6. Results and Discussions

Based on research findings, the quality of life variable with sub-criteria of access to facilities and services and social justice is the most important dimension in determining the level of social stability and instability in Yazd neighborhoods. Participation (i.e., a sense of place, social solidarity, and cohesion) ranks second, and security (i.e., social security and trust) with the minimum average amount ranks the last. The results of this survey are consistent with those of Hoseinpour, Zahiri, and Moosaii, (2010). However, Tavana and Noorian, (2016) concluded that social action and social capital are the most important factors for social sustainability in sprawl neighborhoods in Shad Abad. Melania Jelodar et al., (2020) believes that social security and action are the supreme factors in social sustainability in the central neighborhoods of Babylon city. This result is consistent with the present study results in terms of security. Among the studied indices, the quality of life index ( $R = 0.948$ ), security index ( $R = 0.721$ ), and participation index ( $R = 0.673$ ) have the most impact and a significant relationship with social sustainability, in the order of their appearance. On the other hand, the migration index ( $R = -0.217$ ) showed no significant relationship with the social sustainability of Yazd neighborhoods.

Among neighborhoods, Safayyeh, Emamshahr, and Kooy-e Taleghani are the most sustainable neighborhoods, and Eishabad, Kheirabad, and Foroodgah are the most unsustainable neighborhoods in terms of social sustainability dimension. The obtained results show that neighborhoods near the outskirts are less sustainable.

Based on the research findings, the following suggestions are offered to improve the social stability of Yazd:

- Identifying unsustainable neighborhoods in Yazd and measuring sustainability indicators in neighborhoods in the form of a neighborhood-based research project;
- Paying attention to the geographical, historical, social, and cultural context of Yazd city and presenting urban planning strategies and policies to strengthen the sense of place, social trust, social solidarity, vitality, and satisfaction of citizens;
- Fair distribution of facilities and services in different sectors of sport, recreation, health, medical, disciplinary, and security in urban neighborhoods;
- Planning, designing, and implementing neighborhood-based and community-based programs in urban management, including cultural and social programs, physical and environmental programs, and management programs by the city council; municipality to boost a sense of place and neighborhood; increasing social solidarity and cohesion and a sense of social security;
- Promoting urban services and infrastructure with a justice-oriented approach and attention to the issue of spatial justice to benefit the residents of all urban neighborhoods from the facilities and services available in Yazd city and providing recreational and cultural facilities, especially in unsustainable neighborhoods of Yazd;
- Creating a justice-oriented view of city managers in recognizing the shortcomings and issues of unsustainable neighborhoods in the city and providing executive programs to address the problems of unsustainable neighborhoods in Yazd; and
- Emphasizing the category of neighborhood-based urban management to attract the participation of residents of city neighborhoods.

## References

- Abdollahi, A., & Fattahi, M. (2017). Evaluation of smart urban growth indicators using ELEKTRE technique (Case study: regions of Kerman city). *Journal of Spatial Planning*, 21(2), 147-171.
- Barbara, W. (2017). The socio-economic determinants of urban sprawl between 1980 and 2010 in Switzerland. *Landscape and Urban Planning*, 157, 468-482.
- Bramley, Glen & Dempsey, Nicola & Power, Sinead & Brown, Caroline. (2006). What is sustainability and how do existing urban forms perform in nurturing it?. Planning Research Conference.
- Burton, E. (2000). The Compact City: Just or Just Compact? A Preliminary Analysis. *Urban Studies*, 37(11), 1969–2006.
- Colantonio, A. (2008). Measuring Social Sustainability: Best Practice from Urban Renewal in the EU.02/2008: EIBURS Working Paper Series.
- Colantonio, A., & Dixon, T. (2009). Measuring Socially Sustainable Urban Regeneration in Europe. Oxford Institute for Sustainable Development (OISD), School of the Built Environment, Oxford Brookes University.
- Detailed urban Plan of Yazd. 2017.
- Esmailpoor, N., & Shakibamanesh, M. (2019). Spatial Inequality Analysis in Utilization of Urban Services (Case study: Yazd city). *Spatial planning*, 9(3), 71-88.
- Ghadiri, M., Zayyari, K., & Dasta, F. (2014). Analyzing the Changes of the Spatial Form of Yazd City During 1996-2011. *Geography and Environmental planning*, (4), 17-36.
- Hosseini, D., Aliabadi, K., Hamidiyan, D. (2015). An Analysis on Evaluating the Quality of Social Sustainability in Districts No.2 and 3 of Sabzevar City. *Geography and Territorial Spatial Arrangement*, 5(14), 47-70.
- Hoseinpour, B., Zahiri, H., & Moosaii, M. (2010). Evaluating of social sustainability indicators in district 15 of Tehran. *Urban Social Geography*. 7(2), 217- 237.
- Kelly-Schwartz, A. C., Stockard, J., Doyle, S., & Schlossberg, M. (2004). Is Sprawl Unhealthy?: A Multilevel Analysis of the Relationship of Metropolitan Sprawl to the Health of Individuals. *Journal of Planning Education and Research*, 24(2), 184–196.
- Keiner, M. (2003). Re-Emphasizing Sustainable Development-The Concept of Evolutionability. *Environmental, Development and Sustainability*, (6), 379-393.
- Melania Jelodar, Sh., Daneshvarinasab, A. H., Malmir, M., & Rasouli, S. H. (2020). Assessing social sustainability in the central neighborhoods of Babylon city with an integrated urban management approach. *Public Administration Mission*, 11(38), 83-97.
- Mohammadi, H., Ta'ali Moghaddam, A., & Bastam, M. (2011). Estimation of social capital in different regions of Mashhad and providing solutions to promote it in line with municipal duties. *Urban management, Special issue of Spring and Summer*, 237-258.
- Mousavi, M. N., Zare, A. R., Manoochehri, A., & Ahar, H. (2018). Analysis of the sprawl of the city on urban livability of neighborhoods Case: Maragheh. *Research and Urban planning*, (13), 1-81.
- Murphy, K. (2012). The Social Pillar of Sustainable Development: A Literature Review and Framework for Policy Analysis. *Sustainability: Science, Practice and Policy*, 8(1), 15-29.
- Nastaran, M., Ghasemi, V., Hadizadeh, S. (2013). Assessment of Indices of Social Sustainability by Using Analytic Network Process (ANP). *Journal of Applied Sociology*, 24(3), 155-173.
- Nazarian, A. (2006). *Urban Geography of Iran*. Payame Noor University. Seventh Edition.
- Rezvani, M. R. (2004). *An introduction to rural development planning in Iran*. Tehran: Ghoomes.
- Rahnama, M., Razavi, M. (2012). An Study of Sense of place Effect on Social Capital and Participation in Mashhad's Neighborhoods. *Honar-Ha-Ye-Ziba: Memory & Shahrsazi*, 17(2), 29-36.



- Saraii, M. H., & Iraji, S. (2014). Investigation of the amount of the spatial adaptation of socio-economic inequalities in the eight areas of Yazd. *Journal of Urban Economics and Management*, 13, 35-50.
- Sarvar, R., & Amini, M. (2013). *Guide to Social Analysis of the City*. Tisa. First Edition.
- Soleimani, A. R., Gheisari, H., & Ahar, H. (2015). Analyzing the Effects of Horizontal Extension of the City on Social Capitals, Case Study: Maraghe City. *Geography and Territorial Spatial Arrangement*, 4(13), 53-68.
- Statistical Center of Iran. (2016). General Census of Population and Housing.
- Samuelsson, B.E., Azar, C., Holmberg, J., Johansson, D.J., Morrison, G.M., Nässén, J., Åhman, M., Ahlbäck, A., Sterner, T., Hydén, H., Ness, B., Olsson, L., Urbel, E., Begg, I., Strömberg, D., Lindqvist, O., & Larsson, A. (2004). From Here to Sustainability – Is the Lisbon/Göteborg agenda delivering?
- Tavana, M., & Noorian, F. (2017). Assessment of Social Sustainability in Sprawl Urban Neighborhoods (Case Study: Shadabad, Tehran). *Human Geography Research Quarterly*. 4(49), 885-900.
- Weingaertner, C., & Moberg, A. (2011). Exploring Social Sustainability: Learning from Perspectives on Urban Development and Companies and Products.
- Wei, Y. D., & Ewing, R. (2018). Urban expansion, sprawl and inequality. *Landscape and Urban Planning*. <https://doi.org/10.1016/j.landurbplan.2018.05.021>