Contribution of small and medium enterprises to economic development and quality of life in Turkey

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ABSTRACT

All successful cities are the most developed and productive cities in their regions and countries in terms of economy and quality of life. In addition, it is observed that there are strong industries and enterprises in these regions and cities. Therefore, this study tries to evaluate the quality of life and the development of the industry together. The proposed method can be considered as a combination of operational research and GIS (Geographical Information System). The results of both approaches support each other. In addition, the innovative approaches of the sectors are evaluated by TOPSIS (Technique for Order Preference by Similarity to Ideal Solution). Also, the article recommends SMEs (Small and Medium-Sized Enterprises) for sustainable economic growth. According to the results, the quality of life and socio-economic development has a very close relationship with the existence of investments and manufacturing companies. If the current development policy continues, the regions with low quality of life will continue to lag behind the other cities in terms of development. The study indicates that there are remarkable differences between eastern and western Turkey in terms of living standards and the contribution of SMEs to economic development.

1. Introduction

The share of industrial activities in the economy increased with the improvements in production infrastructure and capacity after the industrial revolution. As a result, the focus of the economy has shifted from rural to urban areas. It has also radically changed the structure and content of urban economic activities. This new economic system in cities created a new form of social life and relationship. Cities have become settlements with greater populations than ever before. This has caused inequalities, social conflicts, and poor living conditions. The word “city” has started to be defined with these negative concepts. Therefore, governments and politicians have prepared new arrangements and urban projects to improve the living conditions in the cities. Urbanization has become a new branch of politics and science.

CNBC-e-Business Magazine has investigated the quality of life of Turkey’s 81 cities and ranked them between 2008 and 2011. The first study was conducted using 28 criteria in 2008 and the last study was conducted using 37 criteria in 2011 (Mavi, 2011). The article tries to evaluate the criteria of this study and the data of TurkStat (2016) by using multi-criteria decision making methods.

SMEs are the catalyzer of the economy of Turkey as well as in other developed and developing countries. As they have more flexible production opportunities compared to large enterprises, they adapt to the changes in demand in a short time and reach full competition conditions quickly. Thus they contribute to national income, employment, productivity and entrepreneur training. The unemployment rate in Turkey is 14.1% (TurkStat, 2019a). SMEs are the main actor in increasing employment. Therefore, SMEs are seen as a key element in achieving the “growth” and “employment” targets. Approximately 26 million SMEs operating within the EU provide employment for 109 million people and constitute 2/3 of the European Gross National Product. In addition, SMEs contribute greatly to the improvement and usage of new technologies.
due to their innovative and flexible structures. SMEs have special importance for the EU’s economy. Therefore, the European Union supports SMEs in order to preserve its flexible and innovative structures and use them as a competitive element (EuroStat, 2019).

Determining the development of a region and comparing it with others is a multi-criteria decision making (MCDM) problem. Thus, it requires evaluation of many conflicting criteria (Erdin and Ozkaya, 2017; Forman and Selly, 2001). When MCDM methods are classified according to their different purposes, the TOPSIS method is recommended in order to determine the best option and rank (Erdin and Ozkaya, 2017; Ozkaya, 2017). As a result of the analyzes performed over the years, the most appropriate MCDM methods were determined according to the type of problem (Erdin and Ozkaya, 2019). Also, there are many studies using GIS to evaluate the location of investment. Some of these are summarized as follows: Safian et al. (2018) recommended a GIS-based decision-making approach in order to evaluate the sustainable business location for purpose-built offices in Malaysia. Fisher, Glaeser, and Su (2016) offered an empirical methodology and application to decide the optimal retail location. Fraser, Chester, and Eisenman (2018) suggested a decision approach based on GIS to determine the strategic location of refuges for extreme heat events (or heat waves). Church and Murray (2009) proposed a GIS and optimization approach to select suitable locations for business. Dodson, Agadjanian, and Driessen (2017) used a method including descriptive statistics, PCA, location-allocation analysis, and GIS in order to decide the location of health services. Gwak, Lee, Lee, and Sohn (2017) used GIS to select the optimal location for the installation of urban green roofs considering honeybee habitats.

In addition, there are many similar articles in terms of the subject. Kubickova, Croes, and Rivera (2017) investigated the relationship between tourism competitiveness and quality of life in developing economies. Craglia, Leontidou, Nuvolati, and Schweikart (2004) reviewed the comparable indicators of the quality of life to monitor development and policy implementation. Morais, Migueis, and Camanho (2013) provided an assessment of the urban quality of life (QoL) of European cities from the perspective of qualified human resources. Also, they stated that the competitiveness of cities relies on their potentials that attracts highly educated workers. Because they are important assets for firms when choosing a location. Turkgolu (2015) evaluated the sustainability and quality of life concept based on quality of life (QoL) researches. Environmental, economic, social, physical and health-related indicators were discussed to contribute to the sustainable development strategies. Arifi-widodo and Perera (2011) explore whether Quality of Life (QOL) corresponds to the spatial pattern of urban system as a result of compact development policy practice in Bandung city. Therefore, they examined the connection between QOL and selected attributes of compact development. Easterlin and Angelescu (2012) resented a survey and an empirical relation between quality of life and modern economic growth. Peterson and Ekici (2007) tried to understand the relationship between Consumer Attitude toward Marketing (CATM) and the quality of life (QOL) in a developing country.

In this study, regions, and cities are analyzed in terms of quality of life. The existing investment and industrial capacities of the regions are compared with these results. It also seeks to determine whether there is a significant difference between cities in terms of development and quality of life. In addition, the innovation performance of the sectors is evaluated by the TOPSIS method.

The rest of the study is organized as follows: Section 2 gives some information about SMEs. Section 3 explains the proposed methods. Section 4 presents the obtained results. Section 5 presents discussions and section 6 presents the conclusion.

2. SMEs (small and medium-sized enterprises)

The great unemployment crisis in the 1980s led policymakers to concentrate on small and medium-sized enterprises in the member countries. It was thought that large enterprises' production, employment, and investment problems could be solved by taking advantage of SMEs. SMEs were handled with sensitivity in all economic arrangements, incentive policies and legislative implementations made after 1990. In the European Research Area (ERA) framework programs, SME support and grant funds were increased every four years. They were € 3.6 billion in the 6th Framework Program, € 7.0 billion in the 7th Framework Program, approximately € 9.5 billion in the 8th Framework Program and € 12 billion in the 9th Framework Program (ERA, 2018). In addition, every European country has its own incentive and support programs for SME enterprises.

The contribution of SMEs to the economy is generally gathered under five main topics: employment creation; fast adaptation to new situations with its flexibility feature; encouraging entrepreneurship; product differentiation through boutique production; working as sub-industry in

| Cities      | Number of firms | Number of employees |
|-------------|-----------------|---------------------|
| Istanbul    | 558.285         | 19,3                |
| Ankara      | 211.165         | 7,3                 |
| Izmir       | 196.701         | 6,8                 |
| Bursa       | 124.384         | 4,3                 |
| Antalya     | 109.921         | 3,8                 |
| Konya       | 98.351          | 3,4                 |
| Adana       | 75.209          | 2,6                 |
| Mersin      | 72.317          | 2,5                 |
| Balikesir   | 57.853          | 2                   |
| Manisa      | 60.746          | 2,1                 |
| Mugla       | 52.068          | 1,8                 |
| Aydin       | 54.961          | 1,9                 |
| Kocaeli     | 54.960          | 1,9                 |
| Gaziantep   | 54.960          | 1,9                 |
| Samsun      | 52.068          | 1,8                 |
| Denizli     | 49.175          | 1,7                 |
| Hatay       | 53.390          | 1,5                 |
| The other cities | 971.941   | 33,6                |
| Total       | 2.892.670       | 100                 |
large enterprises. Among all these features, the most important feature of SMEs is their contribution to employment. In general, SMEs using labor-intensive production techniques are extremely important in terms of social as well as economically. According to the statistics of employment in EU countries (in 2016, %), although SMEs constitute 9.63% of total enterprises, they provide 45.18% of employment. SMEs have a share of 48.54% in the manufacturing industry and constitute 46.09% of the employment. In 2016, the total number of employment of SMEs was 83.6 million. The share of this sector in the total manufacturing industry is 42.5% (Statista, 2017). Therefore, SMEs in the manufacturing industry have an important place in terms of employment.

Distribution of firms by cities and their employment rates are given in Table 1. The cities that have the highest number of firms are Istanbul, Ankara, Izmir, Bursa, Antalya, and Konya. While 43.9% of total enterprises operate in these six cities, 56.3% of total employees are also employed in these cities (KOSGEB, 2016).

Small and medium-sized industrial enterprises constitute 99.4% of the enterprises operating in the manufacturing industry. The share of SMEs in production is 56.2%. While SMEs employ 61.5% of employment, they only contribute 27.6% of the added value. The number of employees per SME enterprise is 8.8 (KOSGEB, 2016).

When Table 2 and Table 3 are analyzed, Turkey’s public fixed capital investments, R&D and innovation investments, and budgets are far behind the EU countries and developed countries. The share of SMEs in exports was 56.2% in 2018 and the goal for 2023 is 60%. Moreover, the share of SMEs in R&D expenditures is 19.6% and the goal for 2023 is 25% (Development, 2019). In this context, the distribution of project applications by cities is shown in Figure 1 (TUBITAK, 2018).

Figure 1. Distribution of project applications by cities (1995–2017) (TUBITAK, 2018).
The European Union’s umbrella programs include support, grants, and loans for SMEs, and these are distributed to countries (including Turkey). These funds are allocated to SMEs through KOSGEB (Small and Medium Enterprises Development Organization of Turkey) and/or investor banks. The loans are given as low interest, long term investment loans. It is difficult for micro-enterprises to benefit from these funds. Medium-sized enterprises employing 50–250 workers often benefit from these loans. They can monitor legislation and credit incentive channels due to their advanced institutional structures. They can provide counter-guarantees for investment banks. Some of them have also R&D infrastructures that have the possibility of designing original products.

Few SMEs in Turkey (up 8% of total business) are able to export directly. Research shows that SMEs have a share of only 15% of total exports. Also, SMEs have a share of 15% of total imports. The share of SMEs in exports in some countries is given in Table 4 (WTO, 2016).

R&D has critical importance, especially in the machinery manufacturing industry. As seen in Table 5, firms do not feel any responsibility to make innovation. This is one of the main reasons why value-added products are not produced. Unfortunately, the private sector does not make the necessary investments for innovation and R&D by using its own capital.

According to Table 4, R & D, information and communication, industry and manufacturing, advertising and market research are Turkey’s most preferred investment sectors in innovation. Unfortunately, there are not any R&D centers or Techno parks in 19 of the 24 cities in Eastern and Southeastern Anatolia. It is seen that almost all of these investments are made in the Marmara, the Central Anatolia, the Aegean, and the Mediterranean regions.

3. Proposed multi criteria decision making method (GIS and TOPSIS)

In Turkey, the seven regions vary dramatically in terms of development. This study investigates the similarities of investment data with the development and quality of life scores of the regions. GIS method is used in order to provide a visual output for the reader. The GIS software used

| Countries                  | Share in Exports (%) | Direct Export Share (%) | Indirect Export Share (%) |
|---------------------------|----------------------|-------------------------|--------------------------|
| United States of America  | 36                   | 22                      | 14                       |
| Germany                   | 35                   | 18                      | 17                       |
| Denmark                   | 33                   | 18                      | 15                       |
| France                    | 27                   | 15                      | 12                       |
| Italy                     | 30                   | 20                      | 10                       |
| Greece                    | 22                   | 12                      | 10                       |
| India                     | 42                   | 22                      | 10                       |
| Japan                     | 38                   | 28                      | 10                       |
| England                   | 27                   | 13                      | 14                       |
| South Korea               | 26                   | 13                      | 13                       |

According to the export rates of SMEs, India and Japan are the leading countries.

| Non-innovators | Reasons not to innovation activities |   |
|---------------|--------------------------------------|---|
| General (%)   | 38,5                                 | 82,2 17,8 |
| Industry      | 35,5                                 | 81,7 18,3 |
| Mining and quarrying | 47,7                   | 84,6 15,4 |
| Manufacturing | 34,7                                 | 81,3 18,7 |
| Electricity, gas steam and air conditioning supply | 58                  | 91,6 8,4 |
| Water supply; sewerage, waste management and remediation activities | 48,2                 | 86,2 13,8 |
| Service       | 42,3                                 | 82,8 17,2 |
| Wholesale trade, except of motor vehicles and motorcycles | 38,9                 | 83,4 16,6 |
| Transportation and storage | 52,5              | 81,2 18,8 |
| Information and communication | 24,4               | 82,2 17,8 |
| Financial and insurance activities | 42,1               | 84,9 15,1 |
| Architectural and engineering activities, technical testing and analysis | 43,9              | 84,3 15,7 |
| Scientific research and development | 14,8          | 66,7 NA |
| Advertising and market research | 31,4            | 87,8 12,2 |
| Size group |   |   |
| Enterprises with 10 employees or more | 38,5 | 82,2 17,8 |
| 10–49 | 39,6 | 82,2 17,8 |
| 50–249 | 35 | 81,9 18,1 |
| 250+ | 29,6 | 83,5 16,5 |

The European Union’s umbrella programs include support, grants, and loans for SMEs, and these are distributed to countries (including Turkey). These funds are allocated to SMEs through KOSGEB (Small and Medium Enterprises Development Organization of Turkey) and/or investor banks. The loans are given as low interest, long term investment loans. It is difficult for micro-enterprises to benefit from these funds. Medium-sized enterprises employing 50–250 workers often benefit from these loans. They can monitor legislation and credit incentive channels due to their advanced institutional structures. They can provide counter-guarantees for investment banks. Some of them have also R&D infrastructures that have the possibility of designing original products.

Table 4. Export shares of SMEs in selected countries (%) (WTO, 2016).

Table 5. Reasons not to innovation activities in non-innovative enterprises, 2014–2016 (TurkStat, 2016).
Table 6. Comparison of sectors with TOPSIS method according to their innovative enterprise performance in Turkey.

| Sectors                                                                 | Ranking Scores |
|------------------------------------------------------------------------|----------------|
| Scientific research and development                                     | 1              |
| Information and communication                                           | 0.64222        |
| Industry                                                                | 0.42048        |
| Manufacturing                                                           | 0.42048        |
| Advertising and market research                                          | 0.40896        |
| Wholesale trade, except of motor vehicles and motorcycles               | 0.30623        |
| Financial and insurance activities                                      | 0.28128        |
| Service                                                                 | 0.2623         |
| Architectural and engineering activities, technical testing and analysis | 0.20353        |
| Water supply; sewerage, waste management and remediation activities     | 0.17842        |
| Mining and quarrying                                                    | 0.1626         |
| Transportation and storage                                              | 0.10105        |
| Electricity, gas steam and air conditioning supply                       | 0.03858        |

in this article is ArcGIS-ESRI 9.1 version software. Then the TOPSIS scores of cities are compared with GIS results. In addition, the innovation performance of the sectors is compared with the TOPSIS method.

3.1. Geographic information systems (GIS)

Geographic information systems (GIS) can be applied for many purposes including resource management, land review, and business planning. GIS is defined as a method of collecting, storing, managing, analyzing and displaying the data introduced to the system geographically (Cheng et al., 2007). The GIS provides data management, integration, data query, analysis and visualization through permitting the evaluation of spatial and non-spatial data together (Li et al., 2003). Then these data are used on different layers. Figure 2 shows the multilayered structure of an exemplary GIS (Cheng et al., 2007; Li et al., 2003).

As shown in Figure 2, each layer shows a particular theme in the same area, such as customers, streets, buildings. Especially, a GIS uses database control procedures to build its individual data indexing scheme where inquiries may be initiated by retrieving values of saved data. Data is saved according to their location in space, and then it is arranged in numerical or alphabetical form. GIS is designed with a network-based structure. A network may describe as a set of points called nodes and a set of arcs in which a pair of nodes are linked in every branch.

Figure 3(a) presents a basic network of travel, including six nodes (marked by A, B, C, D, E, and F) and nine arcs (not to scale) (marked by two capital letters, such as AB, BE, DC, etc.). A path on the network is an array of arcs. It stipulates that no nodes can be used more than once. Figure 4 (b) shows a tree design consisting of five paths: A → B → F, A → B → E → F, A → D → E → F, A → D → C → F and A → C → F. When the length of each arc is known exactly, the distance of each path can also be determined. The GIS can identify the shortest path from A to F by following these steps: (1) nodes are placed on a map, (2) the length of each arc is determined, (3) the lengths of the linked arcs for each path are calculated in order to measure the distance of per path, and (4) the distances of the roads are compared and the shortest one is decided (Burrough et al., 2015; Cheng et al., 2007; Maguire, 1991).

In addition, a GIS can transform available digital knowledge or data, such as a census, into a map-like scheme, thereby creating thematic layers of information (Bahaha and Elliott-White, 1999; Kraak and Ormeling, 2013). GIS is only able to utilize digital data. Otherwise, the data cannot be processed by the computer. Hence, firstly every non-digital data need to be digitized (Pundt, 2002). Data can be obtained with numerous methods. For instance, electronic scanning tools may assist transform map marks and points to digits (Maguire, 1991). A GIS can connect and combine many data types. GIS combines data such as street and building names and their associated latitude and longitude with a programmed method called geocoding (Caramunt et al., 2000). A digital height model is designed to display surface heights by indicating different heights in different colors in order to demonstrate outputs (Andrienko et al., 2003). Projection transformation may be required for digital data before analysis. This procedure is a standard math-based process in which the transformation of map data from a three-dimensional real world to a two-dimensional image (Sondheim et al., 1999). Different methods of collecting and storing digital data can result in different structures. GIS transforms data from independent forms to compatible forms in order to prevent this problem (Goodchild, 1987). Data models are divided into two classes: vector and raster. The vector offers discrete properties, whereas the raster offers continuous quantitative values (Faust, 1995). Raster data records are helpful for creating land usage maps, and vector data records can capture the digital data as points, lines, and areas (Goodchild, 1992). When a GIS is created, layers are able to graphically display on a computer or print on paper. It is possible to make inquiry settings to help decision making. Also, a GIS allows users to see and simulate possible answers by creating wall maps and similar graphics (Burrough et al., 2015; Krygier and Wood, 2016).

The purpose of this research is to compare all cities of Turkey in terms of economic, development and quality of life. The research is based on data derived from “Life Quality Research - 2011” presented by Mavi...
“Research on Socio-Economic Development Order of Cities and Regions SEGE - 2011” introduced by the Ministry of Development (2013). This research, which includes data of 81 cities, covers the subjects of economy, education, health, urban life, security, cultural art. We obtained the data of 81 cities from that study. These data were used in GIS and TOPSIS analyzes. We arranged the data in a matrix to be used in the analysis. The evaluation results of GIS are initially presented as a two-dimensionally map. Also, the regions were assessed by GIS analysis employing 7 criteria related to SME performance. Shares in the total SMEs enterprises (%), SMEs government incentives (%), SMEs bank loans (%), SMEs direct investments (%), SMEs export (%), SMEs employment (%) and SMEs R&D investments (%) were used in order to analyze the contribution of SMEs to economic development by regions. The three-dimensional evaluation results are also presented to ensure that the decision maker can easily understand.

In methods such as TOPSIS and GIS, experts in the relevant field are consulted and these coefficients are decided as a result of their opinions. There are no restrictions on the number of experts. We got the opinion of three experts. The biggest limitation on this subject is to find experts in the field. The experts we consulted found these coefficients appropriate. The scientific explanation of this expert opinion and the coefficients used are as follows:

The Boolean method is used to indicate whether each of the criteria to be used in mapping is either favorable or unfavorable for the existence of what the researcher is looking for. Also, the knowledge-driven approach tries to decide the appropriate criterion in a field of study based on expert knowledge and experience. Methods such as fuzzy logic or Dempster-Shafer belief functions are used and modelling is done. The data-driven approach is based on measuring the relationships between these criteria and known data. Some of these are statistical methods, regression, weights of evidence (WoE), neural networks, and data mining. The hybrid expert-guided data-driven approach combines two of the above approaches to take advantage of both methods. Therefore, an evaluation and scoring method is implemented based on the identified favorability (weights of evidence “WoE”) so that we can analyze the criteria in order to identify areas of high quality of life. Various evidence themes are used (in GIS’s specific language, an evidence theme is a vector or raster formula map or area layer used for estimating objects to be identified): highly favorable = 3; favorable = 2; less favorable = 1; and unfavorable = 0. The coefficients were determined by considering this hybrid method. These favorability scores are then added to a compilation (predictive) map. The third stage is the development of the predictive map. The predictive map is a combination of the spatial criteria values established and quantified during the preceding stages (Roy et al., 2006). Its aim is to provide a better understanding of the factors that control the quality of life distribution and to provide a picture of the potential of the cities and regions. In practice, this predictive map was obtained by adding up the various favorability scores for the criteria. In theory, it should enable us to find out the percentage of quality of life. Then location scores are calculated and illustrated on the last column as shown in Table 8. Based
on these variables, formula 1 is used for location scores, regardless of the type of sectors for each city.

The essential statistical information about the importance of SMEs in the economy of Turkey and other countries are presented in the second section. In this context, the regions are evaluated in terms of SMEs. Seven regions were analyzed in the GIS program using formula 2 below. The most current values of these indicators for each region are taken into account in the calculations and analysis. Experts weighted all indicators equally. Therefore, the scores of the regions are obtained by calculating the arithmetic mean of the indicator values of each regions.

\[ \frac{\text{Share in the total SME enterprises} \times \%}{\text{Share in the total SME Government incentives} \times \%} + \text{Share in the total SME bank loans} \times \% + \text{Share in the total SME direct investments} \times \% + \text{Share in the total SME export} \times \% + \text{Share in the total SME employment} \times \% + \text{Share in the total SME R & D investments} \times \%}{7} \] (2)

3.2. TOPSIS (Technique for Order Preference by similarity to ideal solution)

TOPSIS (Technique for Order Preference by Similarity to Ideal Solution) was developed by Yoon (1980). It involves a 6-step solution process. The steps of the TOPSIS method are described below (Yoon, 1980).

Step 1. In the rows of the decision matrix, there are decision points whose superiorities are to be listed, and in the columns, there are evaluation factors to be used in decision making. Matrix A is the initial matrix created by the decision maker. The decision matrix is shown as formula 3:

\[ A = \begin{bmatrix} a_{11} & a_{12} & \cdots & a_{1n} \\ a_{21} & a_{22} & \cdots & a_{2n} \\ \vdots & \vdots & \ddots & \vdots \\ a_{m1} & a_{m2} & \cdots & a_{mn} \end{bmatrix} \] (3)

Step 2. Creating the Standard Decision Matrix (R)

The Standard Decision Matrix is calculated by using the elements of matrix A and the following formula 4:

\[ r_{ij} = \frac{a_{ij}}{\sqrt{\sum_{j=1}^{n} a_{ij}^2}} \] (4)

The matrix R is defined by the matrix shown below:

\[ R = \begin{bmatrix} r_{11} & r_{12} & \cdots & r_{1n} \\ r_{21} & r_{22} & \cdots & r_{2n} \\ \vdots & \vdots & \ddots & \vdots \\ r_{m1} & r_{m2} & \cdots & r_{mn} \end{bmatrix} \] (5)

Step 3. Creating the Weighted Standard Decision Matrix (V) First, the weight values \( w_i \) of the evaluation factors are determined (\( \sum_{i=1}^{n} w_i = 1 \)). Then the elements in each column of the R matrix are multiplied by the corresponding \( w_i \) value to form the V matrix. The V matrix is shown below:

\[ V = \begin{bmatrix} w_1 r_{11} & w_2 r_{12} & \cdots & w_{\max} r_{1n} \\ w_1 r_{21} & w_2 r_{22} & \cdots & w_{\max} r_{2n} \\ \vdots & \vdots & \ddots & \vdots \\ w_1 r_{m1} & w_2 r_{m2} & \cdots & w_{\max} r_{mn} \end{bmatrix} \] (6)

Step 4. Creating ideal (A’) and negative ideal (A’) solutions:

Finding the ideal solution set is shown in the following formula 7:

\[ A’ = \left\{ \max_{i} v_{ij} | j \in J \right\}, \left\{ \min_{i} v_{ij} | j \in J \right\} \] (7)

Figure 5. Three dimensional graphical representation of the location scores.
Area Table 7. Geographical (spatial) and socio-economical (semantic) data of marmara region.

| Name of City | Geographical Coordinates (X, Y) | Population | Density of % in City Center | Current Area (km²) | Population Densities (Scores) | Developed GIS Location Scores (Scores) | Health (Scores) | Safety (Scores) | Urban Life (Scores) | Education (Scores) | Economy (Scores) | Development (Scores) | Quality of Life (Scores) | Art. Life | Social Equity (Scores) | Life Expectancy (Scores) |
|--------------|----------------------------------|-------------|-----------------------------|-------------------|-----------------------------|----------------------------------------|----------------|----------------|-------------------|-------------------|-----------------|---------------------|-------------------------|-----------|----------------------|-------------------------|
| Bilecik      | 29.0651 40.7643                  | 11087       | 2605495                     | 48.3              | 250                          | 88                                     | 95            | 53             | 76                | 98                | 98              | 99                  | 94                      | 74        | 45                   | 74                      |
| Çanakkale    | 26.4154 40.1483                  | 10201       | 508769                      | 48.3              | 54                           | 22                                     | 95            | 68             | 25                | 95                | 99              | 99                  | 94                      | 74        | 45                   | 74                      |
| Edirne       | 26.4554 40.1833                  | 6241        | 390428                      | 43.4              | 64                           | 31                                     | 94            | 68             | 25                | 95                | 99              | 99                  | 94                      | 74        | 45                   | 74                      |
| Kirklareli   | 26.0651 40.7643                  | 3635        | 1560138                     | 50.3              | 37                           | 2441                                   | 81            | 75             | 40                | 95                | 99              | 99                  | 94                      | 74        | 45                   | 74                      |
| Kocaeli      | 29.0651 40.1833                  | 847         | 203741                       | 50.3              | 241                          | 34                                     | 96            | 75             | 40                | 95                | 99              | 99                  | 94                      | 74        | 45                   | 74                      |
| Kocaeli      | 29.0651 40.1833                  | 847         | 203741                       | 50.3              | 241                          | 34                                     | 96            | 75             | 40                | 95                | 99              | 99                  | 94                      | 74        | 45                   | 74                      |
| Kocaeli      | 29.0651 40.1833                  | 847         | 203741                       | 50.3              | 241                          | 34                                     | 96            | 75             | 40                | 95                | 99              | 99                  | 94                      | 74        | 45                   | 74                      |
| Yalova       | 29.0651 40.1833                  | 847         | 203741                       | 50.3              | 241                          | 34                                     | 96            | 75             | 40                | 95                | 99              | 99                  | 94                      | 74        | 45                   | 74                      |

The set calculated from formula (7) can be shown as $A^+ = \{v_1, v_2, ..., v_n\}$. The set of negative ideal solutions is formed by selecting the smallest of the weighted evaluation factors in the V matrix. Creating the negative ideal solution set is shown in the following formula 8.

$$A^- = \{(\min_{j \in J} v_j), (\max_{j \in J} v_j)\}$$

Step 5. In the TOPSIS method, Euclidian Distance Approach is used to find the deviations of the evaluation factor value for each decision point from the ideal and negative ideal solution set. The calculation of the ideal discrimination ($S_i^+$) measure is shown in formula (9) and the calculation of the negative ideal discrimination ($S_i^-$) measure is shown in formula (10):

$$S_i^+ = \sqrt{\sum_{j=1}^{n} (v_j - v_i^+)^2}$$

$$S_i^- = \sqrt{\sum_{j=1}^{n} (v_j - v_i^-)^2}$$

Step 6. The ideal and negative ideal separation measures are used to calculate the proximity ($C_i^+$) of each decision point relative to the ideal solution. The calculation of the proximity to the ideal solution is shown in the following formula 11:

$$C_i^+ = \frac{S_i^-}{S_i^+ + S_i^-}$$

The value $C_i^+$ is in the range $0 \leq C_i^+ \leq 1$ and $C_i^+ = 1$ indicates the absolute proximity of the corresponding decision point to the ideal solution, and $C_i^+ = 0$ indicates the absolute proximity of the corresponding decision point to the negative ideal solution.

4. Results

GIS location scores for each city were calculated by using formula 1 to generate visual outputs. All values are shown in the appendix. The GIS location scores are presented as two and three-dimensional graphics. These graphs are shown in Figure 4 and Figure 5.

Table 7 shows the values of the Marmara region where has the highest quality of life score.

When Figures 4 and 5 are evaluated, Istanbul, Bursa and Kocaeli in the Marmara, Izmir in the Aegean, Ankara and Konya in Central Anatolia, Antalya, Mersin and Adana in the Mediterranean have higher scores compared to other cities. The cities with the highest scores are Istanbul and its neighboring cities. It is seen that the scores decrease from the center of the country to the east. High scores are seen in the ten most populous cities of the country. The remaining 71 cities have very low scores. Almost all of these cities are in the Black Sea, Eastern Anatolia, and Southeast Anatolia.

The two and three dimensional presentation of the Marmara region produced by GIS is shown in Figure 6 and Figure 7:

When we compare the regions with each other, Marmara is the one that has the highest score. When Figures 6 and 7 are evaluated, the main reason is that Istanbul has a quite high score than other cities. In addition, neighbor cities of Istanbul have high scores.
The same criteria (economic, development and quality of life) and data were evaluated by using the TOPSIS method. The scores of cities and ranking are shown in Table 8.

The criteria used in TOPSIS analysis are location score of closest city, location score of city, economy score, education score, health score, safety score, urban life score, culture – art score, life quality score, development score and population % in city center.

Table 9 presents the results of TOPSIS and GIS analysis related to the quality of life by the cities. It also shows the industrial share of the cities in each region (see Table 10).

According to the map, as shown in Figure 8, only two of the 14 cities in the Eastern Anatolia Region (Elazig and Erzurum) are on the list. In addition, Siirt is the only city on the list among the cities of Southeast Anatolia.

The indicators used in the analysis of SMEs, and their values for each region (KOSGEB, 2015, 2018; Ozdemir, ERSOZ, & SARIOGLU, 2007; TMMOB, 2017a, 2017b; Trade, 2019; TurkStat, 2019b) and GIS location scores calculated with formula 2 are as follows:

Figure 9 presents the two-dimensional map of GIS location scores regarding the contribution of SMEs to economic development by regions.

Figure 6. The location of the Marmara Region in Turkey (above) and the two-dimensional geographic demonstration of location scores.

Figure 7. Three-dimensional graphical representation of the location scores in Marmara Region.
5. Discussion

Quality of life assessment is an interesting and difficult issue. As stated in the literature review, many factors have been tried to explain by the quality of life. The study tries to show industrial investments in regions with a low quality of life. It also demonstrates that eastern cities have not been governed fairly in terms of industrial, innovation and R & D investments. Moreover, when the 11th development plan (2019–2023) is assessed, it is understood that this management style will continue. Large enterprises have not preferred to invest in the East, Southeast, Black Sea and the eastern parts of Central Anatolia so far. They also demand great support and incentives to make an investment there. This situation sharpens and deepens the current inequalities. Small and medium-sized enterprises may be an important source of development and employment for these underdeveloped regions. We stated that the success of SMEs in competitive markets, the source of development and employment for these undeveloped regions. Our study presents an important novelty in this respect. There is no significant amount of initial and long-term capital investment, and KOSGEB have not provided an effective portal for easy access to statistical data from 7 different sources for GIS analysis of SMEs. Unfortunately, TurkStat has not considered SMEs in its comparative method of GIS and TOPSIS. By visualizing the results on maps, it also aims to facilitate reader understanding. Also, the paper offers a detailed analysis of Turkey’s economy and demographic structure.

Table 8. Comparison of cities with TOPSIS method in terms of economic, development and quality of life in Turkey.

| City          | Score | Economic | Development | Quality of life |
|---------------|-------|----------|-------------|-----------------|
| Istanbul      | 0.657718 | 0.28635 | 0.217085 |
| Ankara        | 0.457107 | 0.284523 | 0.215797 |
| Izmir         | 0.43269 | 0.278722 | 0.210244 |
| Bursa         | 0.42083 | 0.278736 | 0.208764 |
| Konya         | 0.370138 | 0.276788 | 0.203684 |
| Antalya       | 0.356207 | 0.276355 | 0.201485 |
| Malatya       | 0.343389 | 0.27569 | 0.198739 |
| Adana         | 0.336922 | 0.274539 | 0.197412 |
| Kocaeli       | 0.335513 | 0.273733 | 0.19052 |
| Eskisehir     | 0.337784 | 0.273236 | 0.185854 |
| Balikesir     | 0.329492 | 0.260154 | 0.177658 |
| Bolu          | 0.319493 | 0.260001 | 0.174302 |
| Mersin        | 0.317811 | 0.258811 | 0.17209 |
| Tekirdag      | 0.314982 | 0.25543 | 0.171853 |
| Sakarya       | 0.31411 | 0.252109 | 0.163412 |
| Isparta       | 0.310468 | 0.250362 | 0.160634 |
| Manisa        | 0.309698 | 0.247483 | 0.156191 |
| Kirkilareli   | 0.309642 | 0.244686 | 0.154081 |
| Denizli       | 0.306992 | 0.243527 | 0.151431 |
| Kayseri       | 0.307379 | 0.240709 | 0.148642 |
| Duzece        | 0.302901 | 0.240486 | 0.14525 |
| Mugla         | 0.300756 | 0.240196 | 0.13348 |
| Usak          | 0.298298 | 0.237522 | 0.127065 |
| Edirne        | 0.294995 | 0.227859 | 0.125983 |
| Kutahya       | 0.294231 | 0.227145 | 0.113046 |
| Kirikkale     | 0.292833 | 0.223992 | 0.0716531 |
| Canakkale     | 0.289223 | 0.221483 | 0.0713005 |

There are 370 140 SMEs in the manufacturing industry in Turkey. These account for 61.5% of manufacturing industry employment. It has a share of only 26.9% of the value-added. On the other hand, large enterprises (2,460) account for 0.7% of the total number of enterprises and 39.5% of employment. They contribute 73.1% to the value-added. These data show that the SME legend does not provide a sufficient economic contribution in Turkey. In medium-sized enterprises, the added value is $1,860,013 per facility and $10,274 per person. These values increase in large enterprises. The added value is $41,222 per facility, while it is $4,703 per employee. When European countries are considered, these values increase by 4–6 times (KOSGEB, 2016). Hence, it is observed that SMEs generally produce low-value-added products in Turkey. Therefore, large-scale enterprises producing high-value-added products are also required for the development of the regions and cities.

The share of SMEs in total loans is 19% in Turkey. These rates are 39.8% in the USA; 37.1% in Germany; 25.3% in India; 54.1% in Japan; 28% in the UK; In South Korea, 51%; 50.3% in France; 37% in Italy and 52.3% in Greece (OECD, 2019). These countries mostly have low-interest rates and long term loans. In Turkey, the interest rates are high, and the maturity period is too short compared to these countries.

One of the biggest limitations of the study is to reach the experts who decide the coefficients in the formula used in GIS analysis. Because it takes a long time to find experts in the field of subject and get their opinions. Another limitation is that statistical data cannot be obtained from only one source. Statistical information of the regions was obtained from 7 different sources for GIS analysis of SMEs. Unfortunately, TurkStat and KOSGEB have not provided an effective portal for easy access to appropriate data yet.

Turkey’s sustainable growth and regional development of the cities have not been considered together by assessing the quality of life and the contribution of SMEs so far. Even though Turkoglu (2015) has proposed indicators, there is not still any study providing evaluation and suggestions. Our study presents an important novelty in this respect. There is no study examining the quality of life and SME activities in eastern Turkey. In this context, the study proposes a significant novelty with the comparative method of GIS and TOPSIS. By visualizing the results on maps, it also aims to facilitate reader understanding. Also, the paper offers a detailed analysis of Turkey’s economy and demographic structure.
| Cities     | Industry share (%) in its region | Ranking in Turkey by TOPSIS Scores | GIS Location Region |
|------------|----------------------------------|------------------------------------|---------------------|
| Istanbul   | 65                               | 1                                  | 100                 |
| Bursa      | 17                               | 4                                  | 62.2                |
| Kocaeli    | 5                                | 9                                  | 50.3                |
| Tekirdag   | 3                                | 14                                 | 47.6                |
| Balikesir  | 3                                | 11                                 | 48.3                |
| Sakarya    | 2                                | 15                                 | 46.7                |
| Canakkale  | 1                                | 27                                 | 43.4                |
| Kirkkareli | 1                                | 18                                 | 45.2                |
| Edirne     | 1                                | 24                                 | 44.6                |
| Bilecik    | 1                                | 50                                 | 34.1                |
| Yalova     | 1                                | 7                                  | 51.1                |
| Izmir      | 37                               | 3                                  | 64.3                |
| Denizli    | 18                               | 19                                 | 45                  |
| Manisa     | 11                               | 17                                 | 45.4                |
| Usak       | 9                                | 23                                 | 44.1                |
| Ayfyon     | 7                                | 31                                 | 41.8                |
| Aydin      | 7                                | 33                                 | 41.1                |
| Mugla      | 6                                | 22                                 | 44.6                |
| Kutahlya   | 5                                | 25                                 | 43.9                |
| Adana      | 25                               | 8                                  | 50.1                |
| Mersin     | 19                               | 13                                 | 47.7                |
| Antalya    | 16                               | 6                                  | 52.8                |
| Hatay      | 13                               | 63                                 | 27.9                |
| Kahramanmaras | 11                          | 61                                 | 28.3                |
| Burdur     | 6                                | 46                                 | 36.1                |
| Isparta    | 6                                | 16                                 | 46                  |
| Osmaniye   | 4                                | 64                                 | 27.6                |
| Samsun     | 19                               | 28                                 | 43.1                |
| Duuzce     | 10                               | 21                                 | 44.7                |
| Trabzon    | 10                               | 29                                 | 42.9                |
| Corum      | 10                               | 57                                 | 31.2                |
| Bolu       | 7                                | 52                                 | 48.8                |
| Kastamonu  | 6                                | 44                                 | 36.6                |
| Ordu       | 5                                | 41                                 | 38.2                |
| Rize       | 5                                | 30                                 | 41.9                |
| Amasya     | 4                                | 36                                 | 40.4                |
| Tokat      | 4                                | 45                                 | 36.4                |
| Zonguldak  | 4                                | 40                                 | 38.4                |
| Karabuk    | 4                                | 53                                 | 32.6                |
| Sinop      | 3                                | 38                                 | 39                  |
| Giresun    | 3                                | 35                                 | 40.7                |
| Bartin     | 3                                | 58                                 | 30.8                |
| Gumushane  | 1                                | 49                                 | 35.6                |
| Artvin     | 1                                | 48                                 | 35.8                |
| Bayburt    | 1                                | 65                                 | 25.6                |
| Gaziantep  | 65                               | 43                                 | 37.5                |
| Sanliurfa  | 10                               | 56                                 | 31.4                |
| Diyarbakir | 9                                | 55                                 | 31.6                |
| Adiyaman   | 6                                | 67                                 | 24.8                |
| Batman     | 4                                | 72                                 | 22.1                |
| Mardin     | 3                                | 66                                 | 25.4                |
| Kilsa      | 1                                | 69                                 | 23.9                |
| Sirt       | 1                                | 74                                 | 21.6                |
| Sirnak     | 1                                | 79                                 | 17.1                |
| Cankiri    | 1                                | 39                                 | 38.9                |
| Kirsehir   | 1                                | 37                                 | 40.3                |
| Malatya    | 29                               | 47                                 | 35.9                |
| Elazig     | 18                               | 54                                 | 32.3                |
| Erzurum    | 13                               | 51                                 | 33.2                |
| Erzincan   | 9                                | 68                                 | 24.3                |
| Van        | 9                                | 60                                 | 30.1                |
| Agri       | 5                                | 80                                 | 11.5                |
| Kars       | 3                                | 70                                 | 23.7                |
| Bingol     | 3                                | 78                                 | 19.3                |
| Bitlis     | 3                                | 71                                 | 22.4                |
| Ardahan    | 2                                | 77                                 | 19.7                |
| Mus        | 2                                | 81                                 | 10.4                |
| Igdir      | 2                                | 75                                 | 20.8                |
| Hakkari    | 1                                | 76                                 | 20.3                |
| Tunceli    | 1                                | 73                                 | 21.8                |
Table 10. Contribution of SMEs to Economic Development and GIS location scores by region.

| Region            | Marmara | Aegean | Central Anatolia | Mediterranean | Black Sea | Eastern Anatolia | Southeastern Anatolia |
|-------------------|---------|--------|------------------|---------------|-----------|------------------|-----------------------|
| Share in the total SME enterprises (%) | 32.8    | 15.25  | 18.62            | 12.42         | 11.32     | 5.87             |
| Share in the total SME Government incentives (%) | 27.72   | 14.58  | 21.52            | 12.03         | 12.39     | 5.11             | 6.65                  |
| Share in the total SME bank loans (%) | 44.9    | 13.4   | 19.1             | 13.1          | 4.1       | 1.2              | 4.2                   |
| Share in the total SME direct investments (%) | 36.41   | 17.43  | 17.7             | 11.63         | 10.7      | 1.56             | 4.57                  |
| Share in the total SME export (%) | 65.9    | 11.8   | 7.8              | 5.6           | 5.9       | 0.7              | 2.3                   |
| Share in the total SME employment (%) | 46.5    | 14     | 15.2             | 11.3          | 9         | 3.9              | 6.1                   |
| Share in the total SME R & D investments (%) | 42.6    | 14.2   | 16.8             | 13.7          | 8.4       | 1.83             | 2.47                  |
| GIS Scores        | 100     | 76.08  | 40.14            | 27.44         | 21.25     | 6.16             | 11.05                 |

Figure 8. The Map of Turkey’s Top 500 Industrial Enterprises (created by authors).

Figure 9. Two-dimensional map of GIS scores regarding the contribution of SMEs to economic development by regions.
6. Conclusion

The paper presents informations about Turkey's economic goals and opportunities by considering the 2023 strategic plan and statistics in the second section. The study also aims to inform all local or foreign investors related to many sectors. The development level and life quality of the city are very important issues for both investors and human resources. If a city has a bad score or impression on these issues, they prefer other alternative developed cities.

One of the objectives of this study is to make recommendations to country managers and researchers who will make similar studies for other countries by using TOPSIS and GIS in selection and ranking studies. There are 7 geographical regions and 81 cities in Turkey. Location scores of the nearest city, location scores of the city, economy scores, education scores, health scores, security scores, urban life scores, culture and art scores, quality of life scores, development scores, percentage of the population in the city center were utilized in order to assess the quality of life for cities. The data were obtained from the TurkStat Quality of Life Index for Cities (2015). Marmara Region is the best geographical region according to GIS - TOPSIS analyses. The ranking is Marmara, Central Anatolia, Aegean, Mediterranean, Black Sea, Southeast Anatolia, and Eastern Anatolia respectively. Istanbul (0.657718), Ankara (0.457107), İzmir (0.43269), Bursa (0.42083), Konya (0.370138), Antalya (0.356207), Yalova (0.343389), Adana (0.336922), Kocaeli (0.335513), and Eskisehir (0.333784) are the top ten cities with the highest quality of life scores. While Istanbul has the highest score with a significant difference, Ankara, İzmir, and Bursa have similar scores. There is a significant difference between these cities and the last 20 in terms of scores. 16 of the last 20 cities are in Eastern and Southeastern Anatolia.

Also, the regions were assessed by GIS analysis. Shares in the total SMEs enterprises (%), SMEs government incentives (%), SMEs bank loans (%), SMEs direct investments (%), SMEs export (%), SMEs employment (%), SMEs R&D investments (%) were used in order to evaluate the contribution of SMEs to economic development of regions. As a result of the analysis, Marmara (100) had the highest score again and Southeast Anatolia (11,05) and Eastern Anatolia (6,16) had the lowest score. The ranking of the seven regions in terms of the contribution of SMEs to their economies is as follows: Marmara (100), Aegean (76,08), Central Anatolia (40,04), Mediterranean (27,44), Black Sea (21,25), Southeastern Anatolia (11,05) and Eastern Anatolia (6,16). This ranking is the same as the results of GIS and TOPSIS analysis of quality of life except that the second and third place of Aegean and Central Anatolia regions change among themselves. The results of this analysis show that Eastern and Southeastern Anatolian economies are the least benefited regions from SMEs.

The indicators used to evaluate the innovative enterprise performances of the sectors are as follows: innovative enterprises, product and/or process innovative enterprises (including abandoned/suspended and ongoing activities), product innovative enterprises, process innovative enterprises, enterprises with abandoned/suspended innovation activities, enterprises with on-going innovation activities, organization and/or marketing innovative enterprises, organization innovative enterprises, and marketing innovative enterprises. According to the TOPSIS results, the ranking and scores of the sectors are as follows: scientific research and development (1); information and communication (0,64322); industry (0,42048); manufacturing (0,42048); advertising and market research (0,40896); wholesale trade, except of motor vehicles and motorcycles (0,36263); financial and insurance activities (0,28128); service (0,2623); architectural and engineering activities, technical testing and analysis (0,20353); water supply; sewerage, waste management and remediation activities (0,17842); mining and quarrying (0,1626); transportation and storage (0,10105); electricity, gas steam and air conditioning supply (0,03858). In Turkey, the most innovative sectors are scientific research and development, information and communication, industry, manufacturing, advertising, and market research. The number of companies operating in these sectors is not satisfactory in Eastern and Southeastern Anatolia. Unfortunately, there are not any R&D center and Technopark in 19 out of 24 cities in Eastern and Southeastern Anatolia. It is seen that almost all of these investments are made in Marmara, Central Anatolia, Aegean, and Mediterranean regions. There are remarkable inequalities between the eastern cities that make up %20 of the population and other western cities in terms of quality of life and SMEs' contribution to development. Policymakers need to put forward more efforts and attention to solving the social and economic problems of these cities. Improving the education system and living standards and increasing efforts for equal distribution of welfare will make more possible to reach Turkey's future goals. These efforts are essential for more sustainable economic growth and prosperity.

In these two regions, there are only 3 industrial companies that are on the list of Turkey's top 500 industrial companies. SMEs can contribute to development, economy, and employment through the presence and cooperation of large companies. Lack of large-scale enterprises in the eastern regions affects the development of SMEs in the regions and their contribution to regional and country development. SMEs are one of the most important solution alternatives that will increase the employment and quality of life in these regions. All developed economies mentioned in the article have accomplished their current economic and welfare goals by taking advantage of SMEs. Therefore, Turkey should determine and implement a systematic action plan that is appropriate for its potential in order to accomplish its 2023 goals.

Declarations

Author contribution statement

Ceren Erdin, Gokhan Ozkaya: Conceived and designed the experiments; Performed the experiments; Analyzed and interpreted the data; Contributed reagents, materials, analysis tools or data; Wrote the paper.

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