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Determining the Effective Factors on Financing the Optimal Capital Structure in Oil and Gas Companies

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ABSTRACT

Companies have access to a variety of financial resources to implement available profitable investment projects, to settle overdue debts, to increase working capital, and to pay dividends to shareholders. These resources include cash from operating activities and the sale of assets (as intra-organizational sources of financing), borrowing loans from the bank, issuance of bonds, and issuance of new shares (as outside the organization sources of financing). Financing and its effects on the returns and risk of the company choose sources that minimize financing costs. Then, to prioritize the parameters, the hierarchical method, Topsis, and ANP were used. The results of this study indicated that the factors of efficiency, cost, sustainability, being operational, fairness, and transparency have been the most important criteria for choosing the financing method, as well as forming sub-consortia, receiving facilities, issuing participation bonds, establishing investment companies, presence in the securities market, creating a shareholder plan, and finally attracting foreign capital have been identified as financing methods. Also, the transparency of the financing method in the surveyed companies to identify the appropriate financing method had the least importance.

1. Introduction

The huge volume of oil and gas reserves, as well as Iran's unique geographical and geopolitical position in achieving the world's major consumer markets, has made Iran one of the most important countries in the world enjoying hydrocarbon reserves. In addition to the importance of these reserves in the world, Iranian oil industry is the most important economic sector and is the mainstay of the economic development of the country. In this respect, the oil industry plays a dual role in Iran. [1].

The environment of the oil and gas industry has always had a large flow of financial resources. Most of the projects in this industry, especially the upstream sector and higher technology sectors, are very costly, and

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limited funding providers can support these types of projects alone. [3].

The volume of financial resources required in this industry is very high, the volume of investment made in the Fourth Development Plan in the oil industry is more than the total investment made in the other sectors of the economy.

Managing these assets and the possibility of using them more effectively over time is one of the main goals and missions of the Ministry of Oil. The ministry is responsible for the optimal use of these assets, including the establishment, maintenance, and development of capacities in the industry by using capital and providing low-cost and low-risk financing and allocating them optimally. [4].

On the other hand, the issue of joint oil and gas resources and fields between Iran and the countries of the southern Persian Gulf is of great importance. In some common hydrocarbon resources in the Persian Gulf, neighbors reap more than their share due to adequate financing and significant financial resources. Therefore, by financing the development plans of the oil and gas industry, especially in the joint fields, it is necessary to bring Iran to the level of its proper harvest from these fields; Because Iran's oil industry has strong and desirable support of efficient manpower, but the limiting factor in the development of oil and gas resources is the limited financial resources [5]. Today, after a century of oil exploration and production in Iran, the oil industry still needs to develop and establish a high technological capacity for production. Innovative solutions to solve the problem of investment financing is one of the most important factors in the development of the oil industry the country and, consequently, the economic development of the country [6]. Considering the natural decline in crude oil production of the country because most of the country's oil fields are in the second half of their life and as a result, their natural pressure drops and also due to the need to increase the country's current production capacity, to attract the financial resources to invest in the various projects of the oil industry is of significant importance.[7].

Based on the characteristics of oil and gas industries and also the characteristics of each of the different Sukuks (so far 31 types of Sukuks have been introduced by the Accounting and Auditing Organization of Islamic Financial Institutions), among the types of Sukuks that can be issued, three types of them have the most usability in oil and gas sectors are rental Sukuk, istisna Sukuk, and participation Sukuk. Considering the nature of these three types of Sukuk and their return, in this study, two types of rent Sukuk (fixed return), and participation Sukuk (variable return) are studied [13].

Agency relationships can be defined in various fields of accounting, management, economics, and other sciences. In the field of finance, the conflict between the interests of the providers of financial resources and the users of these resources leads to the applicability of the theory. In this case, the users of financial resources do not always act in the interests of the resource providers [17].

The countries enjoying oil and gas reserves are generally the developing countries and tend to use international capital markets due to a lack of capital. These countries consider oil and gas as the national capital and try to use the international capital markets while maintaining the ownership of these resources in a way that improves human resources and management. That is why the financing of oil and gas projects has been accompanied by tremendous innovations.

Plans financing can be done in different ways and therefore, the economic experts of a country and especially a specific economic sector should rely on in-depth economic, financial, and legal studies and researches, and identify the efficient and effective strategies for financing plans through internal and external resources or a portfolio of internal and external resources and try to obtain these capitals with the lowest cost of capital and the most appropriate financial structure.

There is no research on providing an appropriate model for the optimal structure of capital using the domestic financial markets, and for this reason, this present study can be designed and researched in terms of innovation. On one hand, due to the insufficiency of financial resources used by the subsidiaries of the Ministry of Petroleum in meeting the financial needs of the company including energy efficiency projects, the other methods of financing through domestic financial markets should be considered, taking into account its costs and necessary strategies should be provided.

Therefore, in this research, the researcher seeks to "provide a model for the optimal capital structure in the subsidiaries of the Ministry of Petroleum and determine the parameters using the decision matrix technique of Topsis and ANP". As a result, prioritizing the provision of resources to optimize the capital structure includes internal and external resources. So, according to the specific conditions of the industry, priority is given to

attracting internal resources including bank loans and the use of financial derivatives.

For this purpose, this study then deals with the research background, methodology, data analysis, and according to the relationships and methods presented, the indexes are prioritized and at the end, the research results are stated.

2. Background of the Study

Financing is one of the main requirements for the implementation of industrial projects in various sectors. So, financing cannot be considered a separate executive goal. Rather, it is a link in a value chain in a comprehensive process, and if properly explained and defined in that process, it can be the source of the effect, and therefore, the whole chain should be considered in financing evaluation.

The appropriate financing refers to the part of financial knowledge that defines and studies the different methods to attract the liquidity required by the project and finally introduces the optimal method or methods based on the mechanism of minimum cost of capital use and minimum conflicts and side effects.

The structural, legal, technical, and economic differences in the types of projects in the different parts of the world lead to the formation of various financing methods for different types of projects. Upstream oil and gas industries generally have features such as government ownership of oil and gas resources, the capitalization of oil and gas projects, especially in the higher rank industries, the necessity of access to new technologies, and high risk, especially in the higher rank sector.

These features overshadow the optimal financing strategy directly and indirectly. In the lower rank sector, due to less sensitivity of the governments to the ownership of resources and a more tangible technical and economic structure, and less risk, the investment decision-making process takes less time. Oil and gas reserves are generally developing countries and tend to use international capital markets due to lack of capital.

The countries that have oil and gas reserves are generally developing countries and tend to use international capital markets due to the lack of capital. These countries consider oil and gas as the national capital and try to use the international capital markets in a way that improves human resources and management while maintaining the ownership of these resources. For this reason, financing oil and gas projects have been accompanied by tremendous innovations.

Due to the limited research on the optimal capital structure in the subsidiaries of the Ministry of Petroleum, in this section, the attempt has been made to provide materials close to the purpose of the research.

Article "the Ranking of Foreign Financing Methods for Investing in the Oil Industry Using the Hierarchical Method"(Spitsin, et, al, 2020) - In this study, identifying the foreign financing methods and evaluating and ranking them are based on the three indexes: risk, capital cost and, the total of risk and capital cost. The results of ranking the studied foreign financing methods were determined as reciprocal sale, BOT, FDI, credit lines, guaranteed loans, finance, and usance respectively.

Article "the application of project-oriented tools in financing oil and gas sector investments (Barison, et al, 2020) This research has been done with a qualitative approach and using an interpretive research method based on the expert opinion and focusing on the case study. It tries to find the project-oriented financing tools appropriate for the upstream oil sector. According to the hypothesis of the article, the mentioned financing can be done by designing project-oriented tools by observing two project-oriented conditions. The findings show that oil companies can use tools such as lease Sukuk, istisna, and Salaf in the upstream oil portfolio. The general contractors can also use the rental Sukuk and istisna in their project approaches to finance the EPCF.

Article "The evaluation of the financing methods in the oil industry using the hierarchical analysis technique"(Salim, et al, 2019), in this study with the aim of "Evaluating the financing methods in the oil industry using hierarchical analysis technique", external cross-selling financing methods, internal reciprocal sale, external reciprocal sale with an internal partner, internal reciprocal sale with an external partner and combined method (finance, bonds, foreign exchange fund resources and internal resources) are reviewed and compared using a hierarchical process analysis model. For this purpose, using the opinions of experts and reviewing the library records, 10 decision-making criteria have been considered to evaluate the method of financing large projects in the oil industry.

Abheiman et al. (2019) by studying some branches of large state-owned banks in India, factors such as manpower, employees' education level, bank environment, location of the bank, advertising, governmental laws and regulations and reducing the government interferences in affairs Banks have been

considered as one of the effective factors in attracting people's deposits. According to them, the most important and effective factor in attracting people's capital is human resources.

Alan et al.'s (2018) paper has examined the project-based financing in the higher rank oil sector emphasizing financial instruments. The researcher in this study, while examining the contracts of the oil and gas sector as well as the financial instruments and using the opinion of oil and gas industry experts, concludes that financial instruments with fixed profits, including lease bonds, the combination of expropriation and lease on the condition of ownership and also parallel expropriation can be used in the upstream oil sector.

In their new research, entitled "An introduction to the new opportunities in the field of Islamic financing in the oil and gas sectors" which was published in Texas International Law Journal, issue 12, Bhardwaj et al. (2018) studies the different dimensions and characteristics of financial Islamic tools and deals with the oil and gas sectors of the US and introduces it as a solution to the problems of the Western financial system.

Jung and Jang (2016) investigated the long-term profitability of Taiwanese banks and concluded that banking services are the most important factor in profitability for the studied bank branches. Also, bank employees have been considered as the most important and basic factors to achieve increased profitability.

Rohling (2015) in examining the income structure of municipalities in developing countries, shows that property tax is the most important type of local tax and more than 130 countries in the world receive some type of it. This tax can serve the broader goals of local accountability and bring an effective relationship between providing municipal services and their financial resources closer together.

According to the presented research background, due to the existing study gap and the lack of presenting an optimal model for financing the subsidiaries of the Ministry of Petroleum, this study is knowledge-based and innovative in this regard.

3. Methodology

In this research, we describe the status of each of the variables in the statistical population. Therefore, this research can be considered descriptive research. As we use the questionnaire as a tool in the field to measure variables, the research can be considered as a survey. Therefore, due to the applicability of the results of this research, it can be placed in the group of applied research.

3.1. Research Execution Algorithm

In this research, hierarchical analysis is used to identify the financing methods and also the criteria to select the appropriate financing method to determine the priorities. And after determining these weights through the TOPSIS method, the options proposed in the hierarchical model are prioritized.

We trust the data resulted from the company's information system (Mainframe) and focus on this data. In addition to using the Mainframe information, the published annual financial statement data has also been used as a benchmark for measuring this information. Then, according to the balance of accounts extracted from the Mainframe system and their nature, the financial statements of companies were designed and they were used as the basis of the subsequent analysis.

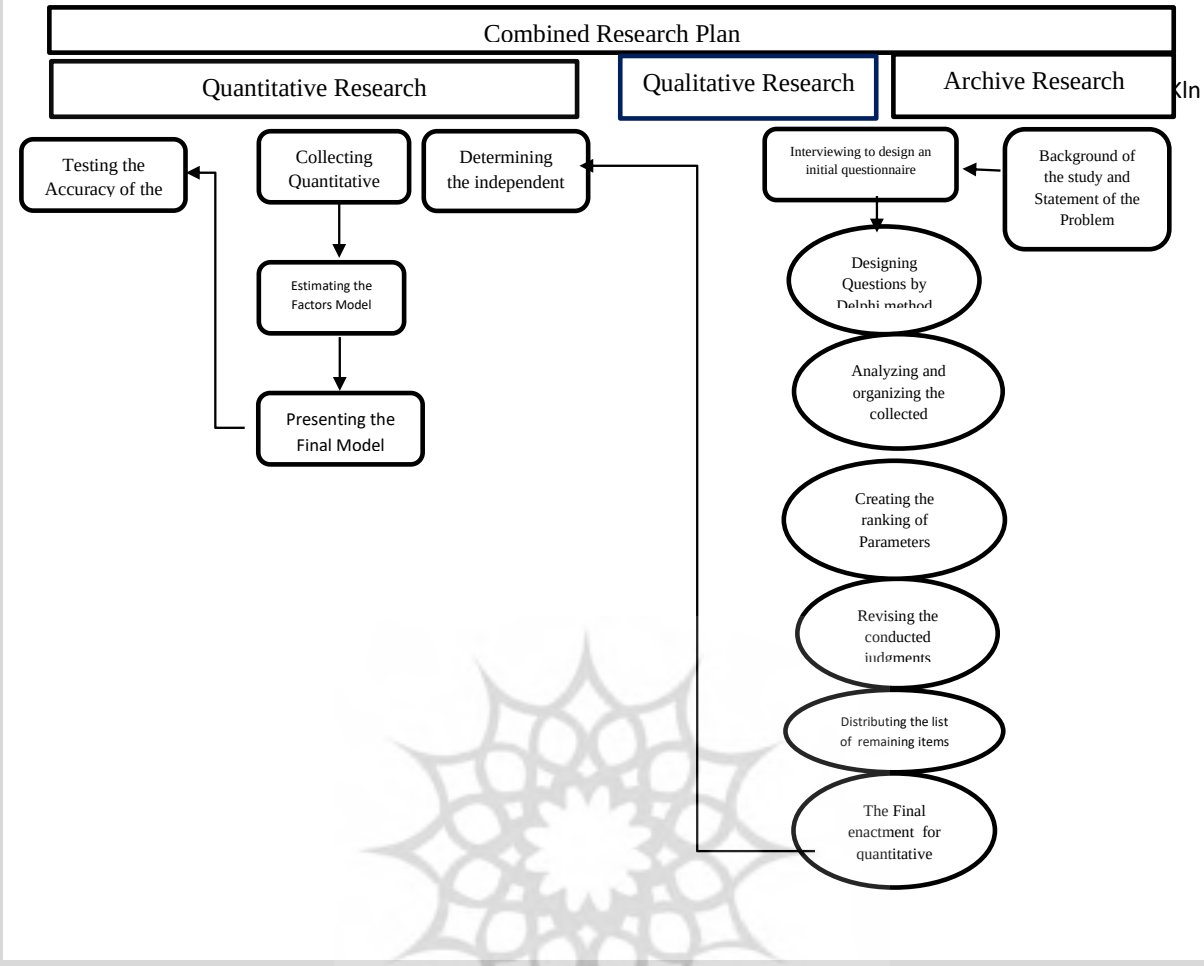

Figure 1. The Stages of research and Delphi method (Source: researcher-made).

In explaining the stages of research implementation, the following issues are raised:

1- Designing a primary questionnaire tool to determine the criteria for comparison with the cooperation and guidance of respected supervisors, advisors, and other experts and collecting information. In this section, according to the hierarchical model, a pairwise comparison questionnaire is designed. In the paired questionnaire, each of the options is compared in pairs based on the components selected in the previous section.

2- Distributing the questionnaire. In this section, according to the purpose of the research, 30 questionnaires are distributed among experts in the statistical population. Before distributing the questionnaire, the researcher tries to give a detailed distribution on how to fill in the data with the matrix of the questionnaire. Experts should be provided to inform individuals about the exact way of completing the questionnaire.

The statistical population of this research is all knowledgeable managers and employees in the field of finance. The selected experts must meet the following requirements:

- Have a relevant field of activity.
- Have at least one year of work experience.
- Be in direct contact with finance.

The size of the research population is 20 people.

In this research, the researchers, by referring to the professors and experts and using their opinions, have ensured the validity of measuring instruments in measuring the research variables. The compatibility rate of AHP questionnaires is used to confirm the reliability of the AHP questionnaire. If this rate is less than 0.1, the compatibility of the questionnaire is confirmed and its data is reliable. The compatibility rate of the questionnaire is calculated to be 0.09, which is less than the criterion of 0.1, and it indicates that the status of the questionnaire is appropriate.

3- Forming a matrix of pairwise comparisons using the opinions of the respondents.

4- Entering the matrix of pairwise comparisons in the form of respondents' opinions in the software environment of hierarchical analysis and software execution.

5- Determining the status of the adaptation rate of research tools.

6- Forming the TOPSIS decision matrix.

7- Scaling the decision matrix using the softening method.

8- Multiplication of weights obtained from the hierarchical analysis stage.

9- Determining distances from ideals.

10- Prioritizing different sections in the form of options.

11- Presenting research results as well as practical suggestions according to the obtained results.

3.2. Executive Research Model

The conceptual model of this research is presented in Figure 1. The first series shows the purpose of the research, the second series shows comparative factors and the third series shows the options being evaluated.

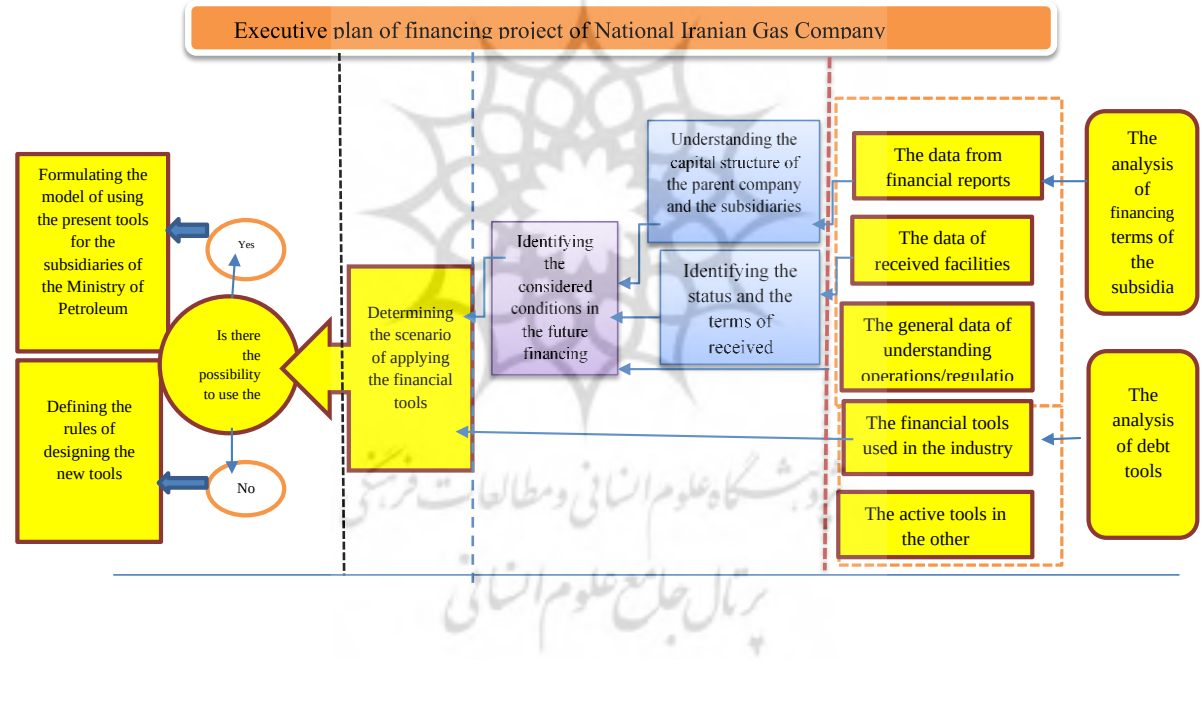

Figure 2. Conceptual model of research.

The statistical population of this research is all knowledgeable managers and employees in the field of finance. Selected experts must meet the following requirements:

- Have a relevant field of activity.
- Have at least five years of work experience.
- Be in direct contact with finance.
- The number of the research population is determined by 20 persons.

The existence of complete and accessible information is a prerequisite for appropriate research. Given that the only reliable reference for collecting financial data is the financial statements of the subsidiaries of the Ministry of Petroleum, and the method of data collection is the library method, interviews with elites and experts and a researcher-made

questionnaire in the field of quality and field studies including investigating the capital structure and the financing model that the subsidiaries of the Ministry of Petroleum have used so far, as well, the analysis of the company's financial statements is over 5 years.

Considering that the research conducted with Topsis is not based on statistical analysis, there is no need to determine the population and statistical sample in a specific sense. Cochran's sampling formula was used to determine the number of samples. This formula is provided below:

$$n = \frac{\frac{z^2 pd}{xd^2}}{1 + \frac{1}{N}\left(\frac{z^2 pq}{xd^2} - 1\right)}$$

According to this formula and the number of 20 persons in the research population, the sample size is equal to 20 persons. Therefore, the census method has been used to distribute the research tools.

4.Data Analysis

4.1. Descriptive Statistics

Most of the subjects were men. In this group, 80% of the total sample is examined. Women also are made up only 20% of the sample population. 55% of the subjects are in the master's group. Also, 35% are in the group of people with a bachelor's degree and 10% are in the group of people with a doctoral degree. 45% of the people who make up the majority of the sample group are in the group of middle-aged people between 30 to 50 years old. . Also, 35% of people are under 30 years old and finally, 20% are over 50 years old. This age group is the lowest in the age component.

As mentioned, the statistical population of this study is all knowledgeable managers and employees in the field of financial affairs.

4.2. Fuzzy Delphi

Step 1: Distributing the initial questionnaire

Definition of linguistic variables

The questionnaire of the present study has been designed to obtain the opinion of experts about the extent of their agreement with the components and criteria of the model. So, experts have expressed their agreement through verbal variables such as strongly disagree, disagree, have no opinion, agree, strongly agree. Since the different characteristics of individuals affect their mental interpretations toward the qualitative variables, so, by defining the range of qualitative variables, experts have answered the questions with the same mentality. These variables are defined as triangular fuzzy numbers according to Table 4 and diagram 4.

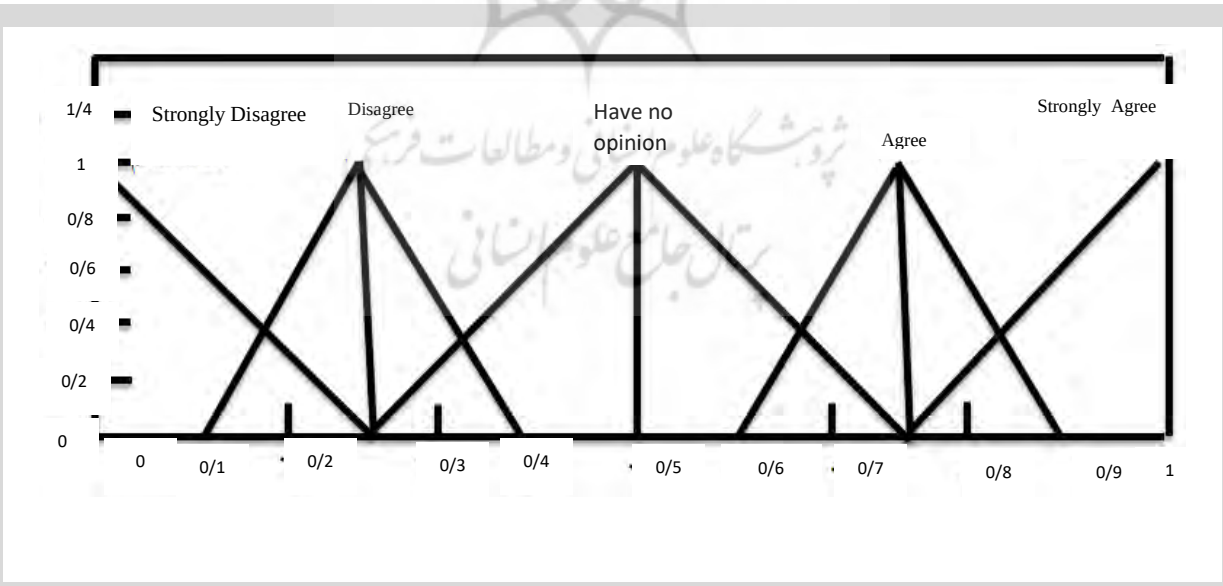

Diagram 1. Definition of Language Variables.

Table 1. Triangular fuzzy numbers of verbal variables.

Verbal Variables	Triangular Fuzzy Number	Defined Fuzzy Number
Strongly Agree	(0,0.25,1)	(0.9375)
Agree	(0.15,0.15,0.75)	(0.75)
Have no opinion	(0.25,0.25,0.5)	(0.5)
Disagree	(0.15,0.15,0.25)	(0.25)
Strongly Disagree	(0.25,0,0)	(0.0625)

In the table above, the definite fuzzy numbers are calculated using the Minkowski formula as follows:

$$X = m + \frac{B - a}{4} \qquad (1)$$

According to the results of this table, the fuzzy mean of each component is calculated according to the following equations:

$$A_i = \left(a_1^{(i)}, a_2^{(i)}, a_3^{(i)}\right) \qquad i = 1,2,3, \dots, n \qquad (2)$$

$$A_{ave} = (m_1, m_2, m_3) = \left(\frac{1}{n}\sum_{i=1}^{n} a_1^i, \frac{1}{n}\sum_{i=1}^{n} a_2^i, \frac{1}{n}\sum_{i=1}^{n} a_3^i\right) \qquad (3)$$

in this regard, iA represents the expert viewpoint of i and Aave represents the average viewpoint of the experts. The results of these calculations are shown in Table 5.

Table 2. Calculating the average opinion of experts obtained from the first survey.

Factor	m	α	β	De-fuzzy Mean
Financing Criteria				
Financing Cost	0.89	0.21	0.07	0.85
The Stability of Financing Method	0.83	0.20	0.10	0.80
The Efficiency of Financing Method	0.80	0.23	0.11	0.77
Operational Financing Method	0.76	0.23	0.13	0.74
Financing Transparency	0.85	0.21	0.09	0.82
Justice in the Distribution of Financial Resources	0.88	0.22	0.07	0.84
The Methods of Financing				
Receiving Facilities	0.84	0.20	0.10	0.81
The Formation of Sub-consortia	0.75	0.23	0.03	0.72
Creating a Project as a Project Shareholder	0.95	0.23	0.03	0.90
Creating Investment Companies	0.61	0.23	0.20	0.61
The Issuance of participation bonds	0.95	0.24	0.03	0.90
Attracting Foreign Capital	0.96	0.24	0.02	091
Presence in the Securities Market	0.88	0.23	0.07	0.83

In the table above, the triangular fuzzy mean is calculated using formula 2, and then, it de-fuzzed using the Minkowski formula (Formula 1). The obtained definite mean indicates the intensity of experts' agreement with each of the components of the conceptual model of research.

Step 2: Distributing the second version of the questionnaire

At this stage, after showing the results of the first questionnaire for each person, an attempt was made to inform the elites about the initial results of each question and the general answers of the people. Then, the second questionnaire was presented to the people. The fuzzy results of the studied options are also shown in Table 6:

Table 3. Calculating the average of experts' response.

Factor	m	α	β	De-fuzzy Mean
Financing Criteria				
Financing Cost	0.96	0.24	0.02	0.91
The Stability of Financing Method	0.94	0.24	0.04	0.89
The Efficiency of Financing Method	0.93	0.24	0.04	0.88
Operational Financing Method	0.94	0.24	0.04	0.89
Financing Transparency	0.95	0.24	0.03	0.9
Justice in the Distribution of Financial Resources	0.93	0.23	0.04	0.88
The Methods of Financing				
Receiving Facilities	0.96	0.25	0.02	0.91
The Formation of Sub-consortia	0.98	0.24	0.02	0.92
Creating a Project as a Project Shareholder	0.98	0.24	0.02	0.92
Creating Investment Companies	0.94	0.24	0.04	0.89
The Issuance of Participation Bonds	0.99	0.25	0.01	0.093
Attracting Foreign Capital	0.99	0.25	0.01	0.93
Presence in the Securities Market	0.95	0.24	0.03	0.9

According to the views presented in the first stage and its comparison with the results of this stage, if the difference between the two stages is less than the too-small threshold, then the poll process stops.

$$S(A_{m2}, A_{m1}) = \frac{1}{3}[(a_{m21} + a_{m22} + a_{m23}) - (a_{m11} + a_{m12} + a_{m13})] \quad (٤)$$

Considering the above formula, the average difference between the opinions of experts in the first and second groups can be calculated. The difference between the first and second stages is presented in Table 4:

Table 4. The difference in the de-fuzzy mean.

Factors	the De-fuzzy Mean of the First Stage	the Second Stage De-Fuzzy Mean	The Difference between the Mean of the two Populations
Financing Criteria			
Financing Cost	0.91	0.85	0.06
The Stability of Financing Method	0.89	0.8	0.09
The Efficiency of Financing Method	0.88	0.77	0.11
Operational Financing Method	0.89	0.74	0.15
Financing Transparency	0.9	0.82	0.08
Justice in the Distribution of Financial Resources	0.88	0.84	0.04
The Methods of Financing			
Receiving Facilities	0.91	0.81	0.10
The Formation of Sub-consortia	0.92	0.9	0.02
Creating a Project as a Project Shareholder	0.92	0.9	0.02
Creating Investment Companies	0.89	0.61	0.28
The Issuance of Participation Bonds	0.93	0.9	0.03
Attracting Foreign Capital	0.93	0.91	0.02
Presence in the Securities Market	0.9	0.83	0.07

As the table above shows, in most components, the expert group members have reached a consensus and the rate of disagreement in the first and second steps has been less than the very low threshold (0.1). So, the survey on the above components has stopped. And in the third survey, the remaining variables are examined.

Step 3: Distributing the third version questionnaire

At this stage, after showing the results of the second questionnaire for each person, an attempt was made to inform the elites about the initial results of each question and the general answers of the people. Then, the third questionnaire was presented to the people. The fuzzy results of the studied options are also shown in Table 8.

Table 5. Calculate the average response of experts.

Factors	m	α	β	De-fuzzy Mean
Financing Criteria				
The Efficiency of Financing Method	0.80	0.23	0.11	0.87
Operational Financing Method	0.76	0.23	0.13	0.85
The Methods of Financing				
Receiving Facilities	0.84	0.20	0.10	0.84
Creating Investment Companies	0.61	0.23	0.20	0.84

According to the views presented in the second stage and its comparison with the results of this stage, if the difference between the two stages is less than the too-small threshold, then the poll process will stop.

According to Formula 4, the difference between the average opinions of the experts in the first and second groups can be calculated. The difference between the first and second stages is presented in Table 6:

Table 6. The difference in the de-fuzzy mean.

Factors	the Me-fuzzy Mean of the Second Stage	the De-fuzzy Mean of the Third Stage	The Difference between the Mean of the two Communities
Financing Criteria			
The Efficiency of Financing Method	0.88	0.87	0.01
Operational Financing Method	0.89	0.85	0.04
The Methods of Financing			
Receiving Facilities	0.91	0.84	0.07
Creating Investment Companies	0.89	0.84	0.05

As the table above shows, in all components, the expert group members have reached a consensus and the rate of disagreement in the first and second stages has been less than the very low threshold (0.1). So, the survey on the above components stops.

4.3. Components Ranking Section with TOPSIS and Hierarchy

4.3.1. Determining the Weight of Criteria

Firstly, in this section, the matrix table of respondents' opinions about the importance of the studied variables is presented. The results of the average opinions of the respondents are presented in the form of Table 7.

Table 7. Matrix of people's opinions about the criteria under review.

	Justice	Transparency	Operational	Efficiency	Stability	Cost
Justice		3.2	3.1	4.1	2.5	4.3
Transparency			2.2	2.3	3.2	3.2
operational				2.2	1.3	2.2
Efficiency					3.4	3.1
Stability						2.3
Cost						

Then, attempts are made to examine the weight of the first level criteria using EXPERT CHOICE software and also according to the data obtained from the Hierarchical Analysis Questionnaire.

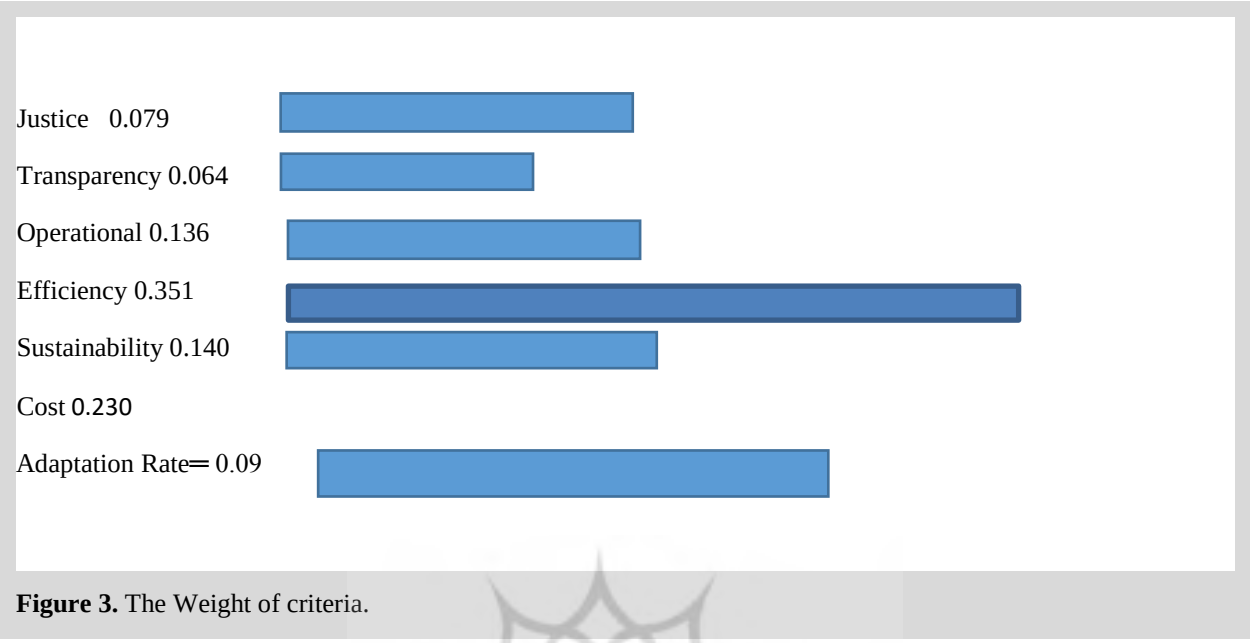

Figure 3. The Weight of criteria.

According to Figure 2, among the factors, the efficiency with weight (0.351), the cost with weight (0.230), sustainability with weight (0.140), operational with weight (0.136), justice with weight (0.079), and transparency with weight (0.064) have the highest and lowest weights in the hierarchical analysis, respectively.

4.4. Prioritization of Different Sections of the Statistical Population Using TOPSIS Technique

a. First step: formation of decision matrix

The results of the expert opinions are presented in Table 8.

Table 8. Decision matrix number.

The Methods of Financing	Cost	Sustainability	Efficiency	Operational	Transparency	Justice
Receiving Facilities	3.18	3.21	3.26	3.31	3.38	4.68
The Formation of Sub-consortia	2.99	3.24	3.57	3.49	3.60	4.49
Creating a Project as a Project Shareholder	1.82	2.05	2.06	1.73	1.68	3.32
Creating Investment Companies	2.83	3.03	2.74	2.16	2.19	4.33
The Issuance of Participation Bonds	3.31	3.19	2.92	2.74	2.43	4.81
Attracting Foreign Capital	1.82	1.79	1.45	1.36	1.45	3.32
Presence in the Securities Market	2.61	2.39	2.06	2.08	1.93	4.11

b. The second step: admeasuring the decision matrix

In this step, each of the values of the decision matrix cells is divided by the vector size of the same index. The unmeasured matrix is presented in Table 9.

$$r_{ij}=\frac{X_{ij}}{\sqrt{\sum_{i=1}^{m} x_{ij}^2}} \quad (5)$$

Table 9. Unscaled matrix.

The Methods of Financing	Cost	Sustainability	Efficiency	Operational	Transparency	Justice
Receiving Facilities	0.44	0.44	0.46	0.50	0.51	0.42
The Formation of Sub-consortia	0.42	0.44	0.50	0.52	0.54	0.41
Creating a Project as a Project Shareholder	0.25	0.28	0.29	0.26	0.25	0.30
Creating Investment Companies	0.39	0.42	0.39	0.32	0.33	0.39
The Issuance of Participation Bonds	0.46	0.44	0.41	0.41	0.37	0.43
Attracting Foreign Capital	0.25	0.25	0.21	0.20	0.22	0.30
Presence in the Securities Market	0.36	0.33	0.29	0.31	0.29	0.37

c. Third step: the multiplication of probability (weights) in the softened matrix

In this section, the weights calculated in the Hierarchical Analysis section are multiplied by the columnar values of each index to obtain a multiplication matrix in intensity.

Table 10. Multiplication of the probability (Weights) in the decision matrix.

The Methods of Financing	Cost (0.230)	Sustainability (0.140)	Efficiency (0.351)	Operational (0.136)	Transparency (0.064)	Justice (0.079)
Receiving Facilities	0.101	0.057	0.161	0.068	0.033	0.033
The Formation of Sub-consortia	0.097	0.057	0.176	0.071	0.035	0.032
Creating a Project as a Project Shareholder	0.058	0.036	0.102	0.035	0.016	0.024
Creating Investment Companies	0.090	0.055	0.137	0.044	0.021	0.013
The Issuance of Participation Bonds	0.106	0.057	0.144	0.056	0.024	0.034
Attracting Foreign Capital	0.058	0.033	0.074	0.027	0.014	0.024
Presence in the Securities Market	0.083	0.043	0.102	0.042	0.019	0.029

d. Fourth step: Determining the ideal and ideal solution

In this part, the highest number for each column is introduced as the ideal solution, and the lowest number is introduced for each column as the anti-ideal solution:

Table 11. The ideal and ideal solution.

	Cost	Sustainability	Efficiency	Operational	Transparency	Justice
Ideal	0.106	0.057	0.176	0.071	0.035	0.034
Anti-ideal	0.058	0.033	0.074	0.027	0.014	0.024

e. Fifth step: obtaining the size of the distances

In this section, Formula 6 is used to measure the size of distances:

$$s_i^* = \sqrt{\sum_{j=1}^{n} (v_{ij} - v_j^*)^2} \qquad i = 1,2,3,4 \qquad (6)$$

Table 12. The size of the distances from the ideal.

Option	Ideal
Receiving Facilities	0.016
The Formation of Sub-consortia	0.009
Creating a Plan as a Shareholder	0.100
Creating Investment Companies	0.052
The Issuance of Participation Bonds	0.037
Attracting Foreign Capital	0.126
Presence in the Securities Market	0.086

f. The distance from the ideal point and anti-ideal

A) The size of the distances from the ideal

B) The size of the distances from the anti-ideal

Table 13. The size of distances from anti-ideal.

Option	Ideal
Receiving Facilities	0.110
The Formation of Sub-consortia	0.122
Creating a Plan as a Shareholder	0.029
Creating Investment Companies	0.077
The Issuance of Participation Bonds	0.094
Attracting Foreign Capital	0
Presence in the Securities Market	0.042

g. Similarity index

In this section, the proximity to the ideal state is calculated based on the values of the distance from the positive and negative ideals. In this step, the following formula is used:

$$c_1^* = \frac{s_1}{s_1^+ + s_1^-} \qquad (7)$$

In this formula:

C * = similarity index

-S1 = distance size from the anti-ideal

+S1 = distance from the ideal

Based on this, the values of the distance close to the ideal state in each option are obtained as follows:

Table 14. Similarity index.

option	Distance from the Ideal
Receiving Facilities	0.87
The Formation of Sub-consortia	0.93
Creating a Plan as a Shareholder	0.22
Creating Investment Companies	0.60
The Issuance of Participation Bonds	0.72
Attracting Foreign Capital	0
Presence in the Securities Market	0.33

According to Table 14, it can be stated that among the methods of financing, the formation of subsidiary consortia (0.93), receiving facilities with weight (0.87), the issuance of participation bonds with weight (0.72), creating investment companies (0.60), presence in the securities market (0.33), creating a shareholder plan (0.22), and finally attracting foreign capital (0.00001) had the highest and lowest priority among financing methods, respectively.

4.3. Applying the ANP Method to Prioritize the Financing Criteria and Methods

In this section, the data obtained from the questionnaires have been collected and the geometric mean has been used to unify the experts' answers. To obtain the research findings, Super Decisions software was used to implement ANP.

a. Problem structure to network analysis process image

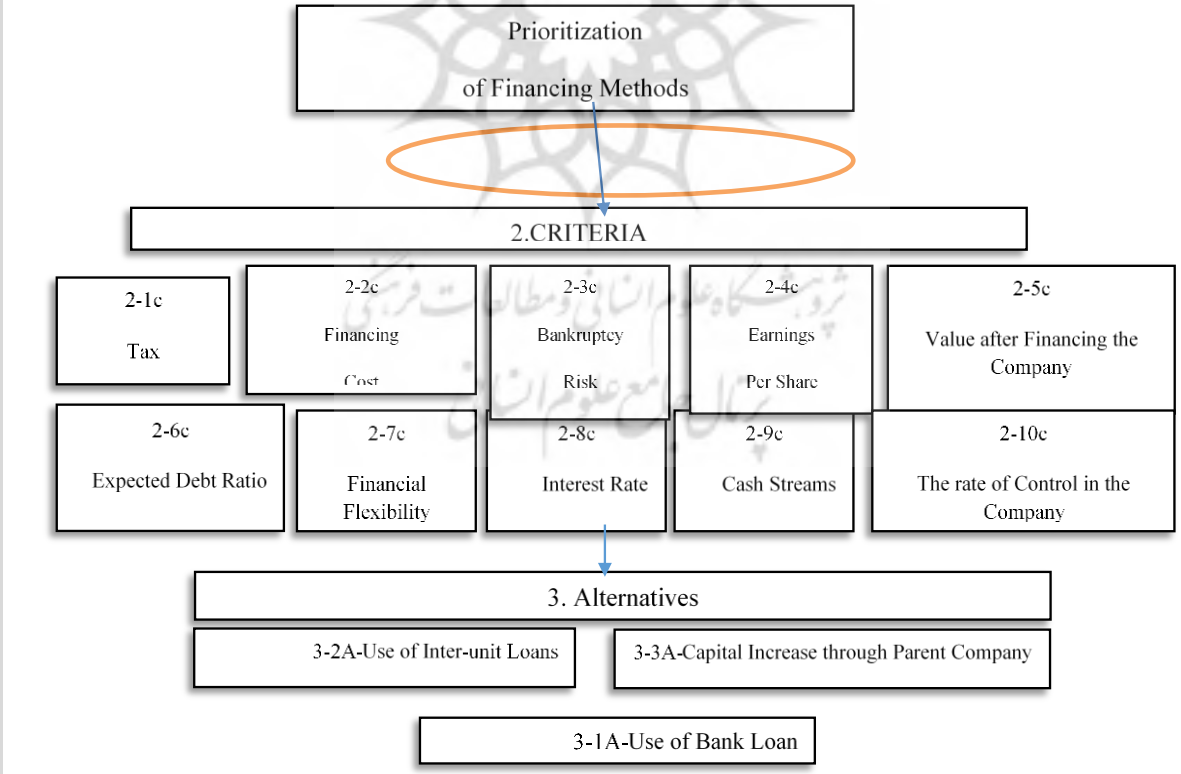

Figure 4. The weight of criteria.

b. Unbalanced super matrix (Unweighted)

The unweighted super matrix contains internal preferences derived from the pairwise comparisons in the network. All information about internal preferences can be viewed directly in the unweighted super matrix. The number 1 indicates equal preference and the number 0 indicates no relationship. The following table shows the parts of the unweighted (unbalanced) super matrix in the research problem:

Table 15. Asymmetric super matrix.

Cluster Node Labels		1.Goal	2.CRITERIA						
		Prioritization of Financing Methods	2-1c Tax Advantage	2-2c FinancingCost	2-3c Bankruptcy Risk	2-4c Earnings per Share	2-5c Value after Financing the Company	2-6c Expected Debt Ratio	2-7c Financial Flexibility
1.Goal	Prioritization of Financing Methods	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
2.CRITERIA	2-1cTax Advantage	0.100000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
	2-2c FinancingCost	0.100000	0.143923	0.000000	0.157048	0.041933	0.044348	0.264806	0.202299
	2-3cBankruptcy Risk	0.100000	0.029022	0.750000	0.000000	0.085818	0.039657	0.243397	0.062528
	2-4c Earningsper Share	0.100000	0.077122	0.000000	0.000000	0.000000	0.091269	0.000000	0.000000
	2-5c Value after Financing the Company	0.100000	0.118436	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
	2-6c Expected Debt Ratio	0.100000	0.109172	0.000000	0.593645	0.172390	0.463512	0.000000	0.313845
	2-7c Financial Flexibility	0.100000	0.227115	0.000000	0.000000	0.308297	0.157971	0.000000	0.000000

c. Balanced or weighted super matrix

The weighted super matrix is obtained by multiplying all the elements in a component by the unweighted super matrix in the corresponding cluster weight. Excerpts from the weighted hyper matrix table of the research problem are as follows:

Table 16. Rhythmic super matrix.

Cluster Node Labels		1.Goal	2.CRITERIA						
		Prioritization of Financing Methods	2-1c Tax Advantage	2-2c Financing Cost	2-3c Bankruptcy Risk	2-4c Earnings per Share	2-5c Value after Financing the Company	2-6c Expected Debt Ratio	2-7c Financial Flexibility
1.Goal	Prioritization of Financing Methods	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
2.CRITERIA	2-1c Tax Advantage	0.100000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
	2-2c Financing Cost	0.100000	0.071961	0.000000	0.078524	0.020967	0.022174	0.132403	0.101149

Cluster Node Labels		1.Goal	2.CRITERIA						
		Prioritization of Financing Methods	2-1c Tax Advantage	2-2c Financing Cost	2-3c Bankruptcy Risk	2-4c Earnings per Share	2-5c Value after Financing the Company	2-6c Expected Debt Ratio	2-7c Financial Flexibility
	2-3c Bankruptcy Risk	0.100000	0.014511	0.375000	0.000000	0.042909	0.019829	0.121698	0.031264
	2-4c Earnings per Share	0.100000	0.038561	0.000000	0.000000	0.000000	0.091269	0.000000	0.000000
	2-5c Value after Financing the Company	0.100000	.059218	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
	2-6cExpected Debt Ratio	0.100000	0.054586	0.000000	0.296822	0.086195	0.231756	0.000000	0.156922
	2-7c Financial Flexibility	0.100000	0.113557	0.000000	0.000000	0.154149	0.078986	0.000000	0.000000

d. Limited or finite super matrix

The limited hyper matrix is obtained by being able to reach the weighted hyper matrix several times until the numbers of all the rows are the same. In this case, the multiplication process is stopped and the finite matrix is obtained, which is the final solution to the problem in this hyper matrix. The following tables are parts of the finite super matrix of the research problem:

Table 17. Limit super matrix.

Cluster Node Labels		1.Goal	2.CRITERIA						
		Prioritization of Financing Methods	2-1c Tax Advantage	2-2c Financing Cost	2-3c Bankruptcy Risk	2-4c Earnings per Share	2-5c Value after Financing the Company	2-6c Expected Debt Ratio	2-7c Financial Flexibility
1.Goal	Prioritization of Financing Methods	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
2.CRITERIA	2-1c Tax Advantage	0.001563	0.001563	0.001563	0.001563	0.001563	0.001563	0.001563	0.001563
	2-2c Financing Cost	0.115566	0.115566	0.005566	0.115566	0.115566	0.115566	0.115566	0.115566
	2-3c Bankruptcy Risk	0.135145	0.135145	0.135145	0.135145	0.135145	0.135145	0.135145	0.135145
	2-4c Earningsper Share	0.002859	0.002859	0.002859	0.002859	0.002859	0.002859	0.002859	0.002859
	2-5c Value after Financing the Company	0.010184	0.010184	0.010184	0.010184	0.010184	0.010184	0.010184	0.010184
	2-6c Expected Debt Ratio	0.096988	0.096988	0.096988	0.096988	0.096988	0.096988	0.096988	0.096988

Cluster Node Labels		1.Goal	2.CRITERIA						
		Prioritization of Financing Methods	2-1c Tax Advantage	2-2c Financing Cost	2-3c Bankruptcy Risk	2-4c Earnings per Share	2-5c Value after Financing the Company	2-6c Expected Debt Ratio	2-7c Financial Flexibility
	2-7c Financial Flexibility	0.006522	0.006522	0.006522	0.006522	0.006522	0.006522	0.006522	0.006522

Finally, the priorities obtained are as follows:

The table below shows the numbers obtained for the criteria and options.

Table 18. The results of ranking options and criteria.

Criterion Name	Normalized Data	Constraints
Prioritization of Financing Methods	0.00000	0.000000
Expected Debt Ratio	0.00313	0.001563
Financing Cost	0.23113	0.115566
The Attraction of Foreign Capital	0.27029	0.135145
Earnings per Share	0.00572	0.002859
Value after Financing the Company	0.02037	0.010184
Tax Advantage	0.19398	0.096988
Financial Flexibility	0.01304	0.006522
Interest Rate	0.11737	0.058685
Cash Flows	0.07720	0.038602
The Rate of Control over the Company	0.06777	0.033886
Use of Bank Loan	0.21138	0.105689
Use of Inter-unit Loans	0.47396	0.236978
Capital Increase through Parent Company	0.31467	0.15733

Therefore, the ranking of criteria influencing the choice of financing method in the ANP method is presented in the table below.

Table 19. Ranking.

Criterion Name	Weight Obtained for this Criterion	Rank Related to the Criterion
Expected Debt Ratio	0.001563	10
Financing Cost	0.115566	2
The Attraction of Foreign Capital	0.135145	1
Earnings per Share	0.002859	9
Value after Financing the Company	0.010184	8
Tax Advantage	0.096988	3
Financial Flexibility	0.006522	4
Interest Rate	0.058685	5
Cash Flows	0.038602	6
The Rate of Control over the Company	0.033886	7

According to the table above, the attraction of foreign capital is in the highest rank. Regarding the foreign and international sources of financing, there are different groups of financiers, each of which has its characteristics and conditions. The most important sources of foreign financing can be listed as follows:

Investment Institutions and Insurance Companies

International Commercial Banks

World Banks Group

International Bonds Markets

Local Bond Markets and Local Banks

Vendors' Credits

Specific Energy Investment Resources

In general, the financing operations from the international sources are divided into direct, semi-direct, and indirect methods depending on the volume, mechanism, and the legal conditions of the lender and the borrower in receiving and repaying the principal and interest of the loan.

The priorities obtained for the options are also shown in the chart below.

Table 20. The prioritization of options.

Name	Graphic	Ideals	Normals	Raw
Use of Bank Loan		0.445986	0.211377	0.105689
Use of Inter-unit Loans		1.000000	0.473955	0.236978
Capital Increase through Parent Company		0.663919	0.314668	0.157334

As can be seen in the chart above, the results are shown in the four columns, the first column being graphical and the description of the next columns are as follows:

Table 21. The description of the relevant columns.

Column Name	Description
Normal	This column shows the priority of each option based on the pairwise comparison form and is the most common way to observe the results.
Ideal	The values of this column are obtained by dividing the Normals column numbers by the largest number of this column. So, the numeric value is the option that has the priority and the selected is always l.
Raw Statistics	The values of this column are obtained directly from the finite super matrix.

According to the above explanations, among the methods of financing, the use of inter-unit loans has the highest priority, and the use of bank loans have the lowest utility according to the effective criteria are decided by experts.

The mismatch rate for pairwise comparisons was generally less than 0.1. So, judgments can be trusted.

It should be noted that the weights related to the prioritization of financing options are used as a coefficient of some deviations in the function of the objective of the ideal planning model.

5. Conclusions

The present study seeks to provide a model for optimal capital structure in the subsidiaries of the Ministry of Petroleum using the domestic financial markets. Based on the research findings, it was found that the factors of efficiency, cost, stability, operational, justice, and transparency have been the most important criteria for selecting financing methods in the subsidiaries of the Ministry of Petroleum. As well, the formation of sub-consortia, receiving facilities, the issuance of participation bonds, creating investment companies, presence in the securities market, the creation of a plan as a shareholder have been identified as financing methods. The results of this paper are in line with the research of Spitsin (2020), Codetzker (2017), DiAngelo (2015), Sean (2015), Alan (2018), and Barrison (2020).

As a result of identifying criteria and methods of financing, it was found that the factors of efficiency, cost, sustainability, operational, justice, and transparency have been the most important criteria for selecting financing methods. As well, the formation of sub-consortia, receiving facilities, the issuance of participation bonds, creating investment companies, presence in the securities market, the creation of a plan as a shareholder, and finally attracting foreign capital have been identified as financing methods. The results of this article are in line with the research of Spitsin (2020), Kutzker (2017), DeAngelo (2015), Synn (2015), Alan

(2018), and Barison (2020).

The results of the criteria analysis showed that among the factors, the efficiency with weight (0.351), the cost with weight (0.230), sustainability with weight (0.140), operational with weight (0.136), justice with weight (0.079), and transparency with weight (0.064) have the highest and lowest weights in hierarchical analysis, respectively. In fact, in this section, it was found that the efficiency of the financing method has been of great importance for the respondents. The results of this study also showed that the transparency of the financing method in the surveyed companies to identify the appropriate financing method has the least importance. The results of this article are in line with the research of Bhardwaj (2018), Ramalho (2018), Levine (2020), Cummins (2016), and Spitsin (2020).

The TOPSIS method has also been used to rank financing methods. The results of information analysis in this section showed that among the methods of financing, the formation of sub-consortia (0.93), receiving facilities with weight (0.87), the issuance of participation bonds with weight (0.72), creating investment companies (0.60), presence in the securities market (0.33), creating a plan as a shareholder (0.22), and finally attracting foreign capital (0.00001) had the highest and lowest priority among the financing methods, respectively. The results of this article are in line with the research of Gao (2017), Barison (2020) and Salim (2019), and Sundaresan (2013).

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