



# A Multi-Criteria Decision-Making Model for Evaluating Priorities for Foreign Direct Investment in Kashkadarya Region

Kobilov Anvar, Kurbonov Oybek

Karshi State University, Uzbekistan

Corresponding author: Kobilov Anvar; [kobilovanvar@gmail.com](mailto:kobilovanvar@gmail.com)

Received 07 July 2020;

Accepted 16 July 2020;

Published 24 July 2020;

## Abstract

Through this study, the main factors and priorities of foreign direct investment (FDI) in the Kashkadarya region were analyzed using the analytic hierarchy process (AHP). According to the research results, the most important factors for foreign investors are the available raw materials, the effectiveness of institutional and legal reforms, the market size of the region, the availability and condition of infrastructure. Besides, the industry sector was selected as a priority direction for attracting investment to the Kashkadarya region.

**Keywords:** *analytic hierarchy process, foreign direct investment, foreign investors, consistency ratio, multi-criteria decision-making model*

## Introduction

Relying on the results of the analysis of the socio-economic development of the Kashkadarya region related to current problems and key areas of economic development, it is necessary to develop a system of strategic policy priorities for each region (city, district) to ensure long-term development. Nowadays, an important task is to increase the efficiency of the use of foreign investment, the development of attractive investment projects based on the potential of each region, and their targeted placement. Therefore, it is advisable to determine the analytic hierarchy process (AHP) and TOPSIS (Technique for Order of Preference by Similarity to Ideal Solution) methods of the multidimensional decision-making model, the factors influencing the decision-making of foreign investors and the priority areas of investment.

To be more precise, this system envisages active investment activities aimed at structural changes and institutional renewal (development of competition, protection of property rights and economic freedom, improvement of the investment climate and business environment). It also takes into account the efficiency and effective use of regional production factors, along with the factors of production, the activation of internal factors of economic growth (increase in overall productivity, development of high-tech production, innovative development).

The increase in competitive activities in the real sectors of the economy, with comparative advantages in the internal and external environment, will allow the regional economy to enter the world economic relations, enriching the traditions of entrepreneurship and crafts development. This, in turn, will ensure the development of competitive activities, such as the creation of clusters in the fields of industry, agriculture, services. As a result, significant progress has been made in improving the quality of life and reducing poverty.

## Literature Review

Nowadays several studies have been conducted on the issues of foreign investment through the usage of the method of hierarchical analysis and TOPSIS methods alone or in combination. For instance, economists Levary and Van have developed a methodology using the AHP to assess the factors influencing the performance of firms that make foreign investments and to rank (rank) investment alternatives [1]. This methodology helps the firm's investment decision-making process by assessing the risks and uncertainties associated with FDI through a variety of criteria and selecting optimal options.

Economists Abid and Bakhulul assessed the investment attractiveness of 7 Middle Eastern and North African countries using AHP methods [2]. Economists Li and Sherali have analyzed the potential of foreign investment in the areas around China's Tuman River with the help of AHP [3].

Moreover, Deng, Wang, and Yeo evaluated the foreign investment performance of 4 free trade ports in China using AHP and TOPSIS [4]. Using both methods, economists Korkhan and Shahram analyzed the factors influencing the volume of FDI inflows into nine developed countries by the United States in three periods: pre-crisis (2004-2006), crisis (2007-2009) and post-crisis (2010-2012). [5].

Economists Wang et al. using the AHP and TOPSIS methods, several factors necessary for attracting foreign investment for industries that set "growth points" for the Vietnamese state were assessed by [6].

The influence of socio-economic criteria on the sustainable development of the regions was assessed by the Russian economist Lobkova using the TOPSIS method [7].

In our previous research, using the AHP of the Kashkadarya region, developed priorities for attracting foreign investment in each district (city) of the region [8], [9]. However, the results of this study were developed in terms of attracting foreign investment, taking into account the assessments of local experts. Therefore, to scientifically improve the results of the study, to further clarify the

investment potential and investment priorities in the region, it is necessary to identify factors and priorities that affect the investment decisions of foreign investors operating in the region.

### Research Methodology

Indeed, of great importance is the attraction of foreign direct investment in the areas of increasing competitiveness and

economic efficiency in order to ensure a stable economic growth rate due to the existing potential of the Kashkadarya region. From the point of view of foreign investors, to determine the factors which sector to invest in and which affects the investment decision is relevant. What is important, this not only affects the economic growth and development of the region receiving the investment but also provides various advantages within the country or company in which the investment is attracted.

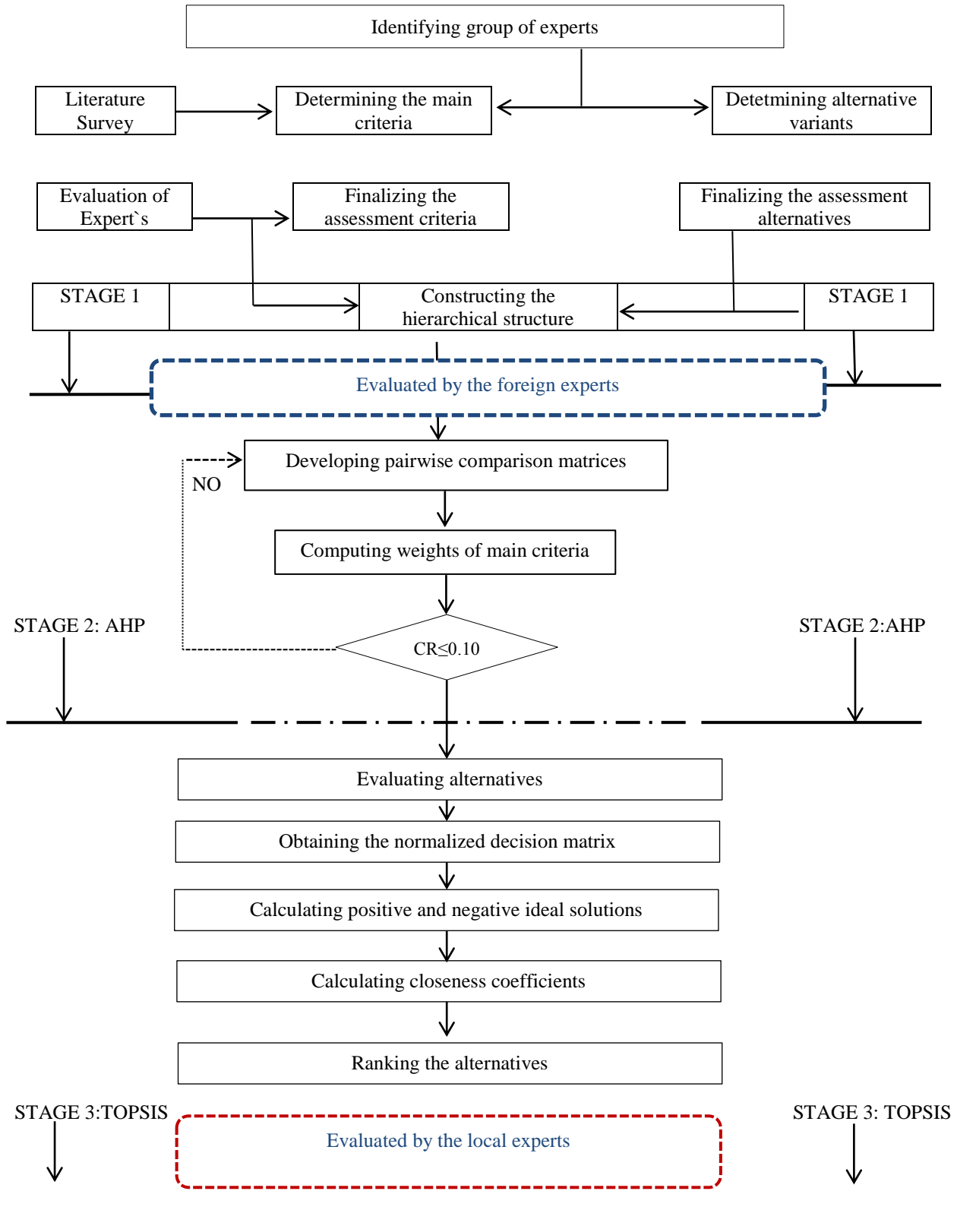


Figure 1: Stages of the proposed methodology

Our research has been conducted combining AHP and TOPSIS (Technique for Order of Preference by Similarity to Ideal Solution) methods in determining the factors influencing the attraction of foreign investment and the most favourable sector (sector) for investment in the economy of the region. The steps of the research methodology are detailed in Figure 1.

For the research involved 10 experts from potential foreign companies operating in the Kashkadarya region (for phases 1-2 of the research) and deputy mayors of 15 districts (cities) in the Kashkadarya region on investment issues (phase 3 of the research).

The method of hierarchical analysis is a method of systematic analysis that can be used in decision-making on complex issues, developed by the American mathematician Thomas Saati [10]. The method of hierarchical analysis was originally developed to solve military problems. Later, these methods are widely used as a complex method of decision-making and resource allocation in solving economic, political, social, medical, educational, engineering, management issues.

**Table 1: Priority table of selected criteria**

The degree of superiority of A over B.	Characteristic	The degree of superiority of B over A.
1	A and B are equal	1
3	A has a slight advantage over B	1/3
5	A has a strong advantage over B	1/5
7	A has a strong enough advantage over B	1/7
9	A has an absolute advantage over B.	1/9
2,4,6,8	The superiority of A over B is among the above cases	1/2, 1/4, 1/6, 1/8

Source: Compiled by the author based on research

Scientist T.Saati introduced nine-point scales to compare the options in pairs based on different criteria and to arrange them. The scale is based on integers from 1 to 9, and the two options A and B are compared (Table 1).

Suppose that  $S = \{C_j \mid \text{Let } j = 1, 2, \dots, n\}$  be the set of selected criteria. The results of the pairwise comparison of the criteria are performed using the matrix A, and each element of  $a_{ij}$  ( $i, j = 1, 2, \dots, n$ ) is compared based on the following criteria:

$$A = \begin{bmatrix} a_{11} & a_{12} & \dots & a_{1n} \\ a_{21} & a_{22} & \dots & a_{2n} \\ \vdots & \vdots & \ddots & \vdots \\ a_{n1} & a_{n2} & \dots & a_{nn} \end{bmatrix}, a_{ij} = 1, a_{ji} = \frac{1}{a_{ij}}, a_{ij} \neq 0 \quad (1)$$

After that, the mathematical operations are performed and the priority elements of each matrix are found.

$$A_w = \lambda_{\max} W \quad (2)$$

The concepts of “consistency index (CI) or “consistency ratio” (CR) are used to assess the logical relevance of feedback made by an expert evaluator. If  $CR \leq 0.1$ , it is recommended to use a specific matrix. Otherwise ( $CR \geq 0.1$ ) the sequence of logical considerations is violated and the experts make a mistake in filling the matrix, and the evaluation work is repeated [4].

$$CI = (\lambda_{\max} - n) / (n - 1) \quad (3)$$

This method allows the design, comparison of rational systems on a hierarchical principle in the search for solutions to complex (multidimensional) problems, and the evaluation of alternatives through quantitative indicators [11], [12].

The decision-making process on the problem under study is carried out in three stages:

The first stage is the stage of creating a hierarchical structure, in which the problem under study, the criteria for selecting its solution, the factors influencing the solution, all possible alternatives to the problem-solving section, and the relationship between them are schematically introduced.

The second stage is the priority determination stage, in which the elements at each level of the hierarchy are arranged based on comparative analysis, depending on the level of importance, and the coefficient of superiority is calculated for each element.

The third stage is the decision-making stage, in which the predominance of alternative options that can be a solution to a problem is determined using the dominance coefficients of the elements in the hierarchy and the relationship between the stages.

$$CR = CI / RI \quad (4)$$

### Analysis and Results

Obviously, the priority strategic directions of investment policy will ensure the entry of foreign companies into the region, the integration of sectors of the economy into major projects. In turn, participation in their implementation is aimed at the implementation of modern projects for the development of the industry through the realization of the comparative advantages of the region, especially in the factors of production (labour and raw materials), the creation of new capacities for processing agricultural products and modernization of existing industries. to the agro-industrial complex (AIC), the development of the services sector, in particular, the realization of tourism and leisure opportunities of the regions, the creation of conditions for attracting international partners to form an international flow of tourists.

At the same time, the construction of a system of efficient use of natural resources of the region as a key mechanism to increase the investment attractiveness of the region is of great importance.

Based on the objectives of the study, the priorities for attracting investment to the Kashkadarya region were identified using 3 steps and a hierarchical structure of the problem under analysis was created (Figure 2).

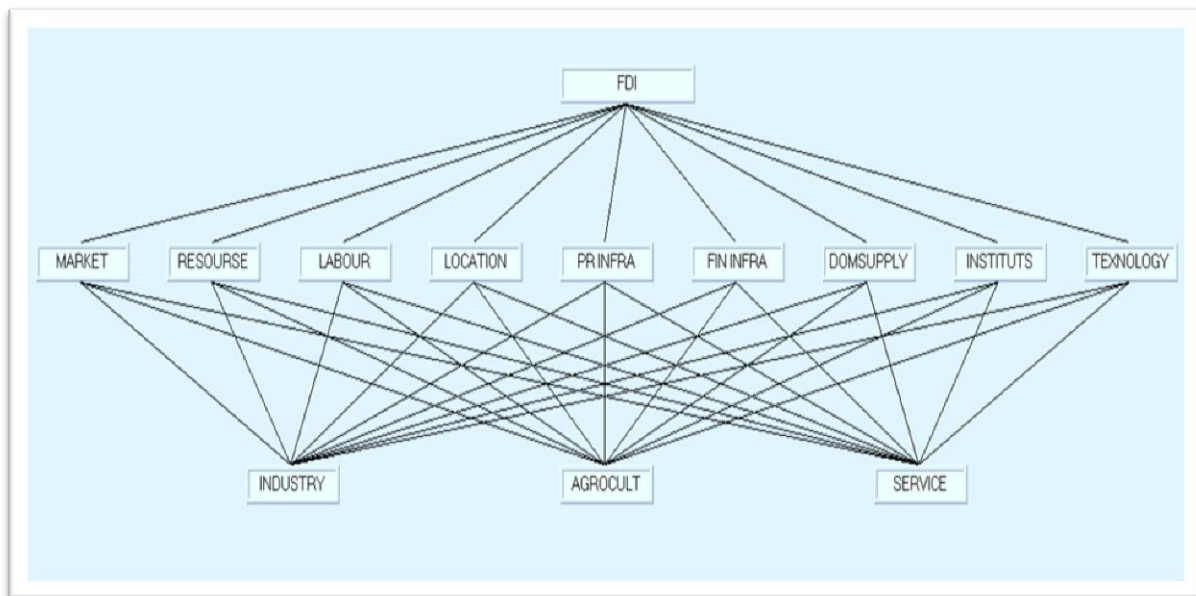


Figure 2: Hierarchy of priorities for attracting investments to the areas of Kashkadarya region

As it is widely considered, the hierarchical structure is a graphical representation of the problem in the form of a tree, where each element depends on one or more elements above, and hierarchical structures are used to break down and analyze complex problems into components.

For our model were selected 9 factors determining the investment climate for attracting foreign investment as criteria for the hierarchical structure.

**Market:** Market size of the region, market demand for manufactured goods (services) and income of the population;

**Resource:** Reserves of existing raw material in the region (natural deposits, agricultural products);

**Labour:** skills, wages, quality of labour force;

**Location:** The geographical location of the area;

**Prinfra:** Availability, condition, and cost of production infrastructure (natural gas, electricity, water supply);

**Fininfra:** Availability, and condition of financial infrastructure facilities (banks, insurance companies) in the region

**Domsupply:** Production of products (services) by a foreign investor by local producers;

**Instituts:** Institutional and legal factors (corruption, bureaucracy, the degree of obedience to the law, compliance with contracts, property rights)

**Technology:** The level of technological and innovative development of the region.

Industry, agriculture, and the service sector were selected as alternative options for the hierarchical structure under study. The cross-comparison of the selected criteria was performed independently by each expert based on the evaluation matrix.

In comparison, the relatively important element is the integer 3, 5, 7, 9, and the other is the inverse of the integer. In some cases, the numbers of 2,4,6,8 were used for intermediate values in the evaluation process. No relatively large errors were made during the comparison process (Table 2).

Based on the assessments of all the experts involved, the priority vectors of the criteria characterizing the investment climate of the regions were identified and the criteria were sorted (ranked) in the sequence of points. According to the results of the analysis, the potential of the existing raw material resources of the regions was assessed as the most important factor influencing the investment decision of foreign investors (0.245 points). The institutional and legal factors of the region were ranked 2nd in the priority sequence of investments, with an average rating of -0.20 points given by experts. It was noted that the market size in the region and the demand for goods (services), the factor of the income level of the population are also important for foreign investors (0.19 points). During deciding on an investment, the availability and quality of production infrastructure in the regions - 4<sup>th</sup> place among the selected criteria, was assessed by experts based on 0.17 points (Table 3).

Table 2: Assessing a matrix of criteria by an expert

Criteria	Market	Resource	Labour	Location	Prinfra	Fininfra	Domsupply	Instituts	Texnology	Weight
Market	1	1/3	3	3	1/3	3	7	3	5	0.15
Resource	3	1	4	5	1	4	9	3	7	0.26
Labour	1/3	1/4	1	3	1/5	5	5	1/3	1	0.07
Location	1/3	1/5	1/3	1	1/3	3	5	1/3	3	0.06
Prinfra	3	1	5	3	1	5	7	2	5	0.24
Fininfra	1/3	1/4	1/5	1/3	1/5	1	5	1/3	1/3	0.03
Domsupply	1/7	1/9	1/5	1/5	1/7	1/5	1	1/3	1/3	0.02
Instituts	1/3	1/3	3	3	1/2	3	3	1	3	0.11
Texnology	1/5	1/7	1	1/3	1/5	3	3	1/3	1	0.04
Consistency ratio (CR)						0.09	0.10 less than critic value (there is no error)			

**Table: 3 Priority vector of criteria evaluated by experts**

Criteria	E1	E2	E3	E4	E5	E6	E7	E8	E9	E10	Average priority weight	Position
MARKET	0.15	0.21	0.30	0.13	0.13	0.20	0.17	0.18	0.21	0.22	0.19	3
RESOURCE	0.26	0.20	0.22	0.29	0.26	0.29	0.18	0.26	0.25	0.18	0.245	1
LABOUR	0.07	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.09	0.09	0.05	6
LOCATION	0.06	0.07	0.06	0.06	0.06	0.07	0.07	0.07	0.06	0.06	0.06	5
PRINFRA	0.24	0.25	0.12	0.15	0.17	0.16	0.17	0.15	0.13	0.14	0.17	4
FININFRA	0.03	0.05	0.04	0.04	0.04	0.05	0.05	0.05	0.04	0.04	0.04	7
DOMSUPPLY	0.02	0.02	0.01	0.01	0.01	0.02	0.02	0.02	0.02	0.02	0.017	9
INSTITUTS	0.11	0.14	0.18	0.24	0.27	0.15	0.27	0.20	0.19	0.22	0.205	2
TEKNOLOGY	0.04	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.022	8
Consistency ratio (CR)	0.09	0.10	0.10	0.10	0.09	0.10	0.10	0.10	0.10	0.10	0.098	

According to foreign investors’ evaluation, the above four factors are the most important criteria for making investment decisions, and their total priority among the selected criteria was 81% (0.81 points).

The total priority vector of the remaining criteria is -19% (0.19 points), the favorable location of the region -0.06 points, labour force, skills, wages -0.05 points, the state of financial infrastructure -0.04 points, the level of technological and innovative development of the region - 0.023 points, the internal bid rate was rated by experts based on -0.017 points.

**Table 4: Priority vector of alternative fields evaluated by experts**

Experts/Alternative areas	Industry	Agriculture	Service
E1	0.48	0.39	0.16
E2	0.55	0.37	0.08
E3	0.53	0.41	0.06
E4	0.42	0.49	0.09
E5	0.38	0.44	0.18
E6	0.51	0.25	0.24
E7	0.39	0.51	0.10
E8	0.56	0.18	0.16
E9	0.59	0.16	0.25
E10	0.31	0.48	0.21
Average value	<b>0.47</b>	<b>0.38</b>	<b>0.15</b>
Consistency ratio (CR)	0.09	0.10	0.09

Source: Calculated by the author in Mpriority 1.0. based on an evaluation matrix performed by experts.

According to the table, foreign experts have identified the priority areas for investors to invest in the Kashkadarya region (industry, agriculture, services). And as the results of the analysis show, the industry was selected as the most priority sector for investment in the Kashkadarya region, and the average score of experts was 0.47 points. Based on the available opportunities and resource potential, the agricultural sector was given the next priority, and as an average score of experts - 0.38 points. The service sector was ranked last as the most important among the selected sectors, and the average score of experts was 0.15 points.

**Conclusion**

During the period of doing this study, the factors influencing the investment of foreign investors in the Kashkadarya region and the priority areas of investment were identified using the method of hierarchical analysis.

According to the results of the analysis, the following are determined as the main factors of investment from the point of view of foreign investors:

- Current raw material reserves in the regions (existing reserves of natural mining and chemical elements, the amount and composition of agricultural products);
- Effectiveness of ongoing institutional and legal reforms, low level of corruption and bureaucracy, high level of compliance with the law;
- The market size of the region, market demand for manufactured goods (services), the income level of the population;
- Availability, condition, and quality and cost of infrastructure facilities in the regions.

Along with the level of importance of the investment areas in the region has been selected:

1. Industry;
2. Agriculture;
3. The service area

By using the method of hierarchical analysis, it is possible to make greater use of the existing opportunities and potential of the regions by identifying the impact of factors influencing foreign investment and the priorities of attraction, eliminating sharp differences between regions across different sectors and industries. The effectiveness of working with foreign and domestic investors will increase through the development of optimal investment projects in each region in priority areas.

**Data Availability**

All data generated and analyzed are available in this paper

**Conflicts of Interest**

The author(s) declare(s) that there is no conflict of interest regarding the publication of this paper.

**References**

1. Levary, R. R., & Wan, K. (1999). An analytic hierarchy process based simulation model for entry mode decision regarding foreign direct investment. *Omega*, 27(6), 661–677. <https://doi.org/10.1016/S0305-0483>

2. Abid, F., & Bahloul, S. (2011). Selected MENA countries' attractiveness to G7 investors. *Economic Modelling*, 28(5), 2197–2207. <https://doi.org/10.1016>
3. Li, Q., & Sherali, H. D. (2003). An approach for analyzing foreign direct investment projects with application to China's Tumen River Area development. *Computers & Operations Research*, 30(10), 1467–1485. <https://doi.org/10.1016>
4. Deng, X., Wang, Y., & Yeo, G.-T. (2017). Enterprise perspective-based evaluation of free trade port areas in China. *Maritime Economics & Logistics*, 19(3), 451–473. <https://doi.org/10.1057>
5. Korhan K., Shahram A. (2015). A multi-criteria decision-making model for evaluating priorities for foreign direct investment. *Croatian Operational Research Review*, 6(2015), 489–510. <https://doi.org/10.17535/crorr.2015.0037>
6. Wang, Tien-Chin, Chia-Nan Wang, and Xuan Huynh Nguyen. (2016). Evaluating the Influence of Criteria to Attract Foreign Direct Investment (FDI) to Develop Supporting Industries in Vietnam by Utilizing Fuzzy Preference Relations. *Sustainability* 8: 447. <https://doi.org/10.3390/su8050447>
7. Lobkova E. (2020). Application of the TOPSIS method in solving the problem of assessing the sustainability of the development of territories. *Regional Economics: Theory and Practice*. 1 (472), 87-104. <https://doi.org/10.24891/re.18.1.84>
8. Kobilov A., Kurbonov O. Priorities for attracting foreign investment in Kashkadarya region: The method of hierarchical analysis. Ensuring macroeconomic stability of the new economy of Uzbekistan: problems, analyzes and results. Tashkent, April 30, 2020. 546-551.
9. Kobilov A., Kurbonov O. (2020) Priorities for attracting foreign direct investment in the Kashkadarya region: The Analytical hierarchy process. *TRANS Asian Journal of Marketing & Management Research*. 3 (9). 18-22. <http://dx.doi.org/10.5958/2279-0667.2020.00012.7>
10. Saaty, T.L. (2001) *Fundamentals of Decision Making and Priority Theory*. RWS Publications, Pittsburgh.
11. Saaty, T.L. (2008) *Decision Making for Leaders: The Analytic Hierarchy Process for Decisions in a Complex World*. RWS Publications, Pittsburgh.
12. Saaty, T.L. (2008) *Relative Measurement and its Generalization in Decision Making: Why Pairwise Comparisons are Central in Mathematics for the Measurement of Intangible Factors-AHP*. *Review of the Royal Academy of Exact, Physical and Natural Sciences: Mathematics (RACSAM)*, 102, 251-318.