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Evaluation of Quality of Life in Metropolitan Areas in a Developing Country Context: The Case of Tabriz, Iran

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Abstract

In developing countries, one of the critical issues in urban planning is investigating and recognizing the quality of life (QoL) in metropolitan areas and preparing a comprehensive solution for it. Recognition of QoL indicators and evaluating their situation in different urban areas is a significant aspect of urban planning and development in metropolitan areas. The present study aims to evaluate the defined indicators of QoL in the urban areas of Tabriz Metropolis. After identifying the effective criteria, a pairwise comparison was conducted by the AHP method to find their weights. Then, ten Tabriz Municipality Districts and three towns located in the metropolitan area, including Basmenj, Sardrood, and Khosrowshahr, were ranked using the models of VIKOR, ELECTRE, and MORRIS. The results indicated that the QoL of districts 5, 2, and 9 among the municipality districts got the highest ranks and had a better situation than the other districts. On the other hand, districts 1, 4, and 6 have no good conditions in terms of QoL. Among the studied towns, Sardrood has better conditions regarding QoL than the others**.**

Keywords: Quality of life, ELECTRE, VIKOR, MORRIS, Tabriz, Metropolitan area

1. Introduction

More than 54% of the population has recently been living in urban areas worldwide (Liu et al., 2020). A new and different pattern of urbanization, settlement system, city size, structure, and spatial organization are created in the metropolitan areas. This phenomenon has become

the dominant urbanization pattern since the second half of the 20th century (UN Human Settlement Program, 2001). Metropolitan areas are considered the center of wealth, capital and production at national, regional and even global levels (Faka et al., 2021; Albouy, 2008; Türksever and Atalik, 2001). Metropolitan life is considered the most advanced stage in human life. These places are the centers of industrial production, science, wealth, and cultural diversity (Nitschke, 2007). Therefore, rapid urbanization affects people's quality of life in urban areas located in the metropolitans domains.

The definition of Quality of Life (QOL) is not clear yet as it is a multi-dimensional concept frequently used by researchers in different study areas (Marans, 2015). QoL is a comprehensive concept used to assess a society's standard of living in all aspects of life (Chen et al., 2016). In 1997, Dine and Sue defined quality of life only as satisfaction with individual life (Van Camp, 2003). Generally, QoL is a social concept and investigating its conditions in metropolitan areas helps researchers to evaluate its effects on economic, social, and cultural aspects of urban life (Liu, 1975; Pazhuhan et al., 2020). The terminology of Quality of Life (QoL) was created at the end of World War II, and it has progressed with globalization and rapid urbanization (Farquhar, 1995). QoL is usually used to explore communities' public services and resources that dwellers consider as affecting variables for their life quality (Sun, 2005).

The concept of QoL was limited to issues related to health in the past, but during the past two decades, it has developed from health to all issues related to human life (Serag et al., 2013). Urban QoL is the consequence of the relationship between different dimensions of urban life (Serag et al., 2013). According to Eldin Et al., “the term urban QoL is not used to describe some physical features but to describe all the relationship, the dynamics, and the reticular relationship that exist between those physical features” (Eldin et al., 2013, 89). The World Health Organization considers the QoL as welfare in the social, psychological and physical fields. It declares that the QoL is people's perception of their life situation within the cultural background in which they live and related to their goals and concerns in their life (WHO-QOL Group, 1993).

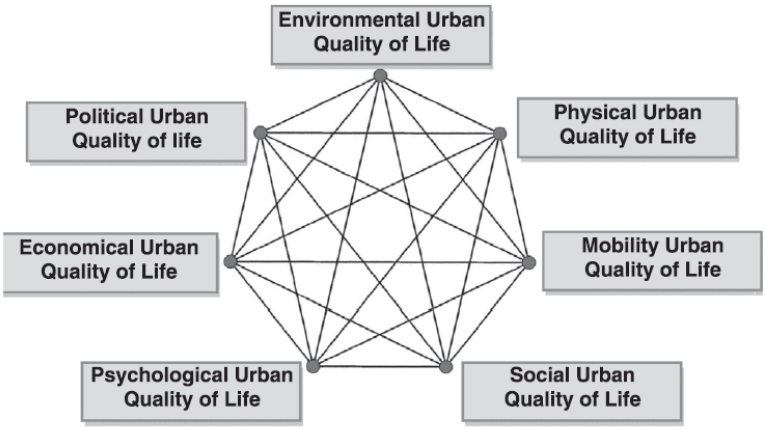

Figure 1. Urban Quality of Life dimensions, Eldin et al., 2013, 89

Nowadays, the QoL is discussed as a critical factor in policymaking and planning for cities and is considered a development indicator (Ghaffari et al., 2009). Thus, due to the fast urban and population growth in recent years, the QoL issue in cities in developing countries has been increasingly emphasized in development programs (Shao et al., 2021).

The QoL in metropolitan areas has been widely studied in recent years. Researchers from various fields, including urban planning, geography, sociology, economics, psychology, political science, marketing, and management, have contributed (Chen et al., 2022; Das, 2008; Boraita et al., 2022; Dehimi et al., 2021). However, no integrated framework is presented for studying the QoL in the world (Van Kamp et al., 2003). In addition, the QoL is often measured using objective or subjective indicators and is rarely measured using both indicators (McCrea et al., 2006). Subjective indicators are gained by investigating perceptions and satisfaction of the residents with urban life, while objective indicators refer to observable facts and are often obtained by secondary data (Garau & Pavan, 2018). Currently, the common goal of development at the local, national, and international levels is to improve the QoL and the future of human life. So, it depends on a better understanding of factors that affect the quality of human life (Levasseur et al., 2009).

Different structural models were proposed to measure the QoL. Based on the simplest model, the overall quality of life is a weighted sum of people's satisfaction levels in different aspects of life (Eldin et al., 2013; Pacione, 2003) (Figure 2).

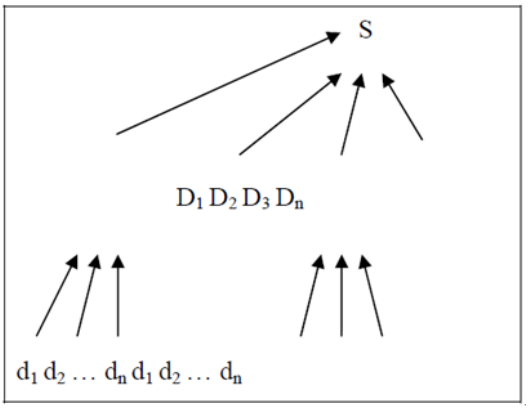

Figure 2. The simplest structural model of QoL

S = overall quality of life; D = satisfaction in the desired category; d = satisfaction in the desired subcategory (Pacione, 2003, 65)

Metropolitan areas are one of the most critical emerging phenomena of the twentieth century, which present different patterns of urbanization, settlement, city size, structure and spatial organization and, consequently, quality of life (Sýkora & Ourednek, 2007). Studying the QoL challenges of urban areas in different dimensions, namely, economic, social and geographical dimensions, is one of the inevitable necessities in planning development. The metropolitan area of Tabriz is one of the major metropolitan areas of Iran. Investigating its QoL according to the social, economic, and physical indicators is among the important steps to assess the life

situation in this metropolitan area. The present study aims to rank the urban areas and towns that have been located in this metropolis and find a spatial pattern of the distribution of QoL indicators with MCDM methods.

2. Method

In this study, the statistical population considered for investigating QoL is ten municipality districts of Tabriz Metropolis and Basmenj, Sardrood, and Khosrowshahr towns located in the metropolitan area. The required data are obtained through the Population, Housing Census Bureau of Iran, Tabriz Master Plan, and the documents and literature related to the study topic. The indicators used to analyze the QoL of the case study are chosen among various social, economic, and physical indicators. In this research, multi-criteria decision-making methods (MCDM) were used to achieve the aim of the study. First, using the AHP hierarchy model, the weight of each indicator was measured regarding its impact on QoL. Then, using the ELECTRE, VIKOR, and MORRIS models, the municipal districts of Tabriz and the three towns in the Tabriz Metropolitan Area were evaluated and ranked in terms of QoL indicators.

2.1 The Case Studies

Tabriz Metropolitan Area consists of ten municipality districts in the Tabriz urban area and three towns of Basmenj, Sardrood, and Khosrowshahr. Tabriz, with an area of 25056 hectares, is located at 38 degrees and 1 minute to 38 degrees and 8 minutes north latitude and 46 degrees 5 minutes to 46 degrees and 22 minutes east longitude. The average height of the city is estimated at approximately 1460 meters above sea level. With 1,611,000 population (Statistical Center of Iran, 2020) Tabriz is located northwest of Iran and along the international axis of Tehran-Bazargan, which connects Iran to Europe.

Basmenj town is located in the central part of the metropolis. It is located 10 kilometers southeast of the province and is considered the twenty-second largest town in East Azerbaijan Province with an 11,090 population.

Sardrood town is located in the central part of Tabriz. According to the latest census of the Iranian Statistics Center, with a population of over 35,000, this town has a history of about 3,000 years. Sardrood is the second most populous town in the Tabriz Metropolitan Area and the 11th most populated town in East Azarbaijan province.

Khosrowshahr is also located in the southwest part of the metropolitan. This town, with a 12794 population, is the 19th town in the province regarding its population.

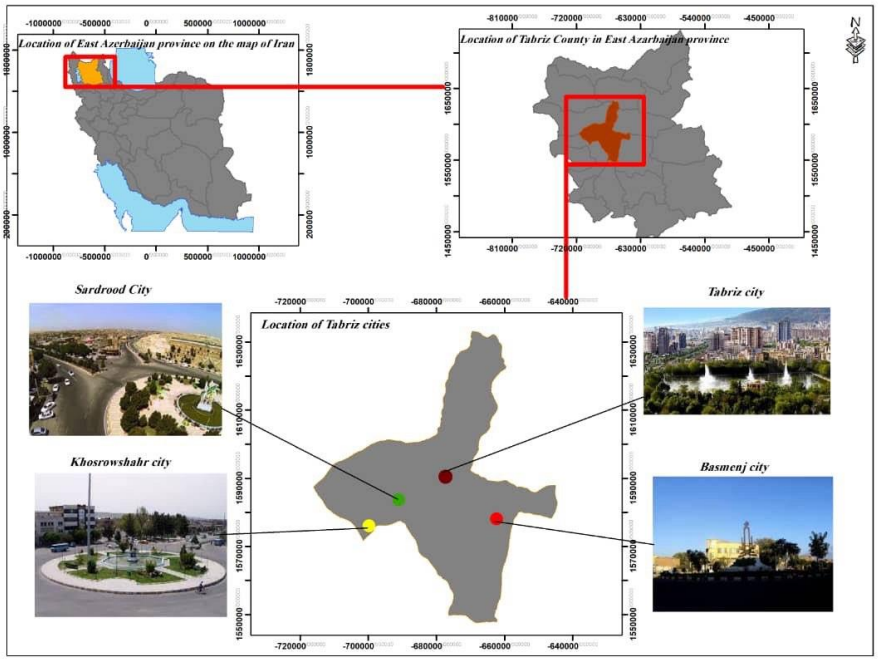

Figure 3. The case study

2.2 Indicators Used in the Research

A large body of studies about QoL considered various factors and indicators to explore communities' life quality, such as employment, social crime, recreation, and cost of living. However, new dimensions of the factors affecting human QoL should be considered (Mittal et al., 2020; Somarriba & Zarzosa Espina, 2019; Khaef & Zebardast, 2016). In this study, three categories, including physical, economic, and social dimensions were used to estimate the QoL of the Tabriz Metropolitan Area. With these three categories, the distribution of urban services in the residential area (physical indicators), economic and income status (economics indicators), as well as the level of literacy and the use of cultural, sports and recreational facilities (social indicators) have been investigated among the municipality districts and towns which are located in the studied metropolis. Therefore, the metropolis urban areas were analyzed under three main physical, economic, and social indicators. 12 sub-indicators for assessing the QoL in the urban areas of Tabriz Metropolis have been used according to the data for the year 2014 (table 1).

Table 1. Indicators used in the research

Indicator	Sub-indicators
Physical	Number of schools, the average area of residential units, building quality, building materials, number of healthcare centers
Economic	The unemployment rate, employment rate, income level
social	Literacy rate, illiteracy rate, cultural and sports facilities, recreational facilities and tourism

Source: Tabriz Master Plan (Naghshe Mohit Consulting Engineers, 2014)

2.3 Introducing Models

In this study, multi-criteria methods have been conducted to analyze the data. Multi-Criteria Decision-Making models can help decision-makers in dealing with the complexity of issues. Multi-Criteria Decision Making (MCDM) consists of Multi-Attribute Decision Making (MADM) and Multi-Objective Decision Making (MODM). The present research used multi-Attribute Decision-Making Methods (MADM) considering the research objective. VIKOR and ELECTRE techniques, as a subset of the MADM, can rank various concepts in various fields. A point of using this technique is that it can be combined with other techniques of the MADM group, such as hierarchical data analysis to evaluate the validity and reliability of research. To interact with the complexity of quantitative and qualitative information, the fuzzy method provides the flexibility required to represent the uncertainty of data error (quantitative data) or ambiguity in the judgments (qualitative data) that have done in interviews (Ocampo, 2022).

2.3.1 ELECTRE Model

The ELECTRE technique was introduced in the late 1980s and is considered a MADM technique. The basis of it is ranking relationships. However, it does not necessarily result in a ranking of options but may remove them. In this technique, a coordinated and uncoordinated set of positive and negative aspects of the indicators is created after transforming the decision matrix into a normalized weighted matrix. Then, the ineffective options are removed by forming an effective coordinate matrix – indicating the order of superiority of different approaches to each other. The data is calculated according to the following equations.

Coordinate and uncoordinated matrices have positive and negative aspects

$$S_{k,l}=\{j \mid Vkj \geq Vij\},\ j=1,\ldots,m \qquad S_{k,l}=\{j \mid Vkj \leq Vij\},\ j=1,\ldots,m$$

Creating an effective coordinate matrix

Creating an uncoordinated effective matrix $\bar{I}=\sum_{i=1}^{m}\sum_{k=1}^{m} I_{ki}/m(m-1)$

$$\overline{NI} = \sum_{i=1}^{m}\sum_{k=1}^{m} NI\ ki/m(m-1)$$

Determining the overall effective matrix H

hk,l = fk,l × gk,l

2.3.2 VIKOR Model

The VIKOR is an agreed MCDM method developed by Opricovic and Zeng (Wei & Lin, 2008) and based on the LP metric methodology.

$$L_{pi}=\left\{\sum_{j=1}^{n}\left[w_i(f_j^{*}-f_{ij})/(f^{*}-f_j^{-})\right]^{p}\right\}^{1/p}$$
$$1\leq p\leq +\infty; i=1,2,\ldots I.$$

Stage 1: Formation of

decision matrix

Step 2: Normalization of the decision matrix

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

Step 3: Weighting the normal matrix

Step 4: Determining the highest and lowest values of the normal weight matrix

$$f_i^* = \max_j f_{ij}; \quad f_i^- = \min_j f_{ij}$$

Step 5: Determine the utility indicator (S) and the dissatisfaction indicator (R)

$$S_j = \sum_{i=1}^{n} w_i \cdot \frac{f_i^* - f_{ij}}{f_i^* - f_i^-}; \qquad R_j = \max_i \left[w_i \cdot \frac{f_i^* - f_{ij}}{f_i^* - f_i^-} \right]$$

Step 6: Calculating the Q value and the final ranking of options

$$Q_j = v \cdot \frac{S_j - S^-}{S^* - S^-} + (1-v) \cdot \frac{R_j - R^-}{R^* - R^-}$$

2.3.3 MORRIS Model

This method has seven stages, which are briefly mentioned here (Feizi and Hosseinpour, 2014):

- Setting the table of indicators (in the first column, in the settlements and the subsequent columns, indicators);

- Standardization of the numbers in the indicators table using the MORRIS unweighted coefficient equation.

Equation 1. MORRIS unweighted coefficient

$$\frac{xij - Xj\ min}{Xj\ max - Xj\ min} * Yij = 1$$

Yij = MORRIS unweighted coefficient (unweighted indicator for i-th variable in j-th unit)

Xij = represents the number related to the variable,

Xjmax = The maximum value of the variables in each column,

Xjmin = The minimum values of the variables in each column;

- Ranking of numbers obtained from the MORRIS unweighted coefficient in such a way that

it belongs to the largest number of rank 1, and this rank belongs to the more facilities of that settlement.

-Calculating the final coefficient of development through the following equation:

Equation 2. The final coefficient of development

$$Di = \frac{\Sigma Yij}{N}$$

Σ_{Yij} = The sum of the unweighted coefficients of development

N = The number of indicators

The final ranking of urban areas regarding the numbers obtained from the last coefficient of development and class of the areas, the larger the Di number, indicates the more development of the areas.

3. Results and Discussion

In this research, the municipal districts of Tabriz and three towns located in the urban area of Tabriz metropolis, including Basmenj, Khosrowshahr, and Sardrood, were studied separately.

3.1 Evaluating the Quality of Life in Tabriz Municipality Districts

To rank the ten districts of Tabriz regarding quality of life (QoL) indicators, a decision matrix consisting of 11 columns (number of indicators) and 10 lines (number of urban areas) was formed. To find the relative importance of the used criteria and indicators, their relative weights should be determined. Therefore, a questionnaire was developed for weighting 11 selected criteria to compare the criteria pairwise using experts' opinions. Eventually, the weight of the criteria was calculated based on the fuzzy AHP model, which is described in Table 2

Table 2. Weighing the indicators studied

Indicators	Number of schools	Average residential	Employment rate	Literacy rate	Sports facilities	Recreational and	Income level	Healthcare centres	Building Materials	The unemployment	Illiteracy rate
Weight	0.0793	0.0341	0.2788	0.1833	0.0209	0.0442	0.1111	0.1462	0.0187	0.0596	0.0442

To determine the weight of each criterion, at first, the VIKOR model was used to rank the districts of Tabriz based on QoL indicators. Then, to rank the final alternatives, the distance from the positive ideal as the sum of the intervals of the options from the best value in the sub-criteria and the distance from the negative ideal as the sum of the intervals of the options was calculated from the worst value in the sub-criteria. Then the proximity indicator was obtained for each option. Based on the criteria and calculations conducted at each stage of the

VIKOR model, the results showed that, among the districts of Tabriz Municipality, districts 5, 2, and 9 were ranked first to third in terms of having a better quality of life indicators, and districts 1, 4 and 6 gain the last ranks (Table 3).

Table 3. Ranking of the areas based on the studied indicators using the VIKOR model

Districts of Tabriz Municipality	Qi	VICOR Rank	Districts of Tabriz Municipality	Qi	VICOR Rank
District 1	1	10	District 6	0.627954366	8
District 2	0.101840471	2	District 7	0.60700172	7
District 3	0.156602466	4	District 8	0.364537863	5
District 4	0.760608969	9	District 9	0.107621054	3
District 5	0.004320836	1	District 10	0.447943016	6

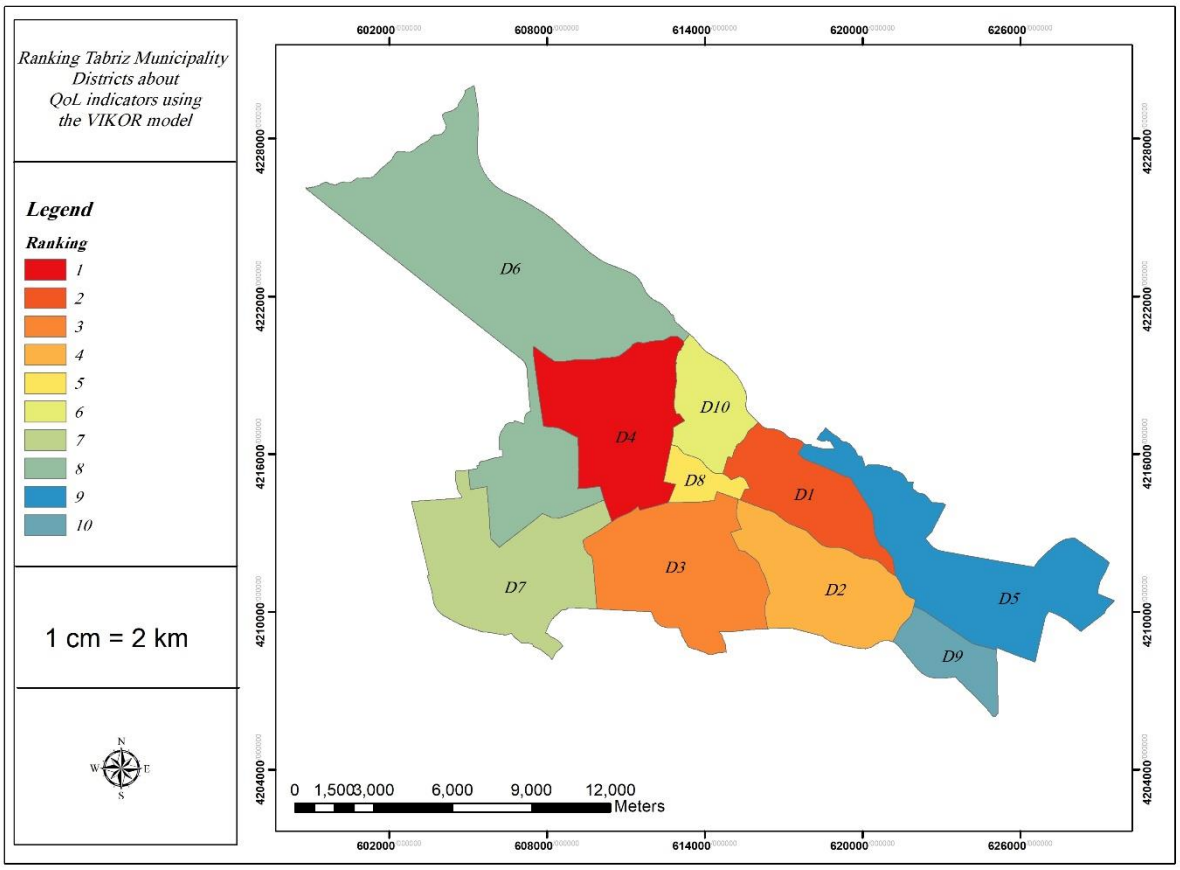

Figure 4. Ranking Tabriz Municipality Districts about QoL indicators using the VIKOR model

In addition to the VIKOR model, according to the weights of each criterion, the districts of Tabriz were ranked using the ELECTRE model. The results of the model show that districts 5, 2 and 3 are in the first ranks, and districts 7, 4, 6, and 10 are in the last ranks (Table 4).

Table 4. Ranking the areas based on the indicators studied using the ELECTRE model

Districts of Tabriz Municipality	Score	ELECTRE Rank	Districts of Tabriz Municipality	Score	ELECTRE Rank
District 1	1	4	District 6	-3	6
District 2	7	2	District 7	-8	8
District 3	5	3	District 8	1	4
District 4	-7	7	District 9	-2	5
District 5	9	1	District 10	-3	6

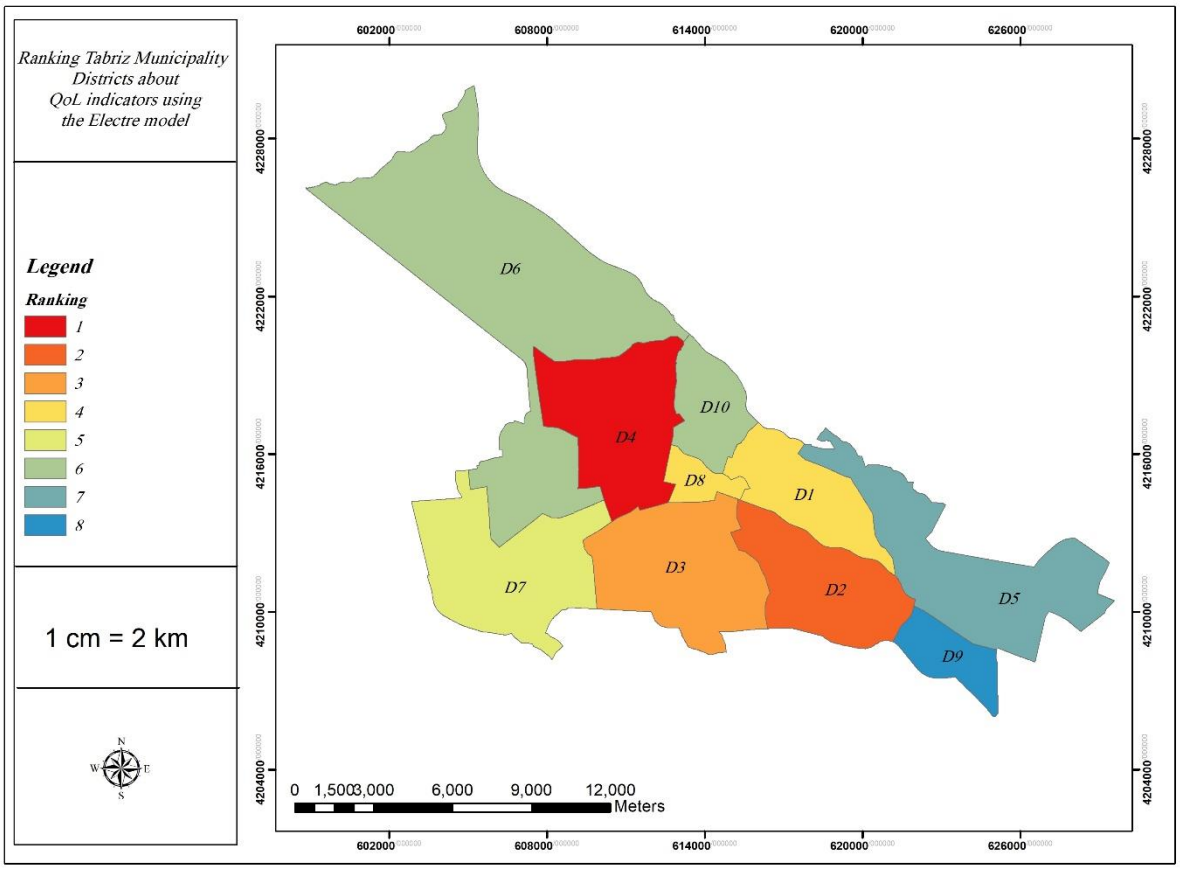

Figure 5. QoL ranking of Tabriz Municipality Districts using the ELECTRE model

Based on the analysis of the models of VIKOR and ELECTRE, districts 5 and 2 have the best conditions according to the QoL indicators, and districts 6 and 4 have the worst conditions.

3.2 Evaluation of the QoL of Towns Located in the Tabriz Metropolitan Area

The evaluation process of QoL for the three cities of Basmenj, Sardrood, and Khosrowshahr is as follows:

The first step in this model is providing the indicators to investigate the QoL in the case study. The table below shows the number of indicators throughout the studied towns.

Table 5. Quantity of QoL indicators in the towns located in the Tabriz Metropolitan Area

Index / Towns	Illiteracy rate	The unemployment rate	Building Materials	Healthcare centers	Income level	Recreational and tourism	Sports facilities	Literacy rate	Employment rate	Average residential area	Number of schools
Khosrowshahr	2	3	5	3	3	2	3	3	2	2	5
Basmenj	6	3	3	2	1	1	2	1	2	3	2
Sardrood	4	2	4	2	2	2	3	2	3	1	3

Weights of criteria are calculated to express the importance of their relationships. The present study uses the AHP method to weigh the criteria.

Table 6. Weighing the criteria used in the VIKOR and MORRIS models using the AHP model

Indicators	Number of schools	Average residential area	Employment rate	Literacy rate	Sports facilities	Recreational and tourism facilities	Income level	Healthcare centers	Building Materials	The unemployment rate	Illiteracy rate
Weight	0.0793	0.0341	0.2788	0.1833	0.0209	0.0442	0.1111	0.1462	0.0187	0.0596	0.0442

After using the VIKOR formula, some numbers will be obtained that value from 0 to 1. Each criterion with the minimum score or rank is the most optimal or preferred option, and the maximum indicates undesirability in the area. After completion of all calculations, the calculation of the quality of life of the study areas is provided.

As mentioned in the research method section, in addition to VIKOR model, according to table (7) the MORRIS model as a well-known model for measuring the development of spatial and non-spatial units, was also used for the evaluation of the QoL in the surveyed urban areas and towns.

Table 7. The rank of the quality of life of cities with the VIKOR and MORRIS models

Towns	The amount of VIKOR	VIKOR Rank	The MORRIS value	MORRIS Rank
Khosrowshahr	0.5	2	48.48	2
Basmenj	1	3	27.27	3
Sardrood	0.12108	1	77.27	1

Thus, using the VIKOR model, the towns were ranked based on the QoL indicators. In this regard, for the final ranking, the distance from the positive ideal (as the sum of the intervals of the option of the best value in the sub-criteria) and the distance from the negative ideal (as the sum of the intervals of the option) was calculated from the worst value in the sub-criteria. Therefore, the proximity indicator was obtained for each option. Based on the criteria and calculations conducted at each stage of the VIKOR model, the results indicated that the

Sardrood town with a value of 0.12108 was in the first ranke. Khosrowshah town with a value of 0.5 was ranked second, and finally, Basmenj town with a value of 1 in the VIKOR model was ranked as the last town. In continuation, the MORRIS model was conducted to rank the towns according to QoL indicators again. Sardrood with a value of 77.27, Khosrowshahr with 48.48, and Basmenj with 27.27, respectively, ranked first to third by the MORRIS model. Therefore, as it is clear, the results of the two models are aligned in the investigated urban areas.

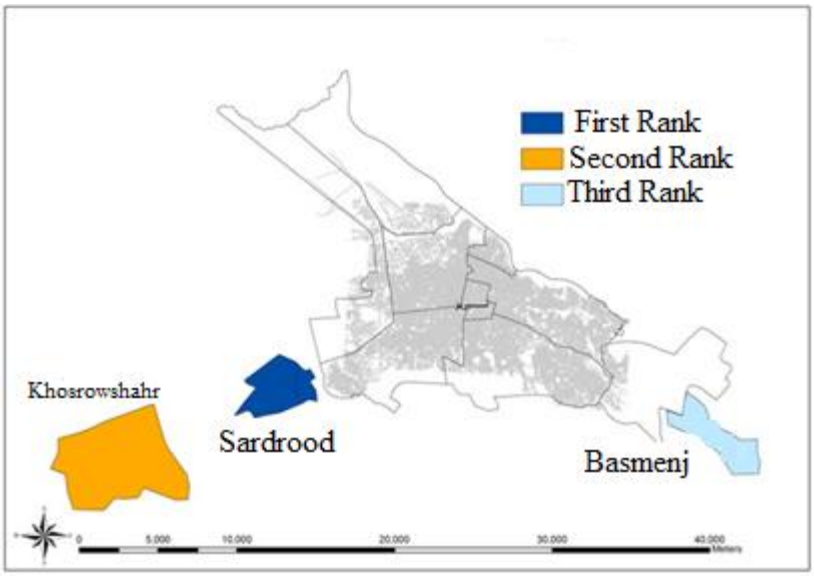

Figure 6. Ranking of towns in the urban area of Tabriz about QoL indicators using the VIKOR and MORRIS models

4. Conclusion

Investigating the metropolitan areas' development issues is an important part of systematic planning for integrated urban development. Quality of life is one of the most important concepts in urban planning.

This study investigated the QoL in Tabriz Metropolitan Area with a comparative study approach. For this aim, ten municipality districts and three towns in the urban area of Tabriz Metropolis have been analyzed to find the QoL situation. To reach this goal, 12 indicators for quality of life in the urban areas of Tabriz were considered. ELECTRE, VIKOR, and MORRIS models were used to analyze the indicators to determine the ranks of the districts and the towns in the urban areas of Tabriz. In this research, the fuzzy hierarchy method was used to assign weights to each criterion involved in the study. After determining the final weights, the models of VIKOR and ELECTRE were used for ranking the ten municipality districts of Tabriz. Also, models of VIKOR and MORRIS were used for ranking Basmenj, Khosrowshahr and Sardood towns. The results indicate that according to the VIKOR model, districts 5, 2, and 9 of Tabriz Metropolitan Area were in the first to third ranks, and districts 1, 4, and 6 were in the last ranks. Also, based on the ELECTRE model, districts 5, 2, and 3 were

in the first to third ranks, and districts 7, 4, 6, and 10 had no good conditions regarding the quality of life indicators. Therefore, municipality districts 5 and 2 have a better situation regarding QoL, and districts 4 and 6 have the worst condition. Also, using the VIKOR and MORRIS models, among the towns of Basmenj, Khosrowshahr and Sardrood, the town of Sardrood has the best situation regarding quality of life indicators in comparison with other towns.

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