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An integrated AHP-TOPSIS framework for foreign direct investment in Turkey

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Abstract

Foreign direct investment (FDI) is seen as an essential part of development due to the contribution of the host country. Profits of FDI such as technology transfers, spillover benefits, and increasing competition have encouraged both of domestic firms and policymakers to attracting FDI. In the course of making investment decisions, foreign investors prefer countries that follow stable economic policies, achieve a certain level of development of financial structure, and have legal regulations that favour foreign capital. Turkey, one of the emerging market economies, met the challenges including but not limited to high inflation, diminishing growth rates, and currency depreciation. Even with its ongoing currency crisis, Turkey continues to remain a top pick for investors. From this point of view, this paper investigates the selection of the most suitable sector by taking into consideration the economic, political, and country factors for foreign investors. The proposed methodology for sector selection contains three stages. The criteria for FDI are defined from the current literature, and we narrow it down according to the opinions of the decision-making group. After that, the analytic hierarchy process method used to obtain the priority order of the criteria. Finally, we use the Technique for Order of Preference by Similarity to Ideal Solution method to rank the sectors in accordance with the evaluation criteria. Additionally, we perform a sensitivity analysis to observe the effects of possible changes in the weights of the criteria. We designate three prime criteria, which are political, economic, and country. The results indicate that political criterion have the highest weight and based on the results of stages, manufacturing sector is obtained as primer election industry.

KEYWORDS

AHP, developing countries, foreign direct investment, multi criteria decision making, TOPSIS

1 | INTRODUCTION

In an increasingly globalized world of economics, countries are in constant competition to gain an advantage over each other. Gigantic investments are being made into different industries in order to advance this economic competition. These are not only traditional ones such as agriculture, industry, and education but also complicated industries such as aviation, microchips, and robotics. However, although countries are making investments, in some cases, their local sources are insufficient. Countries procure the amounts in investments in order to provide additional needs and resources from foreign investors outside the country (Agenor, 2003). In order to achieve this, countries facilitate the direct capital inflow by removing the boundaries of foreign capital movements in time.

Foreign direct investment (FDI) is an investment made by a firm or individual in one country into business interests located in another country. Generally, FDI takes place when an investor establishes foreign business operations or acquires foreign business assets, including establishing ownership or controlling interest in a foreign company. According to Koyuncu (2017), the reason for the economic underdevelopment of some countries is the insufficiency of capital accumulation. In other words, as the national income is low in underdeveloped countries, there is not enough savings; therefore, no investment can be achieved at the desired level. Because low investment does not contribute to the country's capital accumulation, economic growth does not happen. Therefore, it is very important that FDI supports the economic growth of developing countries by contributing to capital deficiency. However, in addition to this definition and statement, FDI is also actualized from technological transfer, strategic partnership, and high-level information exchange between companies or countries (Balasubramanyam, Salisu, & Sapsford, 2018).

Data mining techniques have great importance in modern societies in order to find useful information especially decision-making process. Although most of the decision components are structured, decision-making process can be very complex for decision makers. Therefore data mining techniques are very important for closing gaps in decision-making processes. In recent years, data mining techniques have been significantly popular in the literature (Weber, Özöğür-Akyüz, & Kropat, 2009; Weber, Taylan, Akteke, & Uğur, 2007; Yerlikaya-Özkurt, Batmaz, & Weber, 2014). Therefore, new approaches such as data mining can be incorporated as a powerful toll to make better decisions.

In this study, the application will be implemented regarding FDIs in Turkey. The Turkish economy is one of the emerging market economies in the world. This economic growth is further increased by direct foreign capital investments in recent years. According to EY Attractiveness Survey Europe, Turkey became the seventh most popular FDI destination in Europe in 2017, up to three places from 2016. The country was home to 229 projects, up 66% year-on-year, and enjoyed a 3% share in all FDI projects across Europe. Up until 2002, total FDI into Turkey stood only at USD 15 billion, whereas the country has since attracted around USD 193 billion of FDI during the 2003–2017 period. During the past 15 years, the finance and manufacturing sectors have attracted the highest amount of FDI in Turkey (Turkey, 2017). In the literature, there are very few studies on the criteria that investors make investment decisions. Most of the studies have carried out for model estimation by combining investment data with various statistical analyses. Multi criteria decision making (MCDM) approaches are quite limited related with the FDI, and investment preferences will be guiding researchers in Turkey. The advantages of the proposed methodology to determine the most appropriate sector for FDI are as follows: (a) A hierarchical structure has been established in contrast to survey studies. (b) The importance of each criterion is determined by ease of use and accepted analytic hierarchy process (AHP) method. (c) By Technique for Order of Preference by Similarity to Ideal Solution (TOPSIS) method, closeness coefficient is measured in mathematical form for each alternative, and the values of the best and worst alternatives could be calculated. Initially, the criteria of foreign capital investments are obtained by asking the leading experts in the field with nominal grouping technique. After forming the hierarchical structure, weights are procured by AHP method. The priority of the sectors is acquired by applying the TOPSIS method. In this paper, we use AHP-TOPSIS methods in an integrated way. It is desired to minimize the errors that may occur from mathematical deviations.

The remainder of this paper is organized as follows. Section 2 comprises a literature review on FDI, AHP, and TOPSIS methods on investment problems. Section 3 presents the methods of AHP and TOPSIS. Section 4 gives the hierarchical structure of the problem and results of the integrated MCDM methods. Finally, conclusions are given in the last section.

2 | LITERATURE REVIEW

This section presents a summary of the literature on FDI and MCDM methods in foreign investment. As a result of the globalization, the technological cooperation has played a key role in the economic development of the nations. Unlike conventional approaches, the economic growth of countries cannot be realized independently from the rest of the world. In this pioneering contribution, Nelson and Phelps (1966), who introduced the technology diffusion model, disclose that the economic growth of developing countries is directly related to how adaptable they are to the new technologies currently used by developed countries. This adaptation can be achieved by many different methods, such as importing high-tech products or attracting FDI. Especially in developing countries, collaborations with multinational corporations provide an advantage to adaptation to new technologies. In his study, Findlay (1978) mentioned that FDIs have a clutch effect in the countries, where the investment is made and the benefits of the foreign firms' practices to the domestic companies. Borensztein, De Gregorio, and Lee (1998) examined FDIs affect economic growth in their experimental study. In their study, it is concluded that FDIs are more efficient than domestic investments. On the other hand, considering the country where the investment was made, it was seen that more efficient production was realized as a result of possible technology transfer and high competition. Nonetheless, another significant research has proven that the effect of FDI on the growth of the host country is dependent on the human capital of the nation (Deichmann, Karidis, & Sayek, 2003).

Literature search has shown that FDI is affected by both economic and political factors. However, until the study by Schneider and Frey (1985), determining factors in the literature are mentioned but political and economic factors are not considered together. In the studies that focus more on the political side and overlook economic factors, Bennett and Green (1972) investigated the effects of political instability, and Basi (1963) and Aharoni (1966) supported the view that political instability had a greater impact than all factors except market potential. In other respects, Dunning (1981) considered the economic factors such as market size, national income of the host country, and

workers' wages. Agarwal (1980) is another notable author who feature about economic determinants. In his work, he argued that all the significant criteria are economic except only political stability and threat of nationalization. In the model proposed by Schneider and Frey (1985), they considered that political and economic elements should be taken all together (Schneider & Frey, 1985). The political and economic factors proposed by Schneider and Frey (1985) are listed in below:

- The higher GNP per capita, the better is the nation's economic health, and the better are the prospects that direct investment will be profitable.
- A high rate of growth of GNP is an indicator of a good development potential in the future.
- A high rate of inflation is a sign of internal economic tension.
- A large deficit in the balance payments indicates that the country lives beyond its means.
- The lower wage costs are the more profitable it is directly to invest in the country.
- For direct investment to be worthwhile, a skilled work force is needed.
- Political instability may disturb the economic process and affect foreign investment.
- The more left wing the host government's ideology, the more likely it will be that the foreign direct investor runs into trouble.
- The larger the percentage of aid received by a country form the communist bloc, the less will foreign direct investors be inclined to invest in the country.
- Conversely, a large amount of aid from western countries is conducive to more FDI.
- The host country's economic and political position may be eased by multilateral aid.

This model is considered as the most comprehensive model and widely accepted in the literature. It contains some factors that are valid during the Cold War period. For example, the importance of foreign aid from the communist bloc or west are justified hypothesis for that period, but this hypothesis is not valid nowadays.

Economic development is mainly the result of profitable investments. They are principally divided into domestic investments and foreign investments. Besides, foreign investments could be treated in two ways as direct and portfolio. Foreign investment of any kind may not be the desired one for nations. For instance, short-term loans and portfolio investments could initiate chains that drive emerging economies into crises. For this reason, it is important for countries to give priority to FDI. It has been stated that countries should be attentive about capital inflows other than direct investments. Direct investments are found to be more resistant to crises (Busse & Hefeker, 2007). At the beginning of the 1980s, Turkey has shifted from imported substitution policies to export-oriented growth policy; thus, foreign investments have become an indispensable element for the Turkish economy (Coskun, 2001). Up until 2002, total FDI into Turkey stood only at USD 15 billion, whereas the country has since attracted around USD 193 billion of FDI during the 2003–2017 period (Turkey, 2017). Coskun (2001) identified in his study as the three most important factors in investment in Turkey, respectively: the performance of the Turkish economy, the potential of the local market, and cheap inputs. Cambazoglu and Simay Karaalp (2014) examined the effects of FDIs on the Turkish economy. They found a positive relationship between economic growth and FDIs. Turkey has received FDI up to 25% of GDP in 2010 as its peak (Turkey, 2017). Geyikdağı and Karaman (2013) agreed that the quality of FDIs that increased in recent years. They found that if inflows are evaluated carefully, it is seen that more than 60% of these inflows consist of private mergers and acquisitions undertakings or purchases of privatized public enterprises. Because such FDI inflows do not create new production facilities, their contribution to the economy is very limited. When we look at the literature related to Turkey particularly Oktay's (1996), Tuncer's (1996), and Onaner's (1998) studies, criteria for foreign investment can be summarized as follows:

- High inflation
- Economic and political instability
- Defaults by governments
- High credit costs
- Frequent changes in rules
- Lack of protection of intellectual property and competition
- Lack of implementation of inflation accounting
- Excessive bureaucracy
- High uncertainty
- Acts of terrorism
- Failure to respect international agreements
- Informal economy
- Excessive government interference and involvement in the economy

AHP and TOPSIS methods are applied both in single and combined approaches in foreign investment problems. Abid and Bahloul (2011) presented AHP and goal programming methodology to evaluate attractiveness of seven Middle East and North Africa (MENA) countries for foreign portfolio investment. Jensen (1987) developed a new approach using AHP method based on expert decisions to evaluate alternative projects about risk management in foreign investment projects. Li and Sherali (2003) enhanced a framework for FDI opportunities in China's Tumen River Area together with AHP method. Oztaysi (2014) determined the most suitable content management system performing an integrated AHP and Grey-TOPSIS methodology. Lee, Yang, Chen, and Chen (2011) analysed the decisions of Taiwanese biotech firms in the foreign investment modes taking into account factor analysis, AHP, genetic algorithm, and fuzzy integral. Deng, Wang, and Yeo (2017) evaluated the selected four Chinese free trade port area by using fuzzy AHP and fuzzy TOPSIS methods. Lin and Tsai (2010) present a fuzzy MCDM method based on ANP and TOPSIS in selection of directly foreign investment on new hospitals in China. Kaur, Singh, and Majumdar (2018) analysed the outsourcing

and offshoring decisions by a fuzzy MCDM model. Levary and Wan (1999) developed a decision-making tool by integrating simulation into the AHP for ranking entry mode selection to a multinational firm. López-Duarte and Vidal-Suárez (2010) pointed out language diversity as the main criteria for entry mode selection by using a database collecting 334 FDIs for Spanish companies. Li and Rugman (2007) examined both entry mode selection and location selection to FDI by real options models. Suyanto, Salim, and Bloch (2009) applied using the stochastic frontier approach to investigate productivity in Indonesian chemical and pharmaceutical sectors between the period 1988 and 2000. Kara, Özmen, and Weber (2019) modelled a robust portfolio optimization problem by using a mathematical approach considering uncertainty.

As a result of the literature review, the following research gaps have been identified, and this study develops a methodology for the researchers focusing on FDI decisions and tries to address the FDI with a MCDM perspective.

- Limited work on decisions to determine the most appropriate sector for FDI.
- For FDI, a quantitative approach based on statistical analysis is often followed.
- There are almost no studies involving the evaluations of decision makers for FDI.

3 | SOLUTION METHODOLOGY

It is necessary to overcome the insufficient capital to ensure the economic growth for developing countries such as Turkey. In line with this objective, it is of great importance to attract FDIs that increase the competitiveness and economic efficiency. From foreign investors' point of view, it is necessary to plan which sector to invest and determine the factors that will affect the investment decision. This not only affects the growth and development of the country where the investment is made but also provides various advantages within the country or the company that makes the investment. Progressively, companies cohere in FDI to lower production costs. Although organizations can import low-cost raw materials, they cannot gain leverage of cheaper labours in another country if companies manufacture from their home countries. Aside from apprehension of trade barriers and production costs, producing locally through FDI assist companies put their finger on the pulse of local market trends. Even as free trade has become more widespread, national protectionism may still arise from time to time. In this section, the integrated framework for the determination of the most convenient industry for FDI is explained. The integrated MCDM methodology of AHP and TOPSIS methods are used to determine the best sector selection. Initially, AHP and TOPSIS methods are used to specify the weight of the criteria. Thereafter, TOPSIS method is used to rank alternative sectors in Turkey. The detailed research framework of the solution methodology discussed is shown in Figure 1.

3.1 | AHP method

AHP was developed by Saaty in (1980) as a model to solve decision problems. AHP ensures that both quantitative and qualitative variables can be evaluated together considering the priorities of the decision makers. The stages in the AHP process can be summarized as follows:

- The goal of problem is defined.
- The framework of the decision hierarchy is drawn according to the alternatives.
- Pairwise comparison of the criteria is made, and the pairwise comparison matrix is structured.
- The benchmark weights are obtained from the pairwise comparison matrix.
- The consistency of the determined benchmark weights is calculated.

The steps of the method can be given in the following:

Step 1: Structuring a decision situation into a goal, decision criteria, and alternatives.

Step 2: Constructing a questionnaire and collecting data. The comparisons are made for each criterion and converted into quantitative numbers using linguistic terms.

Step 3: Generating pairwise comparisons for various criteria.

Step 4: Determining respective weights of each criteria.

Step 5: Conducting a consistency analysis. The consistency ratio is calculated based on the following steps (Noorul Haq & Kannan, 2006b, 2006a):

i. The consistency index (CI) is determined through

$$CI = \frac{\lambda_{\max} - n}{n - 1}, \tag{1}$$

where $\lambda_{\max}$ is the maximum eigenvalue of the judgement matrix.

ii. Then, the final consistency ratio (CR) is obtained from

$$CR = \frac{CI}{RI}. \tag{2}$$

3.2 | TOPSIS method

The TOPSIS is a multicriteria decision analysis method, which was originally developed by Hwang and Yoon in 1981 with further developments by Yoon in 1981. The method is based on the concept that chosen alternative should have the shortest distance from the positive ideal solution (PIS) and the longest distance from the negative ideal solution (NIS). The TOPSIS method is often used in that it is easy to calculate, understandable, and allows the evaluation of the performances of alternatives with simple mathematical models. The main steps of the TOPSIS method are given as follows:

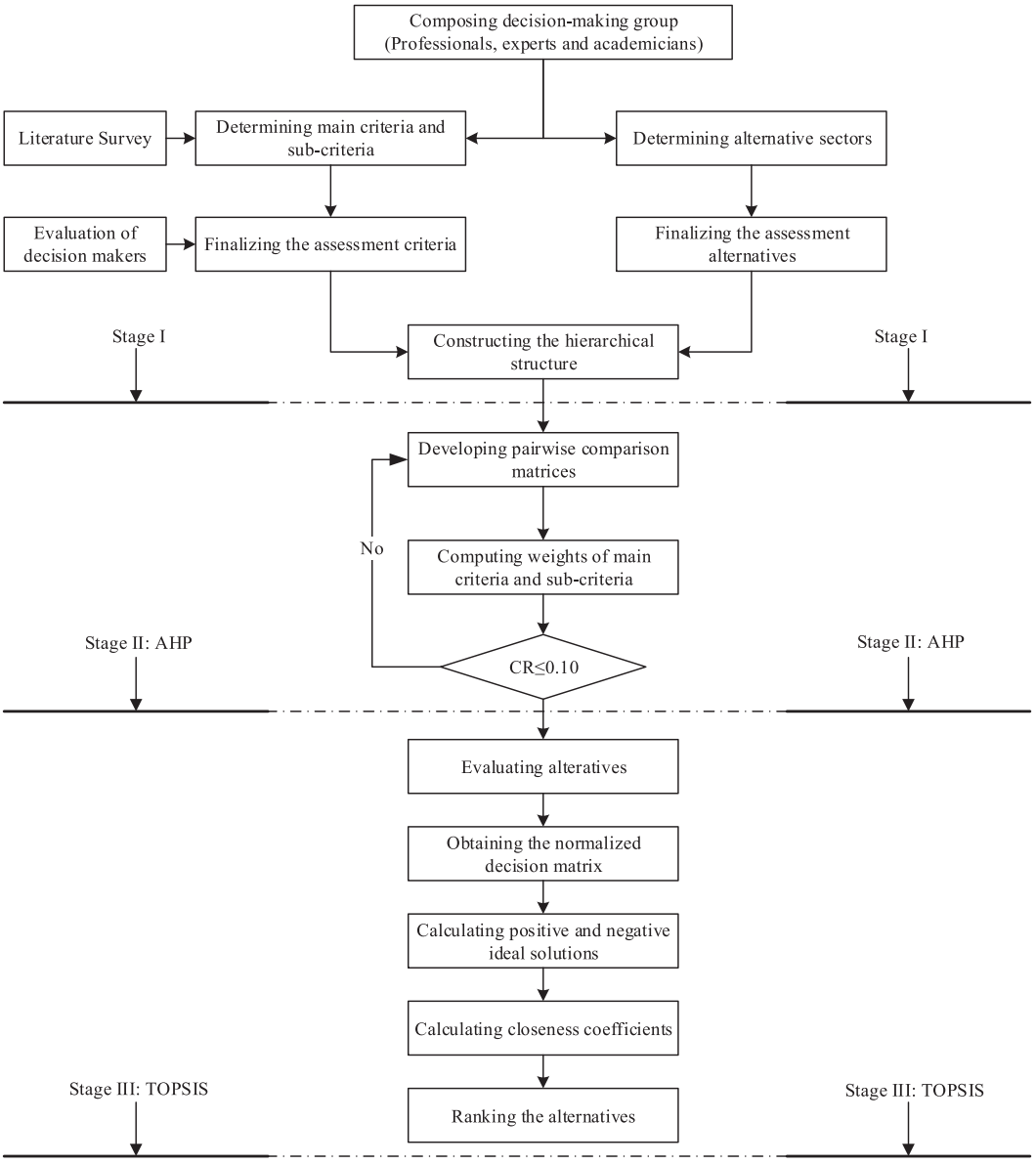


FIGURE 1 Stages of proposed solution methodology

Step 1: Let us consider a set of m alternatives, a set of n criteria, and a set of k decision maker. Decision matrix $D = [x_{ij}]$ is constructed.

$$D = \begin{array}{c} \\ A_1 \\ A_2 \\ \cdots \\ A_m \end{array} \begin{array}{c} \begin{array}{cccc} C_1 & C_2 & \cdots & C_n \end{array} \\ \begin{bmatrix} x_{11} & x_{12} & \cdots & x_{1n} \\ x_{21} & x_{22} & \cdots & x_{2n} \\ \cdots & \cdots & \cdots & \cdots \\ x_{m1} & x_{m2} & \cdots & x_{mn} \end{bmatrix} \end{array}. \tag{3}$$

x_{ij} is the performance rating of alternative A_i with respect to criterion C_j.

Step 2: The normalized decision matrix denoted by $R = [r_{ij}]$ and can be represented as

$$R_{ij} = \begin{bmatrix} r_{11} & r_{12} & \cdots & r_{1n} \\ r_{21} & r_{22} & \cdots & r_{2n} \\ \cdots & \cdots & \cdots & \cdots \\ r_{m1} & r_{m2} & \cdots & r_{mn} \end{bmatrix},$$

$$r_{ij} = \frac{x_{ij}}{\sqrt{\sum_{k=1}^{m} x_{kj}^2}}, i = 1,2,\ldots,m; j = 1,2,\ldots,n. \tag{4}$$

Step 3: The weighted normalized decision matrix $V = [v_{ij}]$ is computed as

$$V_{ij} = \begin{array}{c} v_{ij} = r_{ij} \cdot w_i. \\ \begin{bmatrix} w_1 r_{11} & w_2 r_{12} & \cdots & w_n r_{1n} \\ w_1 r_{21} & w_2 r_{22} & \cdots & w_n r_{2n} \\ \cdots & \cdots & \cdots & \cdots \\ w_1 r_{m1} & w_2 r_{m2} & \cdots & w_n r_{mn} \end{bmatrix} \end{array}, \tag{5}$$

where w_i is the weight of the ith criterion.

Step 4: Positive ideal solution (PIS, A^*) and negative ideal solution (NIS, A^-) can be calculated as

$$A^* = \left\{ \left(\max_i v_{ij} \middle| j \in B \right), \left(\min_i v_{ij} | j \in C \right) \right\}, \quad (6)$$

$$A^- = \left\{ \left(\min_i v_{ij} \middle| j \in B \right), \left(\max_i v_{ij} | j \in C \right) \right\}. \quad (7)$$

Step 5: The distances from PIS and NIS for each alternative are calculated as

$$d_i^* = \sqrt{\sum_{j=1}^{n} \left(v_{ij} - v_j^* \right)^2}, i = 1,2,\ldots,m;\ j = 1,2,\ldots,n, \quad (8)$$

$$d_i^- = \sqrt{\sum_{j=1}^{n} \left(v_{ij} - v_j^- \right)^2}, i = 1,2,\ldots,m;\ j = 1,2,\ldots,n, \quad (9)$$

respectively, where $d(.,.)$ is the distance between two numbers and computed by Vertex method.

Step 6: The closeness coefficient of each alternative is calculated by

$$CC_i = \frac{d_i^-}{d_i^- + d_i^*},\ i = 1,2,\ldots,m. \quad (10)$$

The alternatives are ranked in descending order of the CC_i index.

4 | APPLICATION OF THE PROPOSED FRAMEWORK FOR FDI

In this section, the proposed method has been applied in order to determine the most suitable sector in the Turkish economy by using the theoretical information described in the previous sections. First, the main criteria and subcriteria to be included in the evaluation are clarified as a result of expert interviews. Then, the benchmark weights were determined by the AHP method, and the results were analysed for the industries using TOPSIS method to determine the most suitable sector.

4.1 | Determination of criteria and alternatives

In the first phase of the application, evaluation criteria and alternatives should be determined, and the hierarchical structure of the problem should be established. In this respect, firstly, five different experts (academicians, investment experts, and financial expert) were surveyed to determine the main and subcriteria importance for FDI. In the questionnaire, experts were asked to score between 1 and 5 according to the main criteria and subcriteria in order of importance, and the criteria were chosen according to the total score. According to the results of the survey, the criteria with high total score formed the input hierarchy entries to be used in the FDI for the sector selection. In Figure 2, all the criteria that affect the investment decision determined by the experts and all the subcriteria related to these criteria are given. The abbreviations shown in the figure are given below, and their descriptions are as follows:

Economic factors:

High inflation (C11): High inflation is one of the most fundamental problems in Turkey's economy, and it has become chronic over the years. This situation affects both foreign investments and domestic investments extremely (Ok, 2004).

Exchange rate (C12): In many studies, there is a significant correlation between exchange rate and FDI (Bénassy-Quéré, Fontagné, & LahrÈche-Révil, 2001). The situation is not different in Turkey.

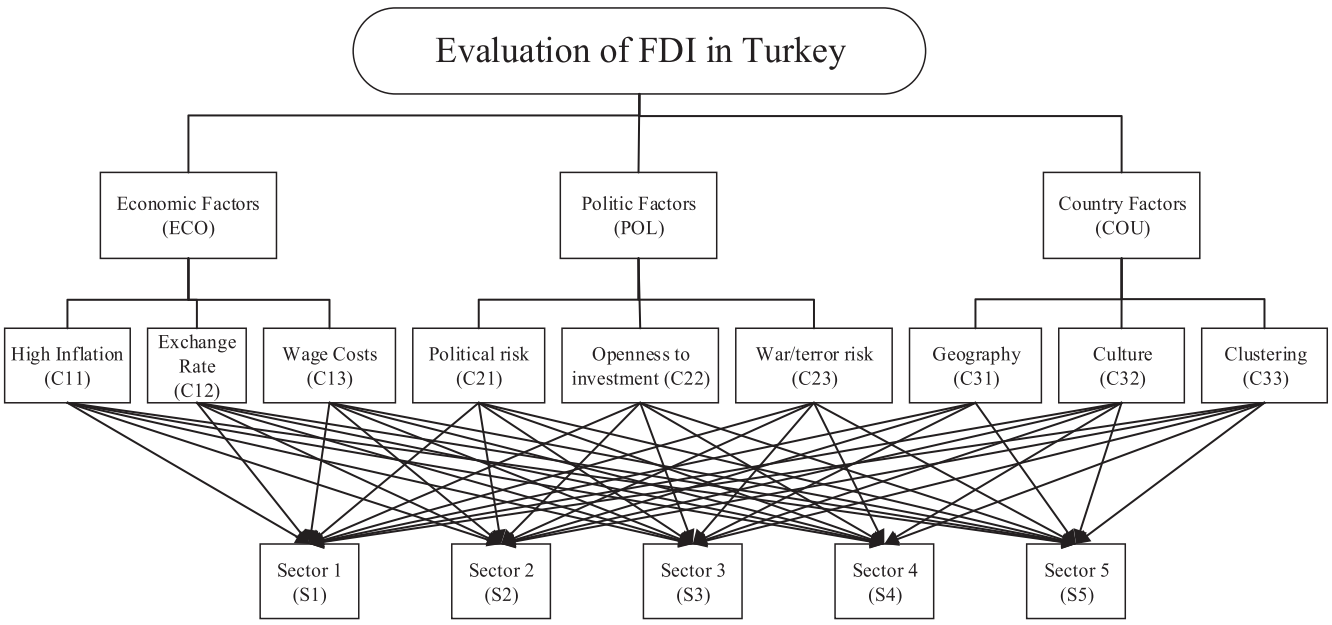


FIGURE 2 Hierarchical structure of foreign direct investment (FDI)

Wage costs (C13): Low employee wages are also an important factor for FDIs. Coskun (2001) found this to be the fourth most important factor in his study.

Political factors:

Political Risk (C21): In many studies, it has been found that there is a very strong relationship between political risk and FDI. It consists of many factors, including corruption, military intervention in politics, ethnic, or religious conflicts. Political risks in developing countries are the most important factors affecting FDI (Busse & Hefeker, 2007).

Openness to investment (C22): Turkish economy has experienced many liberalization movements since the early 1980s. But still, the difficulty of doing business in Turkey may arise as a barrier.

War/terror risk (C23): Turkey is a North Atlantic Treaty Organization (NATO) member whose borders start in Europe and end in the Middle East. Its geopolitical position and the rising heat of the region will continue to be a factor affecting investments.

Country factors:

Geography (C31): In today's world where trade is now made globally, the geographic position of countries has gained importance again. Today, China considers its distance from Europe as a disadvantage and invests heavily in railway transportation. Geography comprise of many elements such as security, proximity to raw materials, and logistical facilities (Chen & Chen, 1998).

Culture (C32): Many studies show that firms look at the human resources of the country they are going to invest in. If the host country cannot provide enough qualified human capital, this becomes a very serious disadvantage (Blanton & Blanton, 2007).

Clustering (C33): Previous investments in any sector in a country have the potential to attract potential investments (De Propris & Driffield, 2006).

After the evaluation criteria were determined, five major sectors, namely, S1: wholesale and retail, S2: energy, S3: information and communication technologies, S4: finance and banking, and S5: manufacturing, were evaluated according to the proposed methodology.

4.2 | Obtaining of criteria weights: AHP stage

The hierarchical structure of the problem has been established as the main criteria and subcriteria related to these criteria as in Figure 2. After applying the expert opinion to determine the selection criteria, MS Excel program was used to solve the method. After the preparation phase, a decision-making group consisting of five experts (academicians, investment experts, and financial expert) evaluated the criteria and sectors. The linguistic variables shown in Table 1 were used to obtain the importance of the criteria. By using the aggregated assessments for main and subcriteria, the significance levels of the criteria were calculated using the AHP method and given in Tables 2–3.

TABLE 1 Linguistic variables for the importance level of criteria

Linguistic variable	Intensity of importance	Triangular fuzzy scale
Equally important	1	(1, 1, 1)
Intermediate	2	(1, 2, 3)
Weakly more important	3	(2, 3, 4)
Intermediate	4	(3, 4, 5)
Strongly more important	5	(4, 5, 6)
Intermediate	6	(5, 6, 7)
Very strongly more important	7	(6, 7, 8)
Intermediate	8	(7, 8, 9)
Absolutely more important	9	(9, 9, 9)

As a result of the comparison matrix of the main criteria, the political factors seen in Table 2 have the most significant weight with 0.614. All matrices are consistent because the consistency rates of the comparison criteria of the main criteria and subcriteria are less than 0.1 with the values of 0.06,0,05,0.01,and 0.005, respectively. Table 4 shows the local weights and spherical weights of the main and subcriteria in the second stage of the solution method. Global weights are obtained by multiplying the local weights by the weight of the relevant criteria. For example, for subcriteria C11, the local weight is 0.666, and for the economic criterion, the local weight is 0.271. Therefore, the overall weight of C11 is $0.667 \cdot 0.271 = 0.181$. Similarly, other subcriteria weights are calculated and presented in Table 4. The political risk (C21) subcriteria holds first rank and, thus, receives the highest priority in reference to other FDI criteria.

4.3 | Assessments of sectors: TOPSIS stage

By using the criteria weights, sectors are listed with the TOPSIS method and the most appropriate sector is determined for foreign investors. At this stage, the decision-making group gave a score between 1 and 10 points for the specified criteria. The sectors are listed using these scores and the criteria weights. The collected decision matrix in Table 5 is obtained for the data, which the experts evaluated the sectors. The bottom line of the decision matrix has weight values that show the importance of each criterion. The values are given in Table 6 of the normalized values, and normalized decision matrix is constructed using Equation (4).

TABLE 2 Aggregated pairwise comparison matrix for main criteria

	ECO	POL	COU	Weight	Rank
ECO	1	0.322	4.642	0.271	2
POL	3.107	1	5.518	0.614	1
COU	0.215	0.181	1	0.084	3

TABLE 3 Aggregated pairwise comparison matrix for subcriteria

	C11	C12	C13	C21	C22	C23	C31	C32	C33	Local weight	Rank
C11	1	3.979	4.718							0.666	1
C12	0.251	1	2.466							0.220	2
C13	0.212	0.405	1							0.114	3
C21				1	5.944	4.327				0.707	1
C22				0.168	1	0.493				0.105	3
C23				0.231	2.027	1				0.188	2
C31							1	4.481	3.557	0.661	1
C32							0.223	1	0.630	0.137	3
C33							0.281	1.587	1	0.201	2

TABLE 4 Global weights for criteria and subcriteria

Criteria	Weight	Subcriteria	Global weight
ECO	0.271	C11	0.181
		C12	0.060
		C13	0.031
POL	0.614	C21	0.434
		C22	0.065
		C23	0.115
COU	0.084	C31	0.055
		C32	0.011
		C33	0.017

Following the steps given in Section 3.2, the closeness coefficient of the alternatives was calculated as in Equation (10) and shown in Table 7. It indicates that manufacturing (S5) is the best alternative, followed by S3, S4, S1, and S2, in this order.

TABLE 7 Final ranking of sectors

Sector	d_i^+	d_i^-	CC_i	Ranking
S1	0.113	0.085	0.429	4
S2	0.192	0.026	0.119	5
S3	0.034	0.182	0.842	2
S4	0.042	0.180	0.812	3
S5	0.020	0.192	0.908	1

4.4 | Sensitivity analysis

Sensitivity analysis was carried out to observe the effects of possible changes in the weights of the criteria in determining the most appropriate sector for foreign investors. For this purpose, the following experimental sets were applied.

In sections (a), (b), and (c) of Figure 3, it is seen how the ranking of the sectors change according to the change of the weight of the criteria. Regardless of which criterion changes in weight, the fifth

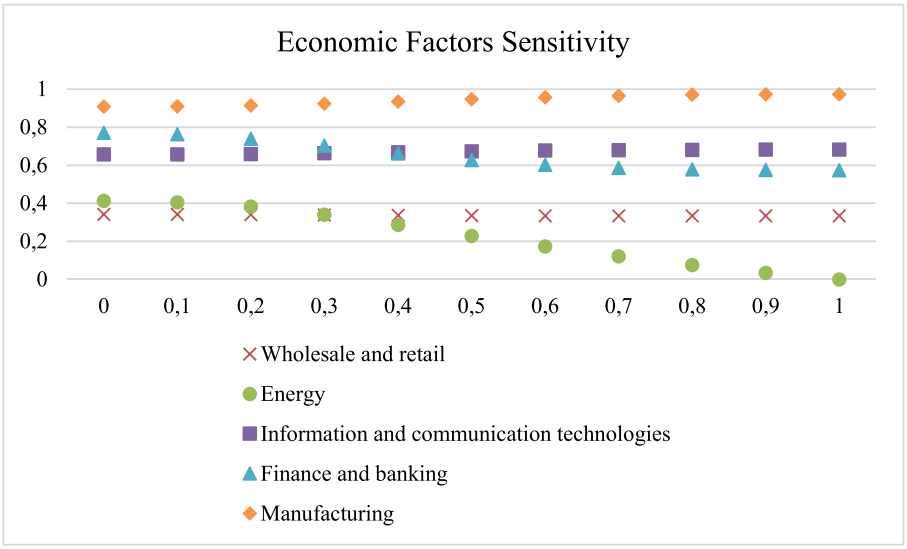
TABLE 5 Aggregated decision evaluation matrix

Sector	C11	C12	C13	C21	C22	C23	C31	C32	C33
S1	4	4	5	3	7	4	4	1	6
S2	3	2	3	1	4	6	8	6	4
S3	7	5	6	5	7	5	5	7	6
S4	6	4	5	5	8	4	7	4	6
S5	9	4	6	5	4	6	8	8	7
Weights	0.181	0.060	0.031	0.434	0.065	0.115	0.055	0.011	0.017

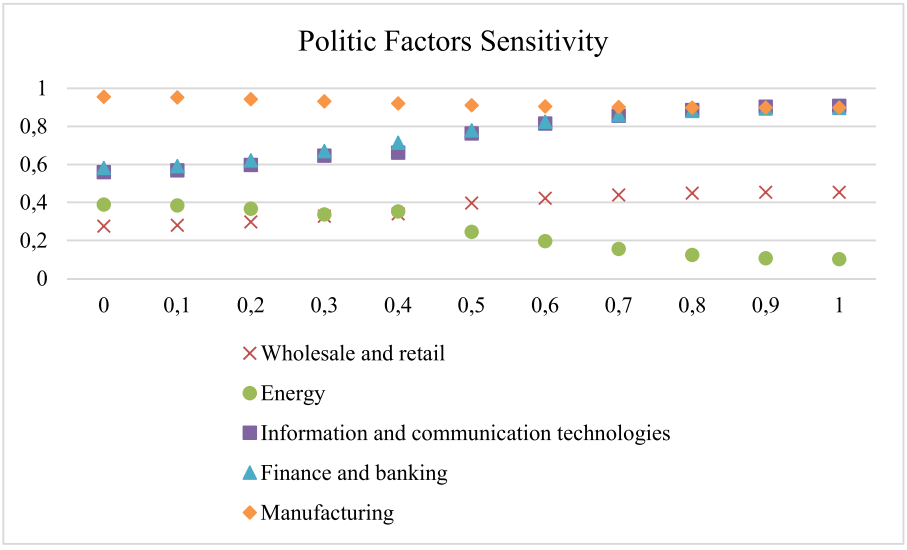
TABLE 6 Normalized decision matrix

Sector	C11	C12	C13	C21	C22	C23	C31	C32	C33
S1	0.322	0.482	0.447	0.324	0.541	0.372	0.270	0.105	0.454
S2	0.198	0.185	0.238	0.144	0.270	0.544	0.563	0.446	0.278
S3	0.495	0.519	0.506	0.540	0.492	0.401	0.338	0.525	0.479
S4	0.445	0.482	0.447	0.540	0.565	0.372	0.451	0.341	0.454
S5	0.643	0.482	0.536	0.540	0.270	0.516	0.541	0.630	0.530

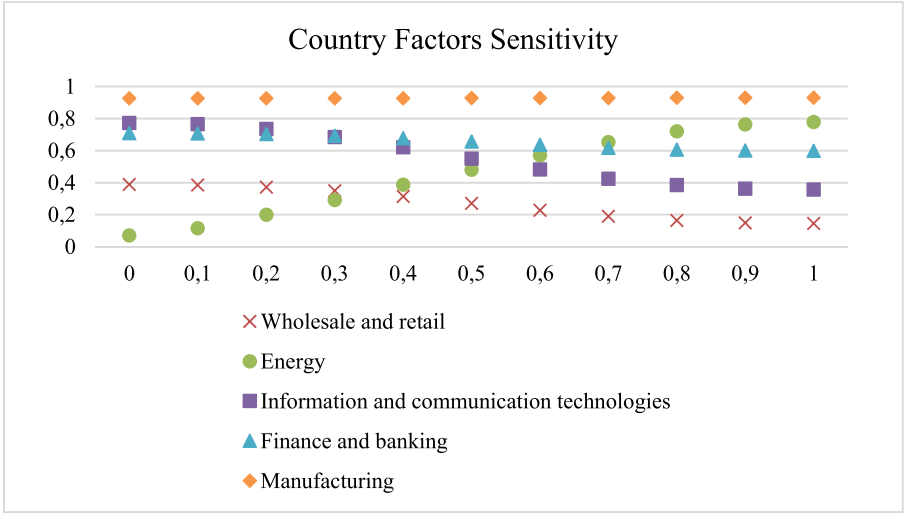
FIGURE 3 Sensitivity analysis results



(a)



(b)



(c)

sector, namely, finance and banking, is in the first place. In the results where only political factors are involved, the last three sectors are very close to the 0.8 weight. Because financial and banking activities attract more FDI interest in the last 15 years in Turkey, it provides best choice by industry experts under each criterion. According to experts, the fact that the finance and banking activities sector is in a predominant position has not affected the weight changes. However, if the political factors that has clear significance (the benchmark weight is at least 80%) shows alteration, information and communication technologies and manufacturing sectors are becoming the preferred alternative.

5 | CONCLUSIONS

FDI is the transfer of foreign capital investment abroad directly, because it is one of the main engines of economic growth in the state. In this business strategy, not only the investor but also the investee procures an economic advantage. Therefore, FDI will hold top-line place in the global economy.

Turkey, one of the emerging market economies, met the challenges including but not limited to high inflation, diminishing growth rates, and currency depreciation. Even with its ongoing currency crisis, Turkey continues to remain a top pick for investors. In the literature, there are very few studies that provide information about FDIs related to Turkey. Thus, in the application part of our paper, MCDM methods are used to obtain precise data. After that, the AHP method used to obtain the priority order of the criteria. Finally, we use the TOPSIS method to rank the sectors in accordance with the evaluation criteria. Additionally, we perform a sensitivity analysis to observe the effects of possible changes in the weights of the criteria. We designate three prime criteria, which are political, economic, and country. The most preferred industry by experts (S5) is the manufacturing sector. The second one (S3) that has the highest investment is the information and communication technologies sector. Despite the negative effects of the crisis in 2001, investments have increased due to factors such as the increase in the sector diversity, the importance of bank mergers, the emergence of information and communication technologies, and trust of the financial services industry in Turkey. The third sector is the finance and banking, which has become an important investment trend in the country in recent years (S4). The rest are wholesale and retail sectors (S1) and energy sectors (S2), respectively.

This study has some limitations that are given chance to researchers for future studies. (a) Because classical assessment methods and crisp numbers are applied at the evaluation process, experts have difficulty in giving a crisp rating for their assessment. In order to solve this problem, implementation of fuzzy set theory and extensions can be considered in future works. (b) In practice, too many criteria can be considered for FDIs. With a more comprehensive framework for FDI, different criteria may be taken into account in future studies. (c) Ranking the sectors in FDI in this study addressed only in Turkey and contained only five experts at the evaluation process. This study can be expanded by including more sectors and involving more experts. (d) The results are obtained only by a hybrid MCDM method. Various statistical methods can also be used in future studies to validate the results. Additionally, as the study is based on AHP method, decision makers must provide pairwise comparisons of criteria to derive weights. But this process requires more pairwise comparisons when the number of criteria is increased. Thus, the AHP method takes much more time and effort. Further, inconsistent results may be obtained between judgments and ranking of criteria in the AHP method.

For further research, companies/experts should choose the appropriate method according to the structure of the problem. Other MCDM methods such as VIKOR, MOORA, COPRAS, ARAS, and DEA can be used for sector selection. In addition to this, data mining techniques could be combined with the proposed methodology if the number of criteria and alternatives are increased. When there is a lack of information or knowledge for decision makers, uncertainty arises and the decision making process is influenced by this situation. Therefore, fuzzy set theory–based approaches and novel extensions of fuzzy sets, such as the interval type 2 fuzzy sets, stochastic modelling, grey theory, and pythagorean fuzzy sets can be applied in future studies.

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