# ANALYSIS OF GREEN SPACES IN THE REGIONS OF SHIRAZ METROPOLIS, IRAN

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**Abstract**
Urban parks and green spaces are considered among the most fundamental factors of sustainability in the accelerating growth of urbanism; and if they are managed and planned productively, they would have useful effects on improving the citizens' physical and emotional health and on improving views of cities; they would also play a vital role on improving life quality and health of citizens. This survey has been conducted using Merec and Codas techniques with the objective of studying and analyzing parks and green spaces in the Regions of city of Shiraz. The scope of research includes the Regions of Shiraz in 2019 and the required data was taken from the Statistical Yearbook of Shiraz in 2019. Its data has been weighted using Merec technique and has been used in Codas. The survey results achieved by the use of Codas technique show that Region10 of the metropolis of Shiraz by achieving 3.498 has the highest number of parks and green spaces. After region10 in this city, region4 can be mentioned with the score 2.013. Region 3 with 1.776, region6 with 0.938, and region9 with the score 0.404 have achieved approximately high scores. Other regions of the city of Shiraz achieved low scores, and region8 of this metropolis with -3.167 had the lowest score. Region 8 which is considered to be the historical and cultural context of the city of Shiraz includes the lowest per capita of green spaces in the urban projects, and this can be observed in Codas technique.
**Keywords**: urban parks, Merec technique, Codas technique, Shiraz metropolis.

## 1. INTRODUCTION

Urban parks and green spaces are public capital (Macedo & Haddad, 2015: 1096-1117). Urban green spaces are considered as highly essential capital which can help cities decrease undesirable effects of rapid urbanism and urban development in a sustainable way (Abu Kasim et al, 2019), and they have important effects on urban ecosystems (Cao et al, 2021: 1). They also elevate the level of social justice and improve life quality (Macedo & Haddad, 2015: 1096-1117). Urban life quality is closely related to access to green spaces and recreational opportunities in the cities (Wang et al, 2015). Since urban green spaces affect urban life quality, their spatial distribution has to be considered more in urban planning and urban research (Kumari Singh, 2018).

At the moment, the ideology of green city has attracted global attention to itself and its objectives are dealing with problems of rapid urbanism, population growth, and climate change (Abu Kasim et al, 2019). Because of the importance of green spaces, access to urban green spaces for welfare of the citizens has turned into an important aspect of planning and research (Kabisch et al, 2016). Green spaces are one of



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the essential elements of urban environment (De Luca et al, 2021) that has been introduced to solve problems of urbanism and to reinforce urban green infrastructures (Nikolic & Yang, 2020). Urban green space, especially a space that is accessible for the public, has a considerable role in improvement of life quality of citizens and improvement of the environment (Gutierrez et al, 2021). Urban green spaces have lots of functions and advantages which are required for sustainable urban development (Jansson, 2014: 139); they have lots of environmental and social advantages (Le Texier, 2018) and play a considerable role in decreasing negative outcomes and effects of rapid growth of urbanism (Harasimowicz, 2018).

Urban parks as an inseparable part of urban green spaces (Loures et al, 2007) are one of the important elements of public and useful infrastructures for urban ecology (Chiesura, 2004) and play a vital role in elevating urban life and public health of citizens (Hu et al, 2020: 1). Spatial distribution of urban parks is highly essential on effective access of residents to recreational services (Liu et al, 2017: 130). Urban parks have lots of benefits for welfare and health of people (Guo et al, 2022: 1), provide various ecological, social, and economic advantages for citizens (Gao et al, 2017: 1), and access to urban parks and green spaces improve the welfare of society (Wang et al, 2015). Since doing service to people is the main goal of providing urban parks, productive use of parks has turned to the main concern of both policymakers and urban planners (Guo et al, 2019: 103-117).

The carried out scientific studies in the recent years have divided advantages of urban green spaces into four categories of advantages related to economy, health, life quality and environment (Benedict & McMahon, 2002). Urban green spaces can have long-term positive effects on economy (Crompton, 2005). Urban green spaces provide advantages for human health (Jansson, 2014) and lack of these spaces might be harmful for human health (Coutts et al, 2010). Urban green spaces can increase attraction of urban regions and neighborhoods for residents and provide the chance to increase life quality (Jansson, 2014). Results of different studies about different aspects show the importance and value of urban green spaces for welfare of citizens (Jabbar et al, 2021). Ecologic benefits of urban green spaces include formulating services, decreasing pollution, adjusting weather, and decreasing global warming (Jansson, 2014).

Byrne et al (2009) showed that in the United States, urban parks have been distributed unfairly. Wolch et al (2014) tried to compare urban green spaces and especially parks in the green cities of the US and China. Results of this survey show that distribution of such spaces is often unequally and inappropriately for the benefit of primarily white and wealthier communities. Izadi & Keramati (2015) concluded that in Shiraz, access to urban parks was mainly appropriate and a small percent of citizens face any problems accessing these spaces. Gao et al (2017) stated that there was not enough spatial design for the urban parks of the city of Shenzhen. Service distribution of the existing urban parks in the region was not appropriate. In some regions, the existing urban parks had large numbers of users. Kumari Singh (2018) showed that in the city of Bathinda in India, distribution of green spaces per capita in this city was unfair and unbalanced. Li et al (2021) pointed out that spatial justice of parks was one of the main concerns in the environmental studies. Findings of this survey help the urban planners and policymakers to set more reasonable policies and plans for improvement of spatial equality and justice in the case of parks in urban areas. Wu & Ding (2022) mentioned that in the city of Shenyang, quality of designing parks and green spaces had to improve. The results of this survey offer some suggestions for green space planning in the future in the city of Shenyang.

This survey has been conducted with the objective of studying the situation of regions of Shiraz metropolis in access to parks and urban green spaces. Parks and urban green spaces should be considered among of the most essential factors of sustainability in the accelerating and irregular growth of urbanism; and if they are managed and planned productively and correctly, they would have useful and appropriate effects on the health, emotions and spirit of citizens and also on improving the view and perspective of the cities. Despite the fact that in the recent years, some projects have been launched in the city of Shiraz by urban managers for improvement and development of urban green spaces, some problems such as turning the city into one of the polluted metropolises of Iran, formation of unofficial residential areas in different regions of this city, etc. have made the need for balanced development of urban green spaces in this metropolis an inevitable issue.

## 2. MATERIALS AND METHODS

In this survey, by the use of Merec and Codas techniques, it has been tried to study the situation of indexes related to parks and urban green spaces in the 11 regions of the metropolis of Shiraz. The scope of research is the regions of Shiraz metropolis in 2019. The studied indexes were number of neighborhood parks, area of neighborhood parks, number of community parks, area of community parks, number of regional parks, area of regional parks, number of region parks, green space per capita, area of region in hectares, and the share of green space from the region area. The required data and information was taken from the Statistical Yearbook of the city of Shiraz in 2019, and this data was weighted using Merec technique and was applied to Codas technique.

### *2.1. Merec technique*

Merec technique was presented in 2021 by Keshavarz Ghorabaee et al. The steps of Merec technique are:



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*2.1.1. Building a decision matrix: a decision matrix is built in this step and shows the score of each option about every criterion. Elements of this matrix are shown by xij and these elements (xij>0) should not be greater than zero. Suppose that there are option n and criterion m, the form of decision-making matrix is like this:*

$$X = \begin{bmatrix} x_{11} & x_{12} & \cdots & x_{1j} & \cdots & x_{1m} \\ x_{21} & x_{22} & \cdots & x_{2j} & \cdots & x_{2m} \\ \vdots & \vdots & \ddots & \vdots & \ddots & \vdots \\ x_{i1} & x_{i2} & \cdots & x_{ij} & \cdots & x_{im} \\ \vdots & \vdots & \ddots & \vdots & \ddots & \vdots \\ x_{n1} & x_{n2} & \cdots & x_{nj} & \cdots & x_{nm} \end{bmatrix}$$

*2.1.2. Normalization: normalization is used almost in all decision-making methods. In this technique, linear normalization has been used to make elements of decision matrix dimensionless. Elements of normalized matrix are shown by nij. If B shows the collection of useful criteria and H shows a collection of non-useful criteria, the below relation can be used for normalization:*

$$n_{ij}^{x} = \begin{cases} \dfrac{\min_{k} x_{kj}}{x_{ij}} & if \quad j \in \mathcal{B} \\ \dfrac{x_{ij}}{\max_{k} x_{kj}} & if \quad j \in \mathcal{H} \end{cases}$$

*2.1.3. Calculating general performance of options (Si): in this stage, an algorithm measurement is done with equal weight of criteria in order to achieve general performance of options. This measurement is based on a non-linear function and it has been shown in the below figure.*

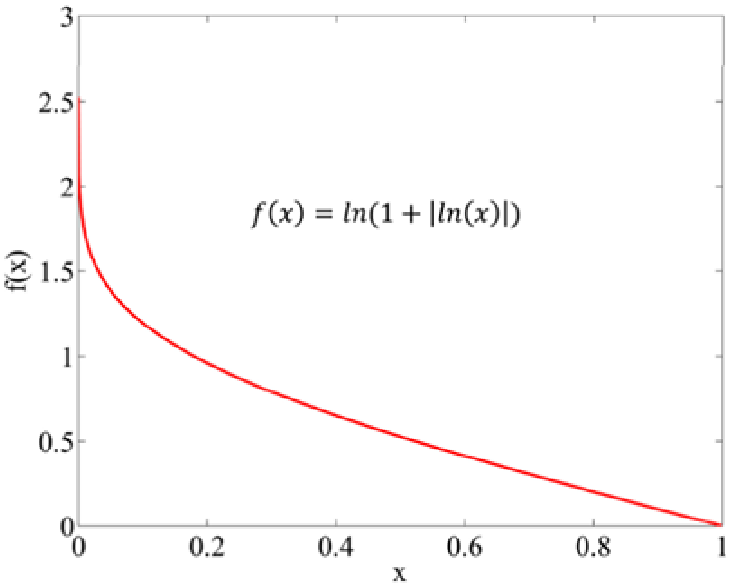


FIGURE 1- THE WEIGHTS OF THE COMPARATIVE

Considering the normal values achieved from the previous step, it can be certainly stated that smaller values of nij lead to greater values of performance (Si). The below relation is used to calculate it:

$$S_i = \ln(1 + (\frac{1}{m}\sum_j |\ln(n_{ij}^x)|))$$

***2.1.4. Calculating performance of options by eliminating effects of criteria (S′): in this step, performance of options is calculated by eliminating each one of the criteria. In order to calculate this step, the below equation is used:***

$$S'_{ij} = \ln(1 + (\frac{1}{m}\sum_{k,k\neq j} |\ln(n_{ik}^x)|))$$

***2.1.5. Calculating the collection of absolute deviations (E): in this step, the effect of eliminating criterion j is calculated on the basis of the values achieved from step 3 and step 4. Ej shows the effect of eliminating criterion j. By the use of the below formula, Ej values can be calculated:***

$$\mathrm{E_j} = \sum_i |S'_{ij} - S_i|$$

***2.1.6. Calculating final weights (w): the final weights of criteria are determined in this step. The weight of every criterion is calculated using the effects of elimination (Ej). The following relation is used for calculating w:***

$$w_j = \frac{E_j}{\Sigma_k E_k}$$

***2.2. Codas technique***

CODAS technique is one of the multi-index decision-making methods. Its objective is ranking options on the basis of a number of criteria. The steps of Codas technique are as follows:

The first step in this method is formation of decision matrix. The general form of decision matrix is as shown below:

$$X = [xij]_{n\times m} = \begin{bmatrix} x_{11} & x_{12} & x_{1m} \\ x_{21} & x_{22} & x_{2m} \\ x_{n1} & x_{n2} & x_{nm} \end{bmatrix}$$

The second step is normalizing decision matrix. Standardization is done using the below relations; if the criterion has positive aspect, the first relation is used, and if the criterion has negative aspect, the second relation is used:



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$$n_{ij} = \{\frac{x_{ij}}{max_i x_{ij}} \quad if \ j \in N_b$$

$$n_{ij} = \{\frac{min_i x_{ij}}{x_{ij}} \quad if \ j \in N_c$$

The third step of Codas method is formation of weighted normal matrix. It means that the weight of criteria should be multiplied by the normal matrix.

$$r_{ij} = w_j n_{ij}$$

In this step, the Euclidean distance and Taxicab distance from the ideal negative should be calculated. These distances are achieved through the following relations. In these relations, nsj is the negative ideal of the criteria.

$$E_i = \sqrt{\sum_{j=1}^{m} \left(r_{ij} - ns_j\right)^2}$$

$$T_i = \sum_{j=1}^{m} \left|r_{ij} - ns_j\right|$$

In this step, the relative evaluation matrix should be formed using the following relation. In this relation, Ψ shows a threshold function to recognize equality of Euclidean distances of the two options.

$$h_{ik} = (E_i - E_k) + \left(\varphi(E_i - E_k) \times (T_i - T_k)\right)$$

In this step, by adding the values of $h_{ik}$ options, they can be ranked. The higher the value of Hi, the better the rank of option (Keshavarz Ghorabaee et al, 2016: 25-44).

The city of Shiraz is the most important urban point of this area and the center of Fars Province. It is located 919 km away from Tehran. This plain city is located in the geographical point of 52° and 30´ eastern longitude and 29° and 30´ northern latitude (Rahimi et al, 2018). Figure 2 shows geographical point of Shiraz metropolis.

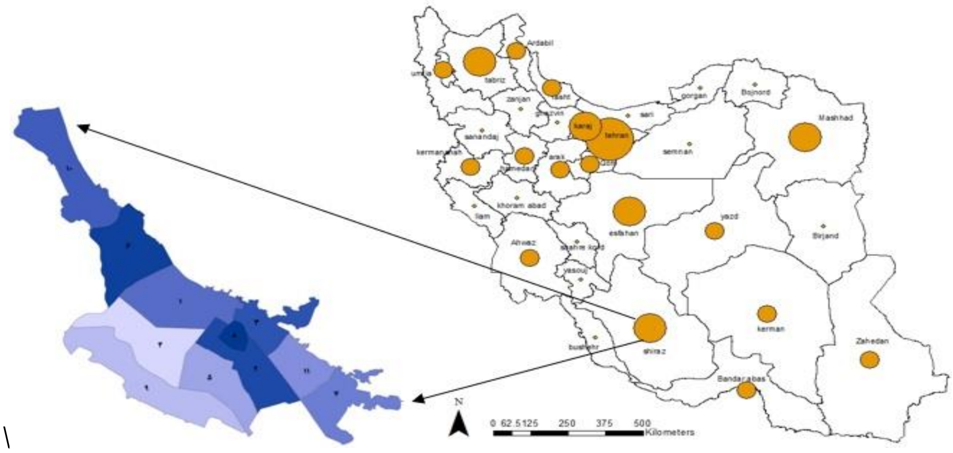

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FIGURE 2- GEOGRAPHICAL POINT OF THE SHIRAZ METROPOLIS
Source: researcher (2022)

According to the population and housing census of 2016, the population of Shiraz was 1565572 people and it is considered the 5th largest city of Iran. At the moment, this city has 11 urban regions (Statistical yearbook of Shiraz city, 2019).

## 3. RESULTS

After forming the decision matrix of indexes for parks and urban green spaces of Shiraz, standardization of the survey data has been conducted. In the third step, the general performance of options has been calculated. In this step, a logarithmic measurement with equal criteria weights is conducted and this measurement is done on the basis of a non-linear function. The fourth step is calculating performance of options by eliminating the effects of criteria. In this step, performance of options is calculated by eliminating each one of the criteria. Calculating the general performance of options (Si) has been done and the value of S has been achieved for region1 (0.7), region2 (0.77), region3 (0.95), region4 (0.9), region5 (0.81), region6 (0.81), region7 (0.67), region8 (0.09), region9 (0.83), region10 (0.96), and region11 (0.69). Calculating performance of options by eliminating the effects of criteria (S´) has been done for the studied indexes. In the fifth step, the sum of absolute deviations has been calculated and these values have been shown in table 1.

TABLE1- CALCULATION OF ABSOLUTE DEVIATIONS AND THE FINAL WEIGHTS OF INDEXES OF PARKS AND GREEN SPACES IN THE SHIRAZ METROPOLIS IN 2019

| **index** | **Number of neighborhood parks** | **Area of neighborhood parks** | **Number of community parks** | **Area of community parks** | **Number of regional parks** |
|---|---|---|---|---|---|
| Ej | 0.3 | 0.26 | 0.91 | 0.78 | 0.54 |
| Wj | 0.0512 | 0.0441 | 0.1559 | 0.1330 | 0.0932 |
| index | Area of regional parks | Number of region parks | Green space per capita | Region area in hectares | Share of green space from region area |
| Ej | 0.49 | 0.23 | 0.84 | 0.79 | 0.71 |
| Wj | 0.0832 | 0.0385 | 0.1435 | 0.1356 | 0.1217 |

Source: researcher (2022)

Collection of absolute deviations of indexes related to urban parks and green spaces in the metropolis of Shiraz in 2019 has been calculated. Deviation value of number of neighborhood parks was achieved (0.30), area of neighborhood parks (0.26), number of community parks (0.91), area of community parks (0.78), number of regional parks (0.54), area of regional parks (0.49), number of region parks (0.23), green space per capita (0.84), area of region in hectares (0.79), and the share of green space from the region area (0.71) (Table 1).

Using Merck technique, the final weights of indexes related to urban parks and green spaces in the Shiraz metropolis in 2019 have been calculated. The value of the weight of neighborhood parks was achieved



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(0.0512), area of neighborhood parks (0.0441), number of community parks (0.1559), area of community parks (0.1330), number of regional parks (0.0932), area of regional parks (0.0832), number of region parks (0.0385), green space per capita (0.1435), region area in hectares (0.1356), and the share of green space from the region area (0.1217) (Table 1). The achieved weights from Merck technique have been multiplied by normal matrix and the weight normal matrix has been achieved (Table 2).

TABLE 2- WEIGHT NORMAL MATRIX OF INDEXES RELATED TO URBAN PARKS AND GREEN SPACES IN SHIRAZ METROPOLIS IN 2019

| Region | Number of neighborhood parks | Area of neighborhood parks | Number of community parks | Area of community parks | Number of regional parks | Area of regional parks |
|---|---|---|---|---|---|---|
| Region1 | 0.0216 | 0.0166 | 0.1114 | 0.0714 | 0.0133 | 0.0137 |
| Region2 | 0.0270 | 0.0212 | 0.1114 | 0.0982 | 0.0665 | 0.0582 |
| Region3 | 0.0351 | 0.0309 | 0.0668 | 0.0464 | 0.0932 | 0.0832 |
| Region4 | 0.0297 | 0.0217 | 0.1559 | 0.1330 | 0.0665 | 0.0548 |
| Region5 | 0.0431 | 0.0384 | 0.0891 | 0.0711 | 0.0799 | 0.0575 |
| Region6 | 0.0324 | 0.0211 | 0.0446 | 0.0441 | 0.0399 | 0.0263 |
| Region7 | 0.0512 | 0.0420 | 0.0557 | 0.0429 | 0.0133 | 0.0131 |
| Region8 | 0.0431 | 0.0208 | 0.0111 | 0.0111 | 0.0133 | 0.0131 |
| Region9 | 0.0351 | 0.0295 | 0.0780 | 0.0499 | 0.0399 | 0.0299 |
| Region10 | 0.0512 | 0.0441 | 0.1337 | 0.1249 | 0.0532 | 0.0496 |
| Region11 | 0.0485 | 0.0288 | 0.0334 | 0.0187 | 0.0665 | 0.0743 |
| **Region** | **Number of region parks** | **Green space per capita** | **Region area in hectares** | **Share of green space from region area** | **Euclidean distance Ei** | **Manhattan distance Ti** |
| Region1 | 0.0385 | 0.0303 | 0.1087 | 0.0215 | 0.155 | 0.321 |
| Region2 | 0.0193 | 0.0127 | 0.0757 | 0.0143 | 0.162 | 0.378 |
| Region3 | 0.0193 | 0.1125 | 0.0616 | 0.1217 | 0.206 | 0.545 |
| Region4 | 0.0385 | 0.0226 | 0.1001 | 0.0286 | 0.222 | 0.526 |
| Region5 | 0.0096 | 0.0207 | 0.0715 | 0.0215 | 0.143 | 0.376 |
| Region6 | 0.0096 | 0.1435 | 0.1032 | 0.0787 | 0.186 | 0.418 |
| Region7 | 0.0193 | 0.0276 | 0.0730 | 0.0239 | 0.093 | 0.236 |
| Region8 | 0.0096 | 0.0067 | 0.0157 | 0.0072 | 0.022 | 0.026 |
| Region9 | 0.0096 | 0.0886 | 0.1252 | 0.0477 | 0.166 | 0.407 |
| Region10 | 0.0096 | 0.0947 | 0.1356 | 0.0453 | 0.237 | 0.616 |
| Region11 | 0.0096 | 0.0223 | 0.0516 | 0.0239 | 0.099 | 0.252 |

Source: researcher (2022)

Weight normal matrix of indexes related to urban parks and green spaces in Shiraz metropolis in 2019 has been calculated. For instance, weight normal matrix of number of neighborhood parks for region1 was achieved (0.0216), region2 (0.0270), region3 (0.0351), region4 (0.0297), region5 (0.0431), region6 (0.0324), region7 (0.0512), region8 (0.0431), region9 (0.0351), region10 (0.0512), and region11 (0.0485). The highest weight standard score in this index belonged to regions7 and 10, and the lowest score belonged to region1 of Shiraz metropolis. Weight standard matrix for other studied indexes has been calculated (Table 2).

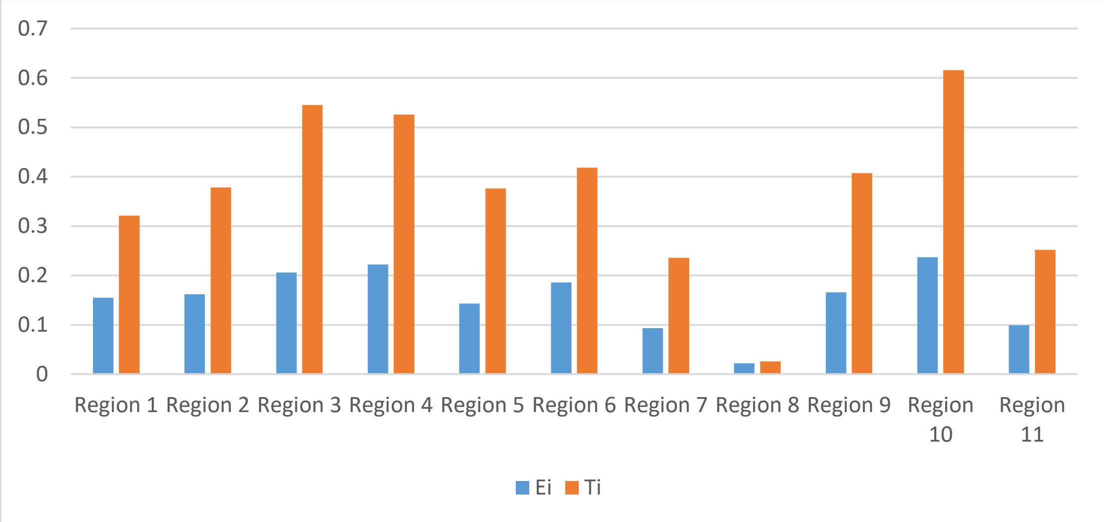


CHART 1- VALUES (EI) AND (TI) OF INDEXES RELATED TO URBAN PARKS AND GREEN SPACES IN SHIRAZ METROPOLIS IN 2019

Euclidean distance values (Ei) and Manhattan distance values (Ti) of indexes related to green city in Shiraz metropolis in 2019 have been calculated. The highest value of Euclidean distance (Ei) belonged to region10 (0.237), and the lowest value of Euclidean distance belonged to region8 (0.022) (table 2 and chart 1).

TABLE 3- RELATIVE EVALUATION MATRIX OF PARK INDEXES AND URBAN GREEN SPACES IN SHIRAZ METROPOLIS IN 2019

| Region | Region 1 | Region 2 | Region 3 | Region 4 | Region 5 | Region 6 | Region 7 | Region 8 | Region 9 | Region 10 | Region 11 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Region1 | 0 | -0.008 | -0.275 | -0.272 | 0.011 | -0.128 | 0.147 | 0.428 | -0.012 | -0.377 | 0.125 |
| Region2 | 0.008 | 0 | -0.210 | -0.207 | 0.019 | -0.442 | 0.212 | 0.493 | -0.004 | -0.312 | 0.190 |
| Region3 | 0.275 | 0.210 | 0 | -0.016 | 0.231 | 0.020 | 0.422 | 0.158 | 0.177 | -0.102 | 0.400 |
| Region4 | 0.272 | 0.207 | 0.016 | 0 | 0.228 | 0.144 | 0.419 | 0.174 | 0.174 | -0.015 | 0.397 |
| Region5 | -0.011 | 0.019 | -0.231 | -0.228 | 0 | -0.084 | 0.191 | 0.096 | -0.054 | -0.333 | 0.169 |
| Region6 | 0.128 | 0.442 | -0.02 | -0.144 | 0.084 | 0 | 0.275 | 0.139 | 0.030 | -0.249 | 0.253 |
| Region7 | -0.147 | -0.212 | -0.422 | -0.419 | -0.191 | -0.275 | 0 | 0.045 | -0.245 | -0.524 | -0.006 |
| Region8 | -0.428 | -0.493 | -0.158 | -0.174 | -0.096 | -0.139 | -0.045 | 0 | -0.526 | -0.805 | -0.303 |
| Region9 | 0.012 | 0.004 | -0.177 | -0.174 | 0.054 | -0.03 | 0.245 | 0.526 | 0 | -0.279 | 0.223 |
| Region10 | 0.377 | 0.312 | 0.102 | 0.015 | 0.333 | 0.249 | 0.524 | 0.805 | 0.279 | 0 | 0.502 |
| Region11 | -0.125 | -0.19 | -0.4 | -0.397 | -0.169 | -0.253 | 0.006 | 0.303 | -0.223 | -0.502 | 0 |

Source: researcher (2022)

Manhattan distance values (Ti) of indexes related to urban parks and green spaces in Shiraz metropolis in 2019 have been calculated. This value has been achieved for region1 as (0.321), region2 (0.378), region3 (0.545), region4 (0.526), region5 (0.376), region6 (0.418), region7 (0.236), region8 (0.026), region9 (0.407), region10 (0.616), and region11 (0.252). The highest value of Manhattan distance belonged to region10 and the lowest value of this distance belonged to region8. Relative evaluation matrix



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of park indexes and urban green spaces in Shiraz metropolis in 2019 has been shown in the table below (Table 3).

In Codas technique, relative evaluation matrix has been calculated by the use of the relation $h_{ik} = (E_i - E_k) + (\varphi(E_i - E_k) \times (T_i - T_k))$. In this relation, Ψ shows a threshold function for identifying equality of Euclidean distance between two options. This matrix has been shown in table 3 and chart 2, and in this step, (Ti) and (Ei) values of indexes of urban parks and green spaces in Shiraz metropolis for each one of the urban regions have been compared two by two (Table 3).

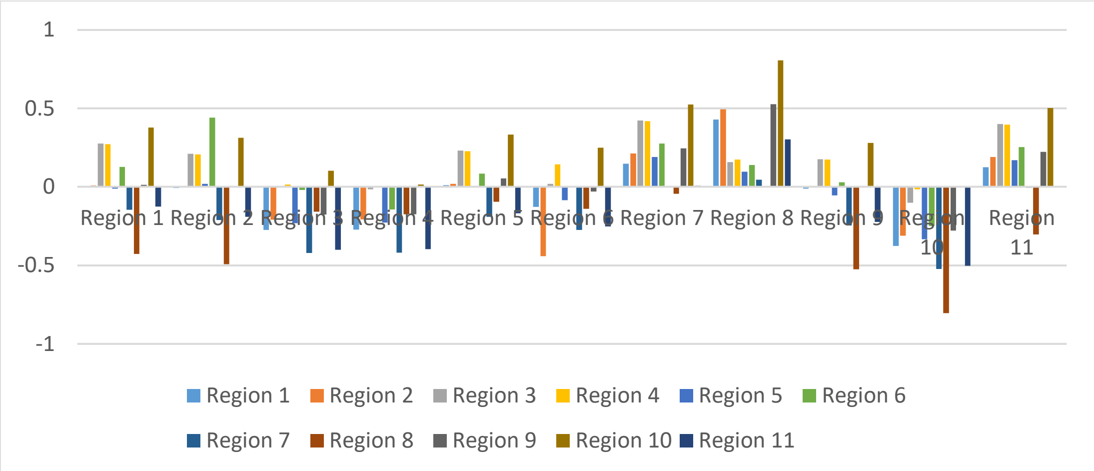


CHART 2- RELATIVE EVALUATION MATRIX OF INDEXES OF URBAN PARKS AND GREEN SPACES IN SHIRAZ METROPOLIS IN 2019

TABLE 4- CALCULATING THE FINAL SCORE OF INDEXES OF URBAN PARKS AND GREEN SPACES IN THE REGIONS OF SHIRAZ METROPOLIS

| Region | Score($h_{ik}$) | Rank |
|---|---|---|
| Region 1 | -0.360 | 7 |
| Region 2 | -0.254 | 6 |
| Region 3 | 1.776 | 3 |
| Region 4 | 2.013 | 2 |
| Region 5 | -0.636 | 8 |
| Region 6 | 0.938 | 4 |
| Region 7 | -2.396 | 10 |
| Region 8 | -3.167 | 11 |
| Region 9 | 0.404 | 5 |
| Region10 | 3.498 | 1 |
| Region11 | -1.950 | 9 |

In Codas model, by adding $h_{ik}$ values of options, they can be ranked. The higher the value of $h_{ik}$, the better rank the option gets. In table 4, the final scores of the 11 regions of Shiraz metropolis have been calculated in terms of indexes of urban parks and green spaces in 2019.

The final score value of $h_{ik}$ of Codas technique for region1 was achieved (-0.360), region 2 (-0.254), region 3 (1.776), region 4 (2.013), region 5 (-0.636), region 6 (0.938), region 7 (-2.392), region 8 (-3.167), region 9 (0.404), region10 (3.498), and region11 (-1.950).

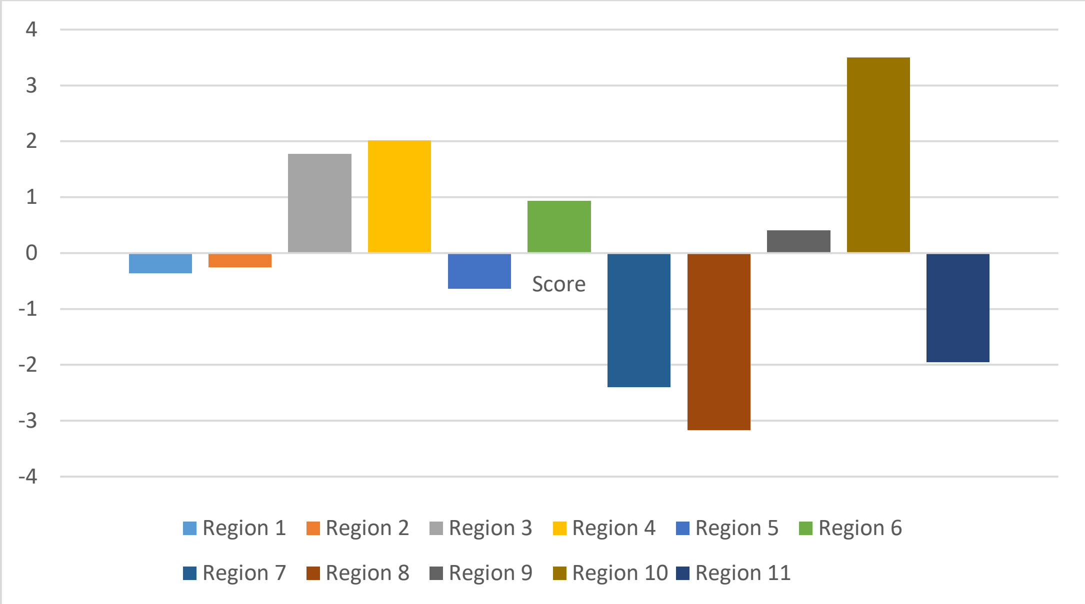


CHART 3- FINAL SCORE OF INDEXES RELATED TO GREEN CITY IN THE SHIRAZ METROPOLIS REGIONS
Source: researcher (2022)

The research findings of Codas technique show that region10 of Shiraz metropolis with score (3.498) includes the highest number of parks and green spaces. After region10 of Shiraz, good situation of region4 can be mentioned with score (2.013). Score (1.776) of region3 of this city is also considerable. Region6 with score (0.938) and region9 with (0.404) have achieved relatively high scores. As it is observed, per capita of green spaces in regions10, 4, 3, and 6 is higher than other districts. This is because of the existence of Ghasruddasht gardens. Other regions of Shiraz achieved low scores, and region8 with (-3.167) achieved the lowest score. Region8 of Shiraz which is considered the historic-cultural region of this city has the lowest level of green spaces. The results of this survey show that there is lack of green spaces per capita and urban parks in Shiraz metropolis and on the other hand, distribution of green spaces in the 11 regions of this city has net been balanced and equal. Decision-making technique of Codas shows these results.

The final score of indexes related to green city in the Shiraz metropolis regions has been entered in ArcGIS software and a field has been created under this title and finally the Moran statistic has been used and the Moran index is 0.050188, the Z score is 0.999274 and the Pvaluo is calculated to be 0.317662. According to the Moran index, the spatial distribution of green Spaces indicators in the Shiraz metropolis regions is random (Figure 3).



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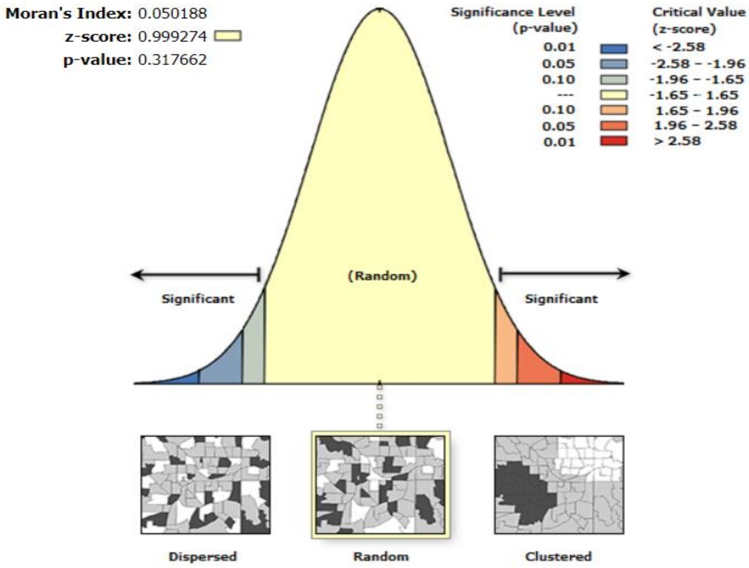


FIGURE 3- MORAN INDEX OF SPATIAL DISTRIBUTION OF GREEN SPACES INDICATORS IN SHIRAZ METROPOLIS REGIONS
Source: researcher (2022)

## 4. DISCUSSIONS

Rapid growth of urbanism in Iran has created lots of physical and spatial issues. One of them is inappropriate distribution of service spaces in the cities especially in the metropolises of Iran. Shiraz metropolis as one of the metropolises of this country is no exception to this. Intensive concentration of service applications and service spaces in some specific regions of this metropolis has deprived other regions from urban facilities.

Results of this survey show that region10 of Shiraz with the score (3.498) includes the highest number of parks and green spaces. After region10, the appropriate situation of region4 can be mentioned. This region has achieved score (2.013). Other regions of Shiraz achieved low scores and region8 of this city with (-3.167) achieved the lowest score. Region8 which is considered historic-cultural region of this city has the lowest level of green spaces. Historic region of Shiraz which is considered a historical heritage has not received much attention from the authorities and has faced migration of residents due to oldness of infrastructural facilities. This means that the original residents have left their residential areas and now this region has become residential area of low-income migrants. In the recent years, urban managers have not done anything for development of green spaces in this district. While nowadays, building urban green spaces and bringing liveliness to the environment in historic textures is a mechanism to revive and recreate these textures.

Results and findings of this survey are compatible with the findings of Byrne et al (2009), Wolch et al (2014), Gao et al (2017), Kumari Singh (2018), and Lee et al (2021). The results and findings of this survey are not compatible with the results of Izadi & Karamati (2015).

The results of this survey are compatible with the results of Wolch et al (2014). The results of Wolch et al (2014) show that spatial distribution of parks are often unequal. Therefore, access to green space is increasingly known as a matter of environmental justice. Lots of cities in the US have presented strategies to increase urban green spaces especially in areas without parks. These strategies include adding greenery to the remaining urban lands and reuse of transportation infrastructures that are obsolete or have little use. Similar strategies have been applied in China where there is more control over land allocation. While building new green spaces can make neighborhoods healthier and aesthetically more attractive; it can also increase housing and land prices. Wolch et al (2014) believe that urban planners, designers and ecologists should focus on strategies of urban green space.

The results of this survey are not compatible with the results of Izadi & Karamati (2015). The results of Izadi & Keramati (2015) show that access to urban parks in the city of Shiraz was approximately appropriate and a low percent of citizens have problem to access them. While this survey shows unbalanced distribution of urban parks in this metropolis. Finally, the results of Izadi & Karamati (2015) show that almost 64% of respondents walked the distance between their homes and parks, over 70% of them were satisfied with the quality and quantity of sidewalks on the way of parks, and approximately 67.9% of individuals had satisfaction level of average and above with the number of parks in their city.

Results of this survey are compatible with the results of Gao et al (2017). Gao et al who studied 10 regions in the city of Shenzhen in China, which had turned to a metropolis from several villages within 30 years, concluded that there isn't enough spatial design of urban parks in Shenzhen. This was because 65% of people living in buildings couldn't reach urban parks after walking for 10 minutes. Distribution and service coverage of existing urban parks are not balanced in the districts. In some districts, the existing urban parks have lots of users. While in some districts, density of buildings around parks is very little, and in the meantime, there are no parks in the neighborhood of some populated areas.

A review of the literature related to green spaces including urban parks and green spaces show that closeness to urban parks is one of the key and main issues that are effective on citizens' tendency to use them. Locating and designing urban parks and green spaces near residential areas and workplaces is one of the highly effective factors on the life quality of citizens. In Shiraz metropolis, in order to further familiarize citizens with nature, it is necessary that in some regions of this metropolis, managers and authorities of this city design urban parks in the scales of neighborhoods, communities, regions and urban



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districts. Despite the fact that some regions of Shiraz metropolis have high populations, they are deprived of having access to these spaces. Because of that, according to the results of this survey, regions8, 7 and 11 of Shiraz metropolis are first priorities of planning green spaces.

## 5. CONCLUSIONS

Urban parks and green spaces have effects on life quality of citizens. Considering this fact, urban green spaces and parks should be considered among the most basic factors of sustainability in the rapid growth of urbanism. If these parks and spaces are managed correctly, they will have useful effects on the physical and emotional health of citizens and on improvement of the structure and view of cities. The process of rapid and uncontrolled physical development of the city of Shiraz since 1950s has progressed in a way that, in different periods, the city has expanded towards the valuable gardens in the suburbs especially along the main roads leading to the city. Gradual destruction of Ghasruddasht gardens which have worked like the respiratory lungs of the city has had lots of negative effects on the life quality in this city. Therefore, it is necessary that urban policymakers and the authorities who control the affairs of the city pay specific attention to conservation and revival of these gardens.

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