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Providing A Model To Optimize The Composition Of External Suppliers In Sanctions Considering Delivery Time In Multi-Product Status Using The Combination Of Multi-Criteria Decision Making And Integer Mathematical Planning

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Abstract

The purpose of this article is to optimize the portfolio of foreign suppliers under sanctions. This paper attempts to calculate the percentage of each supplier supplying products to a domestic importer. Criteria for determining this share include supplier reliability in terms of sanctions restrictions and the pressures that arise, as well as the timing of deliveries. For this purpose, first, appropriate criteria were set for external suppliers under sanctions by interviewing experts. The statistical population consisted of all experts of the study company, ten of whom were interviewed and the other ten were used for quantitative research. After determining the criteria, 7 effective and 8 effective criteria were determined using Demetel technique and the effective criteria were eliminated. Then, using the weighted analytical hierarchy method, the 7 effective criteria set in the DEMATEL method were determined, and then using the Mora method 13 external suppliers of the company based on the weighted criteria in the analytical hierarchy method, by rating each product. Were. Then, using an integer mathematical model, the optimal order quantity for each supplier was modeled separately for each product. This model was solved using an innovative method that optimizes the supplier basket and finally the optimal order quantity. Calculated to each supplier.

Keywords: *SCM-Mathematical planning-multi-criteria decision making- supplier evaluation*

1. **Introduction**:

Sanctions, as a unilateral and pro-planned action by the powers, have always targeted independent and emerging economies in recent years. Indeed, the purpose of economic sanctions has been defined as restricting economic relations to exert pressure on a country to change the behavior of the political system ruling it (Katrayi & Shirazi, 2015), but one of the important processes influencing economic sanctions in organizations is the evaluation and selection process. Provides raw materials or intermediary and capital goods. Obviously, economic sanctions can affect all relationships and relationships with external suppliers and alter many equations (Prajogo et al., 2012). The issue of sanctions can be considered as one of the most important risks facing the supply chain and therefore the uncertainty that is always in the supply chain is the focus of researchers in this field with a new approach to the issue of sanctions. From the perspective of supply chain researchers, there are two levels of risk that include failure risks and operational risks (Gornani et al., 2012 and Savik, 2017). Operational risks are risks that include inherent uncertainties arising from demand and supply synchronization issues such as uncertain customer demand, uncertain supply, uncertain cost and uncertain delay. But the risks of disruption stem from major disruptions to normal activities such as material and information flows from natural and man-made disasters such as floods, or equipment failures and economic crises, terrorist attacks, and widespread workers' strikes (Marshowska, 2016; Savik, 2017) Obviously, economic sanctions can be added to the second category of disruption risks because, from the perspective of victim countries, sanctions are no different from natural disasters and while natural disasters can be repaired in some societies in the short term, economic sanctions are largely The mediation of the dominance of the great powers is almost subject to the long run and can lead to eroding branding which in turn violates the country's supply chains.

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Therefore, it is important to pay attention to the supply chain under sanctions, which is the purpose of this paper. This study attempts to present a hybrid approach to optimize supplier portfolio under sanctions, which focuses on delivery time and supplier reliability under sanctions. To achieve the best combination of suppliers, a combination of quantitative and qualitative approaches is used in the quantitative segment that combines DEMATEL, AHP, MORA techniques as well as integer planning. The ultimate goal of this approach is to obtain a share of the supply of each product separately from suppliers, where suppliers with a share of less than 10% are eliminated and their share is allocated to suppliers with a share of more than 10%. Ultimately, the best suppliers are determined by the percentage they can have of each product.

The structure of this article is as follows in the literature review and then the techniques used in the present study are described. The mathematical model is then presented and the solution method, which is a heuristic algorithm specific to supplier portfolio optimization, is explained. Then numerical calculations are presented and finally the findings and results are expressed.

2. Literature review

(2013) for supplier selection in a closed-loop supply chain multi-objective robust optimization approach using experiment design and simulation to ensure that supply chain costs and quality products are in the optimal decision-making area. Have been used. Rosazi Research and Tavakoli Bank (2014) focuses on supplier selection activity in a supply chain, which consists of two layers of buyer and supplier so that the buyer in each sub period has a number of suppliers to supply items. It chooses its requirements based on price criteria, transaction cost and storage cost. Khatami Firouzabadi (2014) examines the process of evaluating the decisions of importing fully manufactured parts or importing parts of them, and assembling them domestically for a manufacturing company. Akbari (2016) in the research is seeking to develop and apply an evaluation model for supplier selection with regard to quantitative and qualitative criteria. For this purpose hierarchical analytical method and gray relationship analysis have been used. Yahya Zadeh Andari et al. (2016) research seeks to select suppliers and determine the order quantity of products considering all constraints in order to minimize costs and maximize the desirability of purchasing under uncertainty. It is a multi-objective model and then the deterministic model is converted to a robust model using a scenario-based approach. But Mashari et al. (2016) have worked on the agility issue in suppliers, and thus have proposed a network analysis process model as a framework for answering the research question. Then, the ANP approach was used to rank the criteria. In an article, Vosough et al. (1986) identified and determined effective benchmarks in evaluating and selecting external suppliers in ICT infrastructure projects with the help of experts, experts and decision makers of the study company using the AHP group approach. Mousavi-Nia and Soltani (1986) provide a solution for selecting and prioritizing key indicators in the evaluation and selection of suppliers with a green approach to the food industry using a QFD-ANP hybrid model at Pak Dairy. Mousavi Nia and Soltani (1396) in another study provide an integrated approach this time using QFD and DEMATEL methods to evaluate and prioritize technical requirements in supplier selection with green strategies in the food industry. Following on from a series of papers by Mousavi Nia and Soltani, in another study, using the combination of SWARA and QFD techniques, they sought to prioritize technical requirements in evaluating and selecting a supplier with a green approach to the food industry. Other research offers a suitable integrated approach to selecting the best supplier. Their proposed method included ANP, QFD as well as fuzzy SIR.

The purpose of Nemuler and Lash's (2015) paper is to present a comprehensive approach and a problem-based model for configuring strategic supplier selection portfolios in terms of performance-based goals and sustainability goals. The techniques used in this research are ANP multi-criteria decision making techniques as well as ideal planning. The purpose of the paper is to provide a decision support model for supplier selection based on analytical hierarchy process using a case study in the automotive industry in Pakistan, which is then sensitivity analysis to evaluate firm supplier face selection decision. Takes. Avashi et al. (2017) present a hybrid approach based on the ahp and fuzzy Victor approach for global sustainable supplier selection that considers sustainability risks from

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retailers. Song et al. (2017) A new hybrid approach Develop in their paper that this method combines the merits of pairwise comparisons in determining relative importance, the power of decision-making tests and laboratory evaluation in manipulating complex issues with less data, as well as the advantage of inaccurate figures in the face of ambiguous information. In the study of Liu et al. (2017), a new intuitive ANP-based game theory approach is presented to consider supplier management in uncertain environments. Entropy and ANP weights are used to achieve the objective and subjective weights of the criteria and can then be determined based on DEMATEL and game theory. In Savik's research (2018), a scenario-based mixed-integer planning approach is developed to select the supplier of a dynamic risk-averse portfolio. In the scenario analysis of high-impact and low-probability supply disruption scenarios are combined with low-impact and high-probability supply delays. It has 30 benchmarks for car spare parts manufacturer. This approach provides a rigorous sustainable supplier ranking and a reliable solution for sustainable sourcing decisions. (2019) provide a multi-criteria group decision making technique that incorporates ANP and VIKOR under a neutroscopic environment to deal with incomplete information and high order inaccuracy. This is done using triangular neutroscopic figures to represent linguistic variables based on the opinions of experts and decision makers.

Based on the literature review, it can be seen that much research has been done, both internal and external, on supplier evaluation, but several points in the present study can be identified as a research gap.

1. In most of the above researches, suppliers' evaluation is merely focused and less attention is given to optimizing the supplier portfolio or determining each supplier's share in the supply of different product or products. For example, many studies have suggested whether or not to choose a supplier that the present study attempts to go beyond this.
2. Reviewed research has found that less attention has been paid to economic sanctions and most often focuses on issues such as uncertainty, disruption or supply chain risk that, given the recent nature of the sanctions debate, can be considered as other risks. Consider an important risk, in other words, super risk.
3. By reviewing the above research, it can be seen that less research is focused on the integrated model that can combine qualitative techniques, multi-criteria decision making and mathematical models of integers and this can be considered as a research gap. In addition, the method of solving the present research model is an innovative one that has rarely been used in supplier research or supplier evaluation.

2. Methodology

The present study is an applied one in terms of purpose and a survey method in terms of data collection. The statistical population of the present study includes all experts of Azar Sepahan Asia Company, among which 10 are selected for interview and 10 for quantitative. The data analysis method is a combination of qualitative and quantitative methods which are extracted from the qualitative part of the supplier criteria under sanctions by experts and in the quantitative part of these criteria are sifted and weighed using multi-criteria decision making techniques. Based on this sieve and weight, the supplier's rating is calculated using this rating to obtain the reliability rating of each supplier separately for each product. The general framework of the research is outlined below.

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Figure 1. Overall Research Framework

3.1. Interview

As mentioned in the previous section, the research consists of both qualitative and quantitative sections, which were conducted through interviewing experts from Azarspahan Asian Company. The purpose of this section is to derive appropriate supplier criteria under sanctions. To this end, experts from the company under study were asked what are the appropriate supplier criteria under sanctions? The results of the interviews were extracted from the content analysis using the content analysis technique.

3-2. Dimethyl method

After the interview, the extracted factors were determined, but since the effect of these factors is still unclear, the DEMATEL method was used to determine the effective factors. In fact, the DEMATEL method constitutes the first phase of the quantitative analysis of the present article, in which ten experts in Azar Spahan Asia were scored on the criteria extracted in terms of impact ranging from 1 to 10. It should be noted that the DEMATEL method is one of the most effective

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methods in determining effective criteria, but this method is not capable of ranking as well as weighting the criteria and will only determine the impact or effectiveness of the criteria extracted.

3-3. Analytical Hierarchy Process

After determining the criteria effective and effective by using the Demetel method, since this method is not able to determine the weight of the criteria and on the other hand in the ranking of suppliers, the weight and importance of each criterion must be determined. The hierarchical analysis method, or AHP, is used. This technique is one of the paired comparison techniques such as ANP that is able to determine the weight of the criteria. In other words, the output of this method is the weight value that is continuously assigned to any of the criteria in the interval between zero and 1, and this input weight is the input weight of the chosen ranking method such as Topsis, Mora or Vikor and ... . will be.

3-4. Mora's method

After determining the metrics of the supplier's criteria under the sanctions, it is time to prioritize the suppliers based on the set criteria, which is done using the Mora method. Mora's method is selected for the present study for three reasons.

1. Mora is regarded as the latest multi-criteria decision-making technique to cover the weaknesses of other older methods.
2. The result is a fixed nature and the start time is low.
3. The computational time for Mora is similar to other multi-criteria decision making methods.

The ranking is performed by the Mora method for each of the products studied and the output of this method is input reliability parameters to the integer programming model.

3-5. Integer programming models

In this section, the integer planning model seeks to maximize supplier reliability while minimizing delivery times. is presented. Following are the model assumptions and then the parameters and variables.

3.5.1. Assumptions

1- There is reliability for each supplier that comes from the Mora method.
2. The importance of each product's delivery varies from supplier to supplier, and the rating is determined by experts.
3. The average product delivery time is obtainable from the company database
4. The decision variable is the optimal allocation of the product to each supplier that contains a numeric value between zero and one.
5- The decision matrix includes the number of suppliers as well as the products.

Parameters and Variables:

Supplier= s

Product = p

Reliability factor of supplier “S” for product”P” = α_p^s

Reliability factor of delivery of product”P” by supplier“S” =β_p^s

Reliability factor of each supplier“S” for each product = R_p^s

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Average delivery time of each product "P" by supplier"S"=T_p^s
Optimal allocation order of each product "P" to supplier"S" = X_p^s

Objective functions and constraints

$$\max z1 = \sum_{s=1}^{S}\sum_{p=1}^{P} X_p^s \quad (1)$$

$$\sum_{p=1}^{P} X_p^s = 1 \quad (2)$$

$$0.1 \le X_p^s \le 1 \quad (3)$$

$$0 \le R_p^s . X_p^s \le 1 \quad (4)$$

$$T_p^s . X_p^s \ge 0 \quad (5)$$

$$a_p^s . X_p^s \le 10 \quad (6)$$

$$\beta_p^s . X_p^s \le 10 \quad (7)$$

$$\sum_{p=1}^{P} X_p^s = \sum_{p=1}^{P} \left\| \frac{\beta_P^S * 1 - T_P^S + \alpha_P^S * R_P^S}{2} \right\| \quad (8)$$

Description

Equation (1) shows the objective function that maximizes the reliability of the suppliers are.

Equation (2) states that the total reliability for the entire supplier of a product cannot exceed 1.

Equation (3) shows the range of reliability for each supplier that is not less than 0.1 acceptable.

Equation (4) shows that the amount of reliability calculated using the Mora method on the share of each supplier cannot be in the continuous range of zero and one.

Equation (5) states that the average amount of time specified in the share of each supplier cannot be a negative number.

Equation (6) implies that the alpha value in the maximum decision variable for each element leads to the number 10.

Equation (7) implies that the beta value in the maximum decision variable for each element leads to the number 10.

Equation (8) shows the formula for calculating each supplier's share values.

3-6. Solution Methods

The method of solving the research model is based on a heuristic algorithm that is able to calculate the optimal share of each supplier in terms of order quantity, which is assigned to each supplier as a percentage. It is designed to eliminate suppliers with less than 10% share and to increase their share to other suppliers with more than 10% share. The steps of the heuristic algorithm are described in simple terms.

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Figure 2. The Heuristic Algorithm Used in the Present Studyv

3. Case Study Introduction

The company used in the study is Azar Sepahan Asia which supplies petroleum, petrochemical and electronic components. The company was founded in 2004 and has more than 75 specialist employees and 3 branches in Tehran, Tabriz and Qazvin, which is headquartered in Tehran. The technical experts

Creating an R matrix

Creating an T matrix

Normalization R Matrix

Multiply the normalized R matrix in the alpha matrix

Matrix Normalization T

Matrix Formation 1 - Normalized Matrix T

Matrix multiplication 1- Normalized T matrix in beta matrix

*Calculate the average of the matrix 1-normalized matrix T * beta and the normalized matrix R * alpha*

Matrix Normalization Matrix Mean Matrix

Calculate the sum of the values of the layers below 0.1 in the mean normalized matrix

Calculate the number of layers with values greater than 0.1 in the mean normalized matrix

Divide by the sum of the values of the layers below 0.1 divided by the number of layers having a value above 0.1

Adding the value obtained in the previous step to values greater than 0.1

.Assign zero value to layers with values less than 0.1 in the average normalized matrix

and managers of the company were selected as the statistical population of the present study. Some of our products are supplied by foreign suppliers, including 13 suppliers. In terms of confidentiality and that the executives of the study company do not wish to disclose the results of their research to their suppliers and regard it as confidential company information, the researcher does not have the authority to provide any external suppliers. But the products provided by these 13 suppliers are as follows.

Table 1. Company Product Information

Product Title	item
UPS	**1**
UPS battery	**2**
Generator	**3**
Petrol pump nozzle	**4**
Bread rotary oven	**6**

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4.1.Numerical calculations

In this section we enter the numerical computation stage, which combines qualitative and quantitative techniques. First, the coding and content analysis of the interviews are reviewed, followed by a few steps along with relevant tables and charts.

4-2. Qualitative analysis

4.2.1.Data coding: At this point the desired data is encoded. Each of the criteria in the Supplier Selection Criteria section ranges from 1 to 16. As stated, these criteria are extracted from the standpoint of sanctions by experts. So we have 16 criteria called C, which is the first of the criteria, for example C1 code referred to security. Timely response C16.

The interviewees are then coded as e1 to e10, which includes 10 interviewees. Table 4-2 provides the code of the interviewees for the survey. Based on the above criteria, we present the following table, which describes all the criteria obtained with the type of strategy as well as the code in question.

Table 2. Survey Interviewers With Specifications

Interview code	Gender	post	Level of Education	Field of Study
E1	M	Responsible for one of the quality control units	MSc	mechanical engineering
E2	M	designer	MSc	Electronic Engineering
E3	M	Responsible for one of the design units	MSc	mechanical engineering
E4	M	IT Officer	BSc	computer engineer
E5	M	programmer	BSc	computer engineer
E6	F	Technical Assistant	MSc	Electronic Engineering
E7	M	Manager of one of the sales units	BSc	Business Management
E8	M	technical expert	BSc	mechanical engineering
E9	F	Responsible for sales unit	PHD student	Business Management
E10	M	officer	BSc	industrial engineering

Table 3. Supplier Selection Indicators Based on Conditions of Sanctions with Coding

Code	criterion
C1	Safety under sanctions
C2	On time delivery
C3	Financial risks in the currency market turmoil and sanctions
C4	Technology and its transmission under sanctions and barriers
C5	Improving the quality of service under sanctions
C6	Maintain compliance with quality standards and standards despite sanctions
C7	Providing quality products and services despite reduced communication with foreign markets

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C8	R&D under sanctions
C9	Capacity of production in terms of sanctions and despite the shortcomings of sanctions
C10	Flexibility in providing services under sanctions
C11	Acceptable price offer despite sanctions
C12	Management capabilities, especially crisis management under sanctions
C13	Financial position in times of currency crisis and sanctions
C14	The firm's reputation for providing products and services
C15	Proper public relations
C16	Timely accountability

Table 4. Criteria Selected by Experts by Code of Interviewees

Row	Interviewers' code	Criterion	Frequency
1	E1,E2,E3	Safety under sanctions	3
2	E1,E2,E4,E6	On time delivery	4
3	E3,E4,E7,E9,E10	Financial risks in the currency market turmoil and sanctions	5
4	E1,E4,E5,E10	Technology and its transmission under sanctions and barriers	4
5	E3,E4,E5	Improving the quality of service under sanctions	3
6	E2,E3,E5,E9,E10	Maintain compliance with quality standards and standards despite sanctions	5
7	E1,E2,E4,E5,E7	Providing quality products and services despite reduced communication with foreign markets	5
8	E3,E4,E6,E8	R&D under sanctions	4
9	E2,E3,E4,E6,E7	Capacity of production in terms of sanctions and despite the shortcomings of sanctions	5
10	E2,E6,E10,E9	Flexibility in providing services under sanctions	4
11	E3,E4,E6	Acceptable price offer despite sanctions	3
12	E2	Management capabilities, especially crisis management under sanctions	1
13	E2,E3,E7	Financial position in times of currency crisis and sanctions	3
14	E2,E3,E7,E9	The firm's reputation for providing products and services	4
15	E6,E7,E9,E10,E8	Proper public relations	5
16	E2,E3,E6,E9	Timely accountability	4

4.3. Quantitative Analysis

Quantitative data analysis is performed using DEMTEL's multi-criteria decision making technique. Demetel is a pairwise comparisons decision making system, utilizing the judgment of experts in extracting the elements of a system and systematically structuring them by applying the principles of graph theory, the hierarchical structure of the factors present in the system, together with the effective and It gives the interoperability of these elements in such a way that it determines the severity of the effect of the relationships and their importance in numerical concessions. At this stage, a paired comparisons questionnaire was designed for data collection and distributed to the experts of Azar Sepahan Asia Company. The table of values used and the scales are presented.

Table 5. The Values Used in the Research and their Equivalent Names

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amount	Title
0	has no effect
1	has a little effect
2	it is affect
3	It has a relatively large impact
4	Extremely impressive

The following are the breakdown of the steps of the DEMATEL method for each stage that are actually the result of that step.

Table 6. Decision Matrix

	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C15	C16
C1	0	1	1	1	4	4	4	2	3	2	3	2	4	4	4	4
C2	1	0	3	1	3	2	1	1	4	3	4	2	2	1	1	1
C3	1	2	0	2	4	3	1	1	2	3	2	2	3	2	2	4
C4	4	2	1	0	2	3	4	1	1	2	1	3	2	2	2	3
C5	2	4	2	4	0	3	4	2	1	3	3	1	2	3	1	3
C6	2	2	3	2	3	0	4	3	1	2	2	3	2	4	4	4
C7	1	4	4	1	2	1	0	4	3	1	4	1	3	1	1	1
C8	3	1	2	2	3	3	4	0	1	4	3	1	4	2	3	1
C9	1	3	4	4	4	1	3	2	0	1	4	2	3	1	3	2
C10	1	3	2	2	1	4	1	4	2	0	3	4	2	3	4	1
C11	1	4	2	4	1	3	4	3	4	3	0	3	1	2	1	1
C12	3	3	3	4	1	2	1	3	4	1	2	0	3	4	3	3
C13	1	1	2	4	4	3	1	1	3	4	3	4	0	3	1	1
C14	1	2	1	1	4	2	1	2	4	2	1	1	2	0	2	3
C15	3	3	2	2	1	3	3	3	4	3	2	4	2	1	0	1
C16	4	1	1	2	4	2	4	4	4	4	3	1	2	3	3	0

Table 7. Normalized Matrix

	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C15	C16
C1	0.00	0.02	0.02	0.02	0.09	0.09	0.09	0.05	0.07	0.05	0.07	0.05	0.09	0.09	0.09	0.09
C2	0.02	0.00	0.07	0.02	0.07	0.05	0.02	0.02	0.09	0.07	0.09	0.05	0.05	0.02	0.02	0.02
C3	0.02	0.05	0.00	0.05	0.09	0.07	0.02	0.02	0.05	0.07	0.05	0.05	0.07	0.05	0.05	0.09
C4	0.09	0.05	0.02	0.00	0.05	0.07	0.09	0.02	0.02	0.05	0.02	0.07	0.05	0.05	0.05	0.07
C5	0.05	0.09	0.05	0.09	0.00	0.07	0.09	0.05	0.02	0.07	0.07	0.02	0.05	0.07	0.02	0.07

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C6	0.05	0.05	0.07	0.05	0.07	0.00	0.09	0.07	0.02	0.05	0.05	0.07	0.05	0.09	0.09	0.09
C7	0.02	0.09	0.09	0.02	0.05	0.02	0.00	0.09	0.07	0.02	0.09	0.02	0.07	0.02	0.02	0.02
C8	0.07	0.02	0.05	0.05	0.07	0.07	0.09	0.00	0.02	0.09	0.07	0.02	0.09	0.05	0.07	0.02
C9	0.02	0.07	0.09	0.09	0.09	0.02	0.07	0.05	0.00	0.02	0.09	0.05	0.07	0.02	0.07	0.05
C10	0.02	0.07	0.05	0.05	0.02	0.09	0.02	0.09	0.05	0.00	0.07	0.09	0.05	0.07	0.09	0.02
C11	0.02	0.09	0.05	0.09	0.02	0.07	0.09	0.07	0.09	0.07	0.00	0.07	0.02	0.05	0.02	0.02
C12	0.07	0.07	0.07	0.09	0.02	0.05	0.02	0.07	0.09	0.02	0.05	0.00	0.07	0.09	0.07	0.07
C13	0.02	0.02	0.05	0.09	0.09	0.07	0.02	0.02	0.07	0.09	0.07	0.09	0.00	0.07	0.02	0.02
C14	0.02	0.05	0.02	0.02	0.09	0.05	0.02	0.05	0.09	0.05	0.02	0.02	0.05	0.00	0.05	0.07
C15	0.07	0.07	0.05	0.05	0.02	0.07	0.07	0.07	0.09	0.07	0.05	0.09	0.05	0.02	0.00	0.02
C16	0.09	0.02	0.02	0.05	0.09	0.05	0.09	0.09	0.09	0.09	0.07	0.02	0.05	0.07	0.07	0.00

Table 8. Summarizes the Matrix Reduction Results of one of the Normalized Matrices

	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C15	C16
C1	1.00	-0.02	-0.02	-0.02	-0.09	-0.09	-0.09	-0.05	-0.07	-0.05	-0.07	-0.05	-0.09	-0.09	-0.09	-0.09
C2	-0.02	1.00	-0.07	-0.02	-0.07	-0.05	-0.02	-0.02	-0.09	-0.07	-0.09	-0.05	-0.05	-0.02	-0.02	-0.02
C3	-0.02	-0.05	1.00	-0.05	-0.09	-0.07	-0.02	-0.02	-0.05	-0.07	-0.05	-0.05	-0.07	-0.05	-0.05	-0.09
C4	-0.09	-0.05	-0.02	1.00	-0.05	-0.07	-0.09	-0.02	-0.02	-0.05	-0.02	-0.07	-0.05	-0.05	-0.05	-0.07
C5	-0.05	-0.09	-0.05	-0.09	1.00	-0.07	-0.09	-0.05	-0.02	-0.07	-0.07	-0.02	-0.05	-0.07	-0.02	-0.07
C6	-0.05	-0.05	-0.07	-0.05	-0.07	1.00	-0.09	-0.07	-0.02	-0.05	-0.05	-0.07	-0.05	-0.09	-0.09	-0.09
C7	-0.02	-0.09	-0.09	-0.02	-0.05	-0.02	1.00	-0.09	-0.07	-0.02	-0.09	-0.02	-0.07	-0.02	-0.02	-0.02
C8	-0.07	-0.02	-0.05	-0.05	-0.07	-0.07	-0.09	1.00	-0.02	-0.09	-0.07	-0.02	-0.09	-0.05	-0.07	-0.02

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C9	-0.02	-0.07	-0.09	-0.09	-0.09	-0.02	-0.07	-0.05	1.00	-0.02	-0.09	-0.05	-0.07	-0.02	-0.07	-0.05
C10	-0.02	-0.07	-0.05	-0.05	-0.02	-0.09	-0.02	-0.09	-0.05	1.00	-0.07	-0.09	-0.05	-0.07	-0.09	-0.02
C11	-0.02	-0.09	-0.05	-0.09	-0.02	-0.07	-0.09	-0.07	-0.09	-0.07	1.00	-0.07	-0.02	-0.05	-0.02	-0.02
C12	-0.07	-0.07	-0.07	-0.09	-0.02	-0.05	-0.02	-0.07	-0.09	-0.02	-0.05	1.00	-0.07	-0.09	-0.07	-0.07
C13	-0.02	-0.02	-0.05	-0.09	-0.09	-0.07	-0.02	-0.02	-0.07	-0.09	-0.07	-0.09	1.00	-0.07	-0.02	-0.02
C14	-0.02	-0.05	-0.02	-0.02	-0.09	-0.05	-0.02	-0.05	-0.09	-0.05	-0.02	-0.02	-0.05	1.00	-0.05	-0.07
C15	-0.07	-0.07	-0.05	-0.05	-0.02	-0.07	-0.07	-0.07	-0.09	-0.07	-0.05	-0.09	-0.05	-0.02	1.00	-0.02
C16	-0.09	-0.02	-0.02	-0.05	-0.09	-0.05	-0.09	-0.09	-0.09	-0.09	-0.07	-0.02	-0.05	-0.07	-0.07	1.00

Table 9. Reverses the Result of Subtracting one of the Normalized Matrices

	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C15	C16
C1	1.23	0.32	0.30	0.32	0.41	0.39	0.41	0.34	0.39	0.35	0.39	0.32	0.38	0.37	0.36	0.35
C2	0.18	1.21	0.26	0.24	0.29	0.26	0.25	0.23	0.31	0.28	0.32	0.24	0.25	0.23	0.22	0.21
C3	0.21	0.28	1.22	0.28	0.35	0.31	0.28	0.26	0.30	0.31	0.30	0.27	0.30	0.28	0.27	0.30
C4	0.27	0.28	0.24	1.23	0.30	0.31	0.34	0.25	0.28	0.28	0.28	0.28	0.28	0.27	0.26	0.27
C5	0.25	0.34	0.28	0.34	1.28	0.33	0.37	0.30	0.31	0.33	0.35	0.26	0.30	0.31	0.26	0.29
C6	0.27	0.33	0.32	0.32	0.37	1.29	0.39	0.34	0.33	0.33	0.35	0.32	0.32	0.36	0.35	0.33
C7	0.19	0.30	0.29	0.24	0.29	0.25	1.24	0.30	0.30	0.25	0.33	0.23	0.28	0.23	0.22	0.21
C8	0.26	0.28	0.28	0.30	0.34	0.34	0.36	1.25	0.30	0.35	0.34	0.26	0.34	0.29	0.30	0.25
C9	0.23	0.33	0.32	0.35	0.37	0.29	0.35	0.30	1.28	0.29	0.37	0.29	0.32	0.27	0.30	0.27
C10	0.22	0.32	0.28	0.30	0.30	0.35	0.30	0.34	0.33	1.26	0.34	0.33	0.30	0.31	0.33	0.25
C11	0.22	0.34	0.28	0.33	0.30	0.32	0.36	0.31	0.36	0.32	1.28	0.30	0.27	0.28	0.26	0.24

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C12	0.28	0.33	0.31	0.36	0.33	0.33	0.32	0.33	0.39	0.31	0.34	1.26	0.34	0.35	0.32	0.31
C13	0.22	0.28	0.27	0.34	0.36	0.33	0.29	0.27	0.33	0.34	0.33	0.32	1.25	0.31	0.26	0.25
C14	0.18	0.25	0.21	0.23	0.31	0.26	0.25	0.24	0.31	0.25	0.25	0.21	0.25	1.20	0.24	0.25
C15	0.27	0.32	0.28	0.30	0.30	0.33	0.34	0.32	0.37	0.33	0.33	0.33	0.30	0.27	1.25	0.25
C16	0.31	0.32	0.29	0.33	0.40	0.35	0.40	0.37	0.40	0.38	0.38	0.29	0.33	0.34	0.34	1.26

Table 10. Is the Product of the Normalized Matrix in the Inverse Matrix (T matrix)

	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C15	C16
C1	0.24	0.33	0.30	0.33	0.42	0.40	0.42	0.35	0.40	0.36	0.40	0.33	0.39	0.38	0.37	0.36
C2	0.19	0.22	0.27	0.24	0.30	0.27	0.26	0.23	0.32	0.29	0.32	0.25	0.26	0.23	0.22	0.21
C3	0.22	0.29	0.22	0.29	0.36	0.32	0.29	0.26	0.31	0.32	0.31	0.27	0.31	0.28	0.27	0.30
C4	0.28	0.28	0.24	0.23	0.31	0.31	0.35	0.26	0.29	0.29	0.28	0.29	0.28	0.28	0.27	0.28
C5	0.25	0.35	0.29	0.35	0.29	0.34	0.37	0.31	0.31	0.34	0.35	0.27	0.31	0.32	0.27	0.30
C6	0.27	0.33	0.33	0.33	0.38	0.30	0.40	0.35	0.34	0.34	0.36	0.33	0.33	0.36	0.36	0.34
C7	0.19	0.31	0.30	0.25	0.29	0.26	0.24	0.30	0.31	0.26	0.33	0.23	0.29	0.24	0.23	0.22
C8	0.27	0.29	0.29	0.30	0.35	0.34	0.37	0.26	0.31	0.36	0.35	0.27	0.35	0.30	0.31	0.25
C9	0.23	0.33	0.33	0.35	0.38	0.30	0.35	0.30	0.29	0.30	0.38	0.29	0.33	0.28	0.31	0.28
C10	0.23	0.33	0.29	0.31	0.31	0.36	0.31	0.34	0.33	0.27	0.35	0.33	0.30	0.32	0.33	0.26
C11	0.22	0.35	0.29	0.34	0.30	0.33	0.36	0.32	0.37	0.33	0.28	0.30	0.28	0.29	0.27	0.25
C12	0.29	0.34	0.32	0.37	0.34	0.34	0.33	0.34	0.40	0.31	0.35	0.26	0.35	0.36	0.33	0.32
C13	0.22	0.28	0.28	0.35	0.36	0.33	0.30	0.27	0.34	0.35	0.34	0.33	0.25	0.32	0.26	0.25
C14	0.19	0.26	0.22	0.23	0.32	0.26	0.25	0.25	0.32	0.26	0.25	0.22	0.25	0.20	0.24	0.25
C15	0.27	0.33	0.29	0.31	0.31	0.34	0.35	0.33	0.38	0.33	0.33	0.33	0.31	0.28	0.25	0.26
C16	0.32	0.32	0.30	0.34	0.41	0.36	0.41	0.38	0.41	0.39	0.39	0.30	0.34	0.35	0.35	0.26

Table 11. Effect Matrix

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	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C15	C16
C1	0.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
C2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00
C3	0.00	0.00	0.00	0.00	1.00	1.00	0.00	0.00	1.00	1.00	1.00	0.00	0.00	0.00	0.00	0.00
C4	0.00	0.00	0.00	0.00	0.00	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C5	0.00	1.00	0.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	1.00	0.00	0.00	1.00	0.00	0.00
C6	0.00	1.00	1.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
C7	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00
C8	0.00	0.00	0.00	0.00	1.00	1.00	1.00	0.00	1.00	1.00	1.00	0.00	1.00	0.00	1.00	0.00
C9	0.00	1.00	1.00	1.00	1.00	0.00	1.00	0.00	0.00	0.00	1.00	0.00	1.00	0.00	1.00	0.00
C10	0.00	1.00	0.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00
C11	0.00	1.00	0.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00
C12	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00
C13	0.00	0.00	0.00	1.00	1.00	1.00	0.00	0.00	1.00	1.00	1.00	1.00	0.00	1.00	0.00	0.00
C14	0.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C15	0.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00	0.00	0.00
C16	1.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00	1.00	1.00	1.00	0.00

Table 12. D-R and D-R matrices

	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C15	C16
D+R	9.66	9.03	9.17	9.42	10.45	10.65	9.62	9.84	10.47	10.04	10.28	9.93	9.77	8.76	9.66	10.04
D-R	1.89	-0.87	0.09	-0.41	-0.41	0.28	-1.11	0.11	-0.40	-0.11	-0.50	0.74	-0.08	-0.82	0.35	1.25

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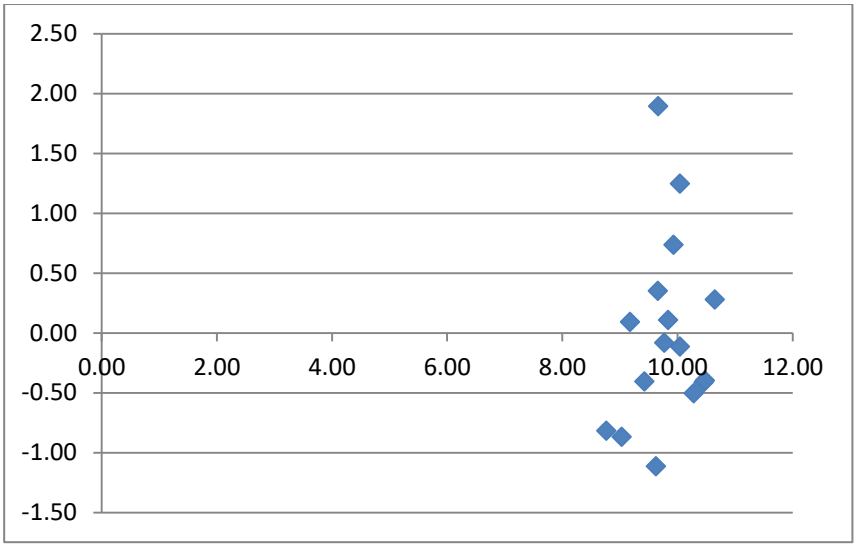

Figure 2. Identification of Effective Factors Using the DEMTEL Method

As you can see in the graph above, there are 7 points above the value of zero indicating effective criteria and other criteria below zero indicating the effective criteria. Finally, the effective criteria can be summarized in Table 13-13.

Table 13. Effective Supplier Selection Criteria under Sanctions

Item	criterion	Title
1	C15	Proper Public Relationship
2	C16	Timely accountability
3	C12	Management capabilities, especially crisis management under sanctions
4	C1	Safety under sanctions
5	C6	keeping compliance with quality standards and standards under sanctions
6	C3	Financial risks in the context of currency market upheavals and sanctions
7	C8	R&D under sanctions

4.4.Calculation of criteria weight by AHP method:

After determining the effective criteria using the DEMTEL method, these criteria can now be compared and weighted using the AHP method. It should be noted that because the definitive AHP method is used here, it is possible to compare the criteria using Expert Chase software. The weighted result is presented in Table 4-14.

Table 14. Weighting the Criteria Using the AHP Method

R &D under sanctions	Financial risks in the context of currency market upheavals and sanctions	keeping compliance with quality standards and standards under sanctions	Safety under sanctions	Management capabilities, especially crisis management under sanctions	Timely accountability	Proper Public Relationship
0.827	0.109	0.756	0.107	0.090	0.220	Wi

4.5.Supplier Ranking Using the Mora Method

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Since the criteria and their weights have been determined using the Demetel and AHP methods, it is now possible to rank suppliers and obtain their reliability parameter. Given that there are 5 products under review, ranking will be done separately for the 5 products under review.

Table 15. Decision Matrix for First Product Suppliers

R&D under sanctions	Financial risks in the context of currency market upheavals and sanctions	keeping compliance with quality standards and standards under sanctions	Safety under sanctions	Management capabilities, especially crisis management under sanctions	Timely accountability	Proper Public Relationship	The decision matrix
9	3	8	7	9	9	7	S1
5	4	4	7	4	1	3	S2
7	1	10	1	4	8	9	S3
10	5	6	3	4	4	5	S4
6	3	6	3	1	2	10	S5
10	1	2	9	2	10	2	S6
6	1	5	6	4	6	4	S7
1	9	2	1	4	2	8	S8
10	10	8	3	5	10	7	S9
8	4	5	2	7	4	3	S10
1	10	8	6	8	8	10	S11
3	6	1	2	3	7	2	S12
6	10	10	7	10	4	1	S13

Table 16. Second Power Matrix for First Product Suppliers

R&D under sanctions	Financial risks in the context of currency market upheavals and sanctions	keeping compliance with quality standards and standards under sanctions	Safety under sanctions	Management capabilities, especially crisis management under sanctions	Timely accountability	Proper Public Relationship	
81	9	64	49	81	81	49	S1
25	16	16	49	16	1	9	S2
49	1	100	1	16	64	81	S3
100	25	36	9	16	16	25	S4
36	9	36	9	1	4	100	S5
100	1	4	81	4	100	4	S6
36	1	25	36	16	36	16	S7
1	81	4	1	16	4	64	S8
100	100	64	9	25	100	49	S9
64	16	25	4	49	16	9	S10
1	100	64	36	64	64	100	S11

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9	36	1	4	9	49	4	S12
36	100	100	49	100	16	1	S13

Table 17. Normal Matrix for First Product Suppliers

R&D under sanctions	Financial risks in the context of currency market upheavals and sanctions	keeping compliance with quality standards and standards under sanctions	Safety under sanctions	Management capabilities, especially crisis management under sanctions	Timely accountability	Proper Public Relationship	Normal matrix
0.014	0.006	0.015	0.021	0.022	0.016	0.014	S1
0.008	0.008	0.007	0.021	0.010	0.002	0.006	S2
0.011	0.002	0.019	0.003	0.010	0.015	0.018	S3
0.016	0.010	0.011	0.009	0.010	0.007	0.010	S4
0.009	0.006	0.011	0.009	0.002	0.004	0.020	S5
0.016	0.002	0.004	0.027	0.005	0.018	0.004	S6
0.009	0.002	0.009	0.018	0.010	0.011	0.008	S7
0.002	0.018	0.004	0.003	0.010	0.004	0.016	S8
0.016	0.020	0.015	0.009	0.012	0.018	0.014	S9
0.013	0.008	0.009	0.006	0.017	0.007	0.006	S10
0.002	0.020	0.015	0.018	0.019	0.015	0.020	S11
0.005	0.012	0.002	0.006	0.007	0.013	0.004	S12
0.009	0.020	0.019	0.021	0.024	0.007	0.002	S13
0.938	0.827	0.109	0.756	0.107	0.090	0.220	Wi

Table 18. Normal Weight Matrix for First Product Suppliers

R&D under sanctions	Financial risks in the context of currency market upheavals and sanctions	keeping compliance with quality standards and standards under sanctions	Safety under sanctions	Management capabilities, especially crisis management under sanctions	Timely accountability	Proper Public Relationship	Normal Weighted Matrix
0.013	0.005	0.002	0.016	0.002	0.001	0.003	S1
0.007	0.007	0.001	0.016	0.001	0.000	0.001	S2
0.010	0.002	0.002	0.002	0.001	0.001	0.004	S3
0.015	0.008	0.001	0.007	0.001	0.001	0.002	S4
0.009	0.005	0.001	0.007	0.000	0.000	0.004	S5

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0.015	0.002	0.000	0.020	0.001	0.002	0.001	S6
0.009	0.002	0.001	0.013	0.001	0.001	0.002	S7
0.001	0.015	0.000	0.002	0.001	0.000	0.003	S8
0.015	0.017	0.002	0.007	0.001	0.002	0.003	S9
0.012	0.007	0.001	0.004	0.002	0.001	0.001	S10
0.001	0.017	0.002	0.013	0.002	0.001	0.004	S11
0.004	0.010	0.000	0.004	0.001	0.001	0.001	S12
0.009	0.017	0.002	0.016	0.003	0.001	0.000	S13

Table 19. Final Ranking for First Product Suppliers

score	Negative sum	Positive Sum	Final rating
0.032	0.005	0.037	S1
0.020	0.007	0.026	S2
0.019	0.002	0.021	S3
0.018	0.008	0.026	S4
0.017	0.005	0.022	S5
0.037	0.002	0.038	S6
0.025	0.002	0.027	S7
-0.006	0.015	0.009	S8
0.012	0.017	0.029	S9
0.014	0.007	0.021	S10
0.008	0.017	0.024	S11
0.002	0.010	0.012	S12
0.014	0.017	0.030	S13

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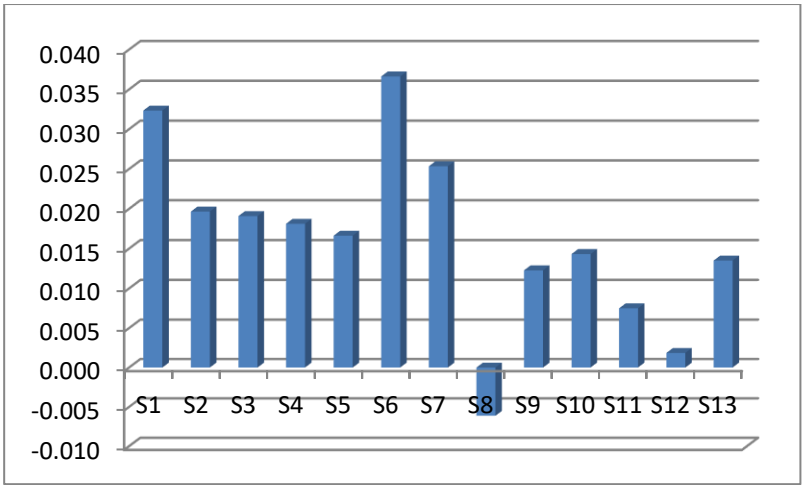

Figure 3. Final ranking for first product suppliers

Table 20. Final Rankings for First Product Suppliers in Order of Rank

score	Negative sum	Positive Sum	Final rating	rating
0.037	0.002	0.038	S6	1
0.032	0.005	0.037	S1	2
0.025	0.002	0.027	S7	3
0.020	0.007	0.026	S2	4
0.019	0.002	0.021	S3	5
0.018	0.008	0.026	S4	6
0.017	0.005	0.022	S5	7
0.014	0.007	0.021	S10	8
0.014	0.017	0.030	S13	9
0.012	0.017	0.029	S9	10
0.008	0.017	0.024	S11	11
0.002	0.010	0.012	S12	12
-0.006	0.015	0.009	S8	13

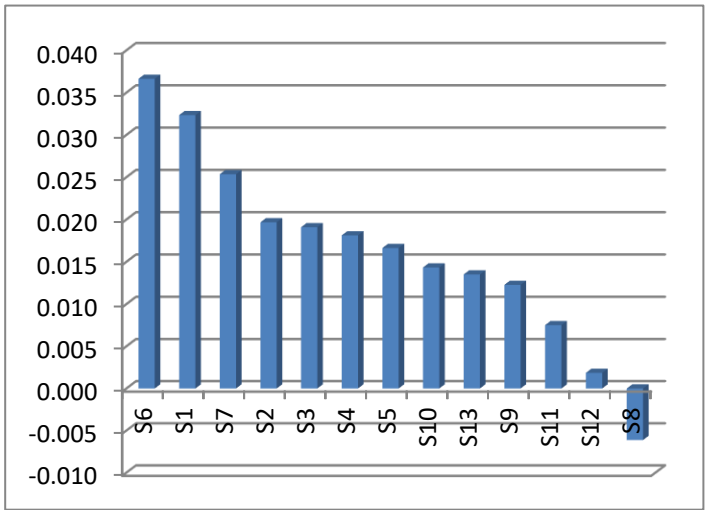

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Figure 4. Final Rankings for First Product Suppliers in Order of Rank

Table 21. Decision Matrix for the Second Product

R&D under sanctions	Financial risks in the context of currency market upheavals and sanctions	keeping compliance with quality standards and standards under sanctions	Safety under sanctions	Management capabilities, especially crisis management under sanctions	Timely accountability	Proper Public Relationship	The decision matrix2
9	3	8	3	5	5	6	S1
5	4	4	7	4	1	3	S2
4	10	6	3	4	8	9	S3
3	5	6	3	4	4	5	S4
6	3	6	3	1	2	3	S5
2	6	2	3	2	5	2	S6
6	1	5	3	4	6	4	S7
1	9	2	1	4	2	8	S8
2	1	8	3	5	5	7	S9
8	4	5	2	7	4	3	S10
1	10	8	6	3	8	2	S11
3	6	4	2	3	7	5	S12

Table 22. Second Power Matrix for the Second Product

R&D under sanctions	Financial risks in the context of currency market upheavals and sanctions	keeping compliance with quality standards and standards under sanctions	Safety under sanctions	Management capabilities, especially crisis management under sanctions	Timely accountability	Proper Public Relationship	
81	9	64	9	25	25	36	S1
25	16	16	49	16	1	9	S2
16	100	36	9	16	64	81	S3
9	25	36	9	16	16	25	S4
36	9	36	9	1	4	9	S5
4	36	4	9	4	25	4	S6
36	1	25	9	16	36	16	S7
1	81	4	1	16	4	64	S8
4	1	64	9	25	25	49	S9
64	16	25	4	49	16	9	S10

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1	100	64	36	9	64	4	S11
9	36	16	4	9	49	25	S12
36	100	100	49	100	16	1	S13

Table 23. Normal Matrix for the Second Product

R&D under sanctions	Financial risks in the context of currency market upheavals and sanctions	keeping compliance with quality standards and standards under sanctions	Safety under sanctions	Management capabilities, especially crisis management under sanctions	Timely accountability	Proper Public Relationship	Normal Matrix
0.028	0.006	0.016	0.015	0.017	0.014	0.018	S1
0.016	0.008	0.008	0.034	0.013	0.003	0.009	S2
0.012	0.019	0.012	0.015	0.013	0.023	0.027	S3
0.009	0.009	0.012	0.015	0.013	0.012	0.015	S4
0.019	0.006	0.012	0.015	0.003	0.006	0.009	S5
0.006	0.011	0.004	0.015	0.007	0.014	0.006	S6
0.019	0.002	0.010	0.015	0.013	0.017	0.012	S7
0.003	0.017	0.004	0.005	0.013	0.006	0.024	S8
0.006	0.002	0.016	0.015	0.017	0.014	0.021	S9
0.025	0.008	0.010	0.010	0.023	0.012	0.009	S10
0.003	0.019	0.016	0.029	0.010	0.023	0.006	S11
0.009	0.011	0.008	0.010	0.010	0.020	0.015	S12
0.019	0.019	0.020	0.034	0.033	0.012	0.003	S13
0.938	0.827	0.109	0.756	0.107	0.090	0.220	Wi

Table 24. Weighted Normal Matrix for the Second Product

R&D under sanctions	Financial risks in the context of currency market upheavals and sanctions	keeping compliance with quality standards and standards under sanctions	Safety under sanctions	Management capabilities, especially crisis management under sanctions	Timely accountability	Proper Public Relationship	Normal Weighted Matrix
0.026	0.005	0.002	0.011	0.002	0.001	0.004	S1

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0.015	0.006	0.001	0.026	0.001	0.000	0.002	S2
0.012	0.016	0.001	0.011	0.001	0.002	0.006	S3
0.009	0.008	0.001	0.011	0.001	0.001	0.003	S4
0.017	0.005	0.001	0.011	0.000	0.001	0.002	S5
0.006	0.009	0.000	0.011	0.001	0.001	0.001	S6
0.017	0.002	0.001	0.011	0.001	0.002	0.003	S7
0.003	0.014	0.000	0.004	0.001	0.001	0.005	S8
0.006	0.002	0.002	0.011	0.002	0.001	0.005	S9
0.023	0.006	0.001	0.007	0.002	0.001	0.002	S10
0.003	0.016	0.002	0.022	0.001	0.002	0.001	S11
0.009	0.009	0.001	0.007	0.001	0.002	0.003	S12
0.017	0.016	0.002	0.026	0.004	0.001	0.001	S13

Table 25. Final Supplier Ranking for Second Product

score	Sum Negative	Sum Positive	Final ranking
0.041	0.005	0.046	S1
0.039	0.006	0.045	S2
0.018	0.016	0.033	S3
0.019	0.008	0.027	S4
0.028	0.005	0.033	S5
0.011	0.009	0.021	S6
0.034	0.002	0.035	S7
0.000	0.014	0.014	S8
0.025	0.002	0.026	S9
0.031	0.006	0.037	S10
0.016	0.016	0.031	S11
0.014	0.009	0.023	S12
0.035	0.016	0.051	S13

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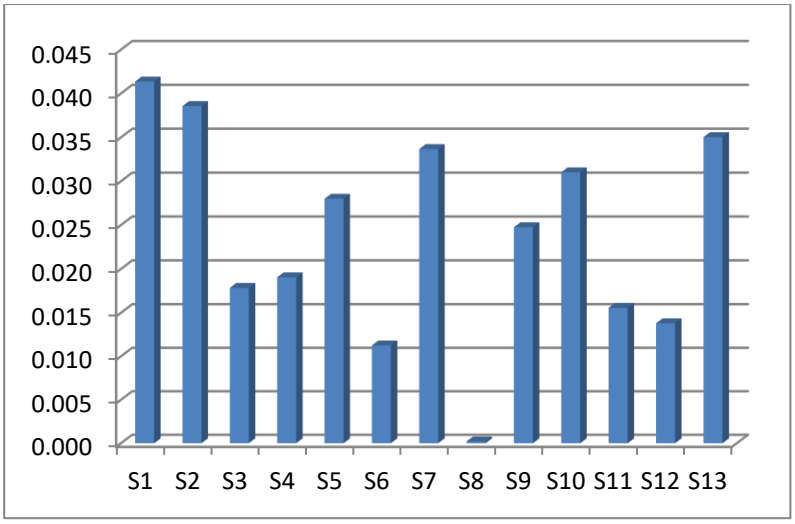

Figure 5. Final Supplier Ranking for Second Product

Table 26. Final Supplier Rankings for the Second Product Order, Respectively

score	Sum Negative	Sum Positive	Final ranking
0.041	0.005	0.046	S1
0.039	0.006	0.045	S2
0.035	0.016	0.051	S13
0.034	0.002	0.035	S7
0.031	0.006	0.037	S10
0.028	0.005	0.033	S5
0.025	0.002	0.026	S9
0.019	0.008	0.027	S4
0.018	0.016	0.033	S3
0.016	0.016	0.031	S11
0.014	0.009	0.023	S12
0.011	0.009	0.021	S6
0.000	0.014	0.014	S8

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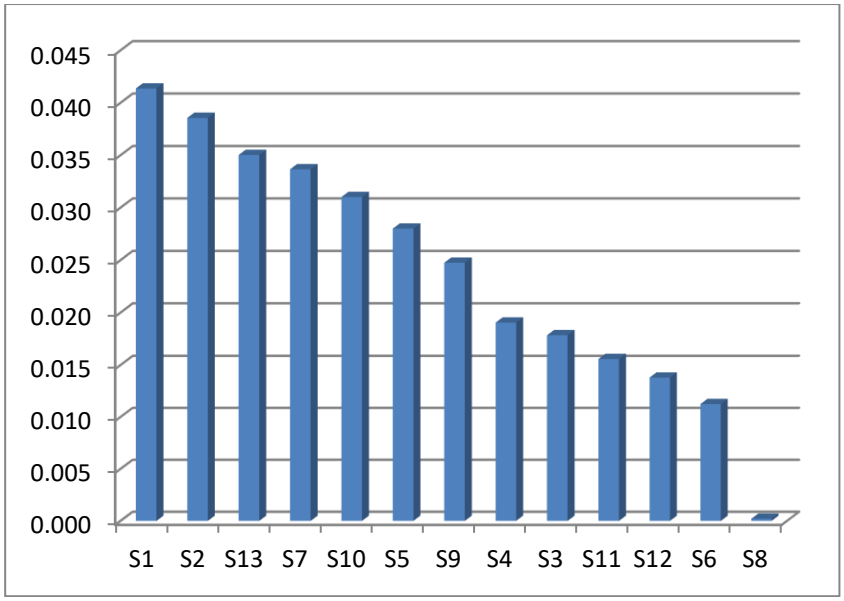

Figure 6. Final Suppliers Rankings for Second Product in Order of Rank

Table 27. Decision Matrix for Product No. 3

R&D under sanctions	Financial risks in the context of currency market upheavals and sanctions	keeping compliance with quality standards and standards under sanctions	Safety under sanctions	Management capabilities, especially crisis management under sanctions	Timely accountability	Proper Public Relationship	The decision matrix2
9	3	1	3	5	5	3	S1
5	4	4	7	4	1	2	S2
4	4	2	3	4	3	3	S3
3	5	6	5	4	4	5	S4
2	3	6	3	1	2	1	S5
2	6	2	5	2	5	2	S6
6	1	5	3	4	2	4	S7
1	9	2	1	3	2	6	S8
2	1	8	4	5	1	7	S9
1	4	5	2	7	4	3	S10
1	10	3	6	3	2	2	S11
3	6	4	2	3	2	3	S12
6	10	4	7	5	4	1	S13

Table 28. Second Power Matrix for Product # 3

R&D under sanctions	Financial risks in the context of currency market upheavals and sanctions	keeping compliance with quality standards and standards under sanctions	Safety under sanctions	Management capabilities, especially crisis management under sanctions	Timely accountability	Proper Public Relationship	

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81	9	1	9	25	25	9	S1
25	16	16	49	16	1	4	S2
16	16	4	9	16	9	9	S3
9	25	36	25	16	16	25	S4
4	9	36	9	1	4	1	S5
4	36	4	25	4	25	4	S6
36	1	25	9	16	4	16	S7
1	81	4	1	9	4	36	S8
4	1	64	16	25	1	49	S9
1	16	25	4	49	16	9	S10
1	100	9	36	9	4	4	S11
9	36	16	4	9	4	9	S12
36	100	16	49	25	16	1	S13

Table 29. Normal Matrix for Product No. 3

R&D under sanctions	Financial risks in the context of currency market upheavals and sanctions	keeping compliance with quality standards and standards under sanctions	Safety under sanctions	Management capabilities, especially crisis management under sanctions	Timely accountability	Proper Public Relationship	Normal Matrix
0.040	0.007	0.004	0.012	0.023	0.039	0.017	S1
0.022	0.009	0.016	0.029	0.018	0.008	0.011	S2
0.018	0.009	0.008	0.012	0.018	0.023	0.017	S3
0.013	0.011	0.023	0.020	0.018	0.031	0.028	S4
0.009	0.007	0.023	0.012	0.005	0.016	0.006	S5
0.009	0.013	0.008	0.020	0.009	0.039	0.011	S6

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0.026	0.002	0.020	0.012	0.018	0.016	0.023	S7
0.004	0.020	0.008	0.004	0.014	0.016	0.034	S8
0.009	0.002	0.031	0.016	0.023	0.008	0.040	S9
0.004	0.009	0.020	0.008	0.032	0.031	0.017	S10
0.004	0.022	0.012	0.024	0.014	0.016	0.011	S11
0.013	0.013	0.016	0.008	0.014	0.016	0.017	S12
0.026	0.022	0.016	0.029	0.023	0.031	0.006	S13
0.938	0.827	0.109	0.756	0.107	0.090	0.220	Wi

Table 30. Weighted Normal Matrix for Product No. 3

R&D under sanctions	Financial risks in the context of currency market upheavals and sanctions	keeping compliance with quality standards and standards under sanctions	Safety under sanctions	Management capabilities, especially crisis management under sanctions	Timely accountability	Proper Public Relationship	Normal *Weighted* Matrix
0.037	0.006	0.000	0.009	0.002	0.003	0.004	S1
0.021	0.007	0.002	0.022	0.002	0.001	0.002	S2
0.017	0.007	0.001	0.009	0.002	0.002	0.004	S3
0.012	0.009	0.003	0.015	0.002	0.003	0.006	S4
0.008	0.006	0.003	0.009	0.000	0.001	0.001	S5
0.008	0.011	0.001	0.015	0.001	0.003	0.002	S6
0.025	0.002	0.002	0.009	0.002	0.001	0.005	S7
0.004	0.017	0.001	0.003	0.001	0.001	0.007	S8
0.008	0.002	0.003	0.012	0.002	0.001	0.009	S9
0.004	0.007	0.002	0.006	0.003	0.003	0.004	S10
0.004	0.019	0.001	0.019	0.001	0.001	0.002	S11
0.012	0.011	0.002	0.006	0.001	0.001	0.004	S12
0.025	0.019	0.002	0.022	0.002	0.003	0.001	S13

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Table 31. Final Ranking for Product No. 3

score	Sum Negative	Sum Positive	Final ranking
0.051	0.006	0.057	S1
0.042	0.007	0.049	S2
0.027	0.007	0.034	S3
0.032	0.009	0.041	S4
0.018	0.006	0.023	S5
0.020	0.011	0.031	S6
0.043	0.002	0.045	S7
0.002	0.017	0.018	S8
0.034	0.002	0.036	S9
0.015	0.007	0.022	S10
0.011	0.019	0.029	S11
0.016	0.011	0.027	S12
0.036	0.019	0.055	S13

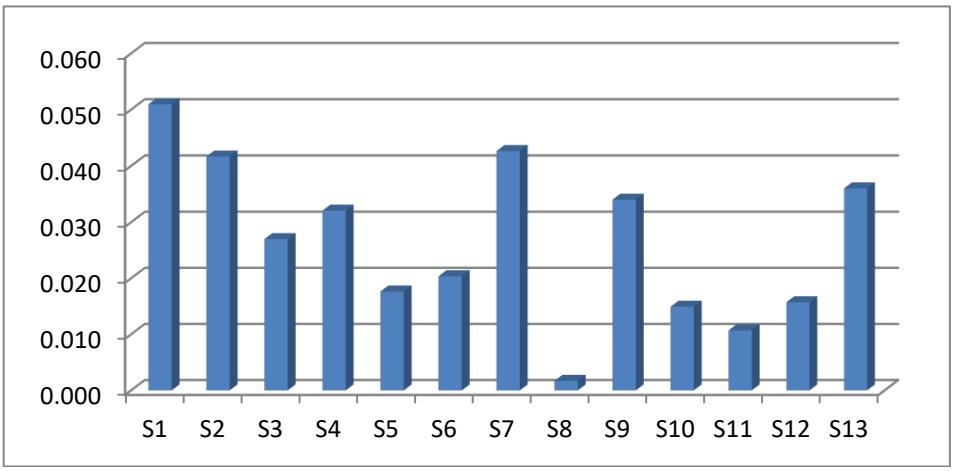

Figure 7. Final Rating for Product # 3

Table 32. Final Rankings for Product # 3 in Order of Rank

score	Sum Negative	Sum Positive	Final ranking
0.051	0.006	0.057	S1
0.043	0.002	0.045	S7
0.042	0.007	0.049	S2
0.036	0.019	0.055	S13
0.034	0.002	0.036	S9
0.032	0.009	0.041	S4
0.027	0.007	0.034	S3
0.020	0.011	0.031	S6
0.018	0.006	0.023	S5

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0.016	0.011	0.027	S12
0.015	0.007	0.022	S10
0.011	0.019	0.029	S11
0.002	0.017	0.018	S8

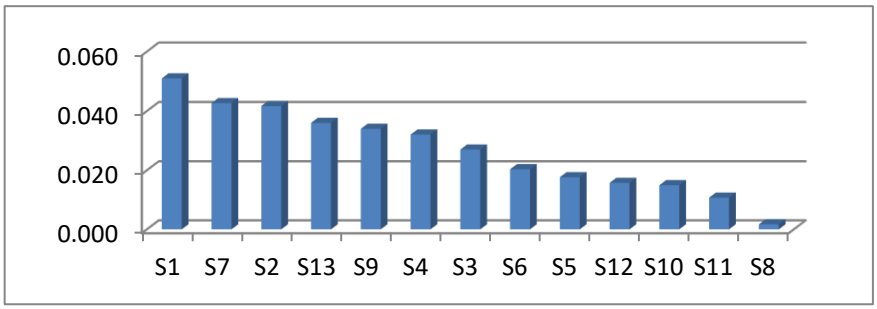

Figure 8. Final Rankings for Product # 3 in Order of Rank

Table 33. Decision Matrix for Product No. 4

R&D under sanctions	Financial risks in the context of currency market upheavals and sanctions	keeping compliance with quality standards and standards under sanctions	Safety under sanctions	Management capabilities, especially crisis management under sanctions	Timely accountability	Proper Public Relationship	The decision matrix
7	1	2	3	5	5	3	S1
4	4	4	8	3	1	2	S2
4	4	3	3	4	3	3	S3
3	5	1	5	4	4	5	S4
2	3	2	3	4	2	1	S5
2	6	2	2	2	5	2	S6
6	1	5	3	4	2	4	S7
8	9	2	9	4	7	2	S8
3	4	8	4	5	2	7	S9
1	4	5	2	7	4	3	S10
1	1	3	6	3	2	2	S11
3	6	4	4	3	2	3	S12
6	1	4	7	5	2	6	S13

Table 34. Second Power Matrix for Product # 4

R&D under sanctions	Financial risks in the context of currency market upheavals and sanctions	keeping compliance with quality standards and standards under sanctions	Safety under sanctions	Management capabilities, especially crisis management under sanctions	Timely accountability	Proper Public Relationship	
49	1	4	9	25	25	9	S1

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16	16	16	64	9	1	4	S2
16	16	9	9	16	9	9	S3
9	25	1	25	16	16	25	S4
4	9	4	9	16	4	1	S5
4	36	4	4	4	25	4	S6
36	1	25	9	16	4	16	S7
64	81	4	81	16	49	4	S8
9	16	64	16	25	4	49	S9
1	16	25	4	49	16	9	S10
1	1	9	36	9	4	4	S11
9	36	16	16	9	4	9	S12
36	1	16	49	25	4	36	S13

Table 35. Normal Matrix for Product No. 4

R&D under sanctions	Financial risks in the context of currency market upheavals and sanctions	keeping compliance with quality standards and standards under sanctions	Safety under sanctions	Management capabilities, especially crisis management under sanctions	Timely accountability	Proper Public Relationship	Normal atrix
0.028	0.004	0.010	0.009	0.021	0.030	0.017	S1
0.016	0.016	0.020	0.024	0.013	0.006	0.011	S2
0.016	0.016	0.015	0.009	0.017	0.018	0.017	S3
0.012	0.020	0.005	0.015	0.017	0.024	0.028	S4
0.008	0.012	0.010	0.009	0.017	0.012	0.006	S5
0.008	0.024	0.010	0.006	0.009	0.030	0.011	S6
0.024	0.004	0.025	0.009	0.017	0.012	0.022	S7

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0.031	0.035	0.010	0.027	0.017	0.042	0.011	S8
0.012	0.016	0.041	0.012	0.021	0.012	0.039	S9
0.004	0.016	0.025	0.006	0.030	0.024	0.017	S10
0.004	0.004	0.015	0.018	0.013	0.012	0.011	S11
0.012	0.024	0.020	0.012	0.013	0.012	0.017	S12
0.024	0.004	0.020	0.021	0.021	0.012	0.034	S13
0.938	0.827	0.109	0.756	0.107	0.090	0.220	Wi

Table 36. Weighted Normal Matrix for Product No. 4

R&D under sanctions	Financial risks in the context of currency market upheavals and sanctions	keeping compliance with quality standards and standards under sanctions	Safety under sanctions	Management capabilities, especially crisis management under sanctions	Timely accountability	Proper Public Relationship	Normal *Weighted* Matrix
0.026	0.003	0.001	0.007	0.002	0.003	0.004	S1
0.015	0.013	0.002	0.018	0.001	0.001	0.002	S2
0.015	0.013	0.002	0.007	0.002	0.002	0.004	S3
0.011	0.016	0.001	0.011	0.002	0.002	0.006	S4
0.007	0.010	0.001	0.007	0.002	0.001	0.001	S5
0.007	0.019	0.001	0.005	0.001	0.003	0.002	S6
0.022	0.003	0.003	0.007	0.002	0.001	0.005	S7
0.030	0.029	0.001	0.021	0.002	0.004	0.002	S8
0.011	0.013	0.004	0.009	0.002	0.001	0.009	S9
0.004	0.013	0.003	0.005	0.003	0.002	0.004	S10
0.004	0.003	0.002	0.014	0.001	0.001	0.002	S11
0.011	0.019	0.002	0.009	0.001	0.001	0.004	S12
0.022	0.003	0.002	0.016	0.002	0.001	0.007	S13

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Table 37. Final Ranking for Product No. 4

score	Sum Negative	Sum Positive	Final ranking
0.039	0.003	0.042	S1
0.027	0.013	0.040	S2
0.017	0.013	0.030	S3
0.017	0.016	0.033	S4
0.010	0.010	0.019	S5
0.000	0.019	0.019	S6
0.036	0.003	0.040	S7
0.030	0.029	0.059	S8
0.024	0.013	0.037	S9
0.007	0.013	0.020	S10
0.021	0.003	0.024	S11
0.009	0.019	0.029	S12
0.048	0.003	0.051	S13

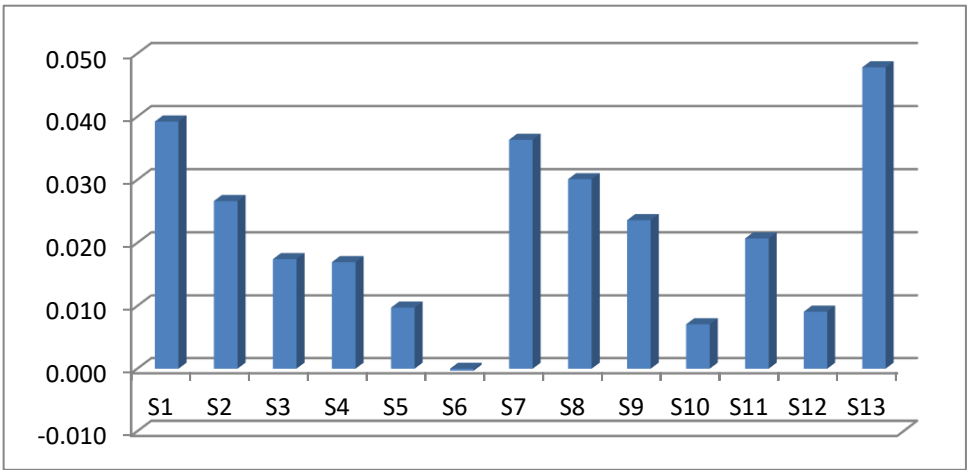

Figure 9. Final Ranking for Matrix No. 4

Table 38. Final Rankings for Matrix No. 4 Rank Respectively

score	Sum Negative	Sum Positive	Final ranking
0.048	0.003	0.051	S13
0.039	0.003	0.042	S1
0.036	0.003	0.040	S7
0.030	0.029	0.059	S8
0.027	0.013	0.040	S2
0.024	0.013	0.037	S9
0.021	0.003	0.024	S11
0.017	0.013	0.030	S3
0.017	0.016	0.033	S4
0.010	0.010	0.019	S5
0.009	0.019	0.029	S12

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0.007	0.013	0.020	S10
0.000	0.019	0.019	S6

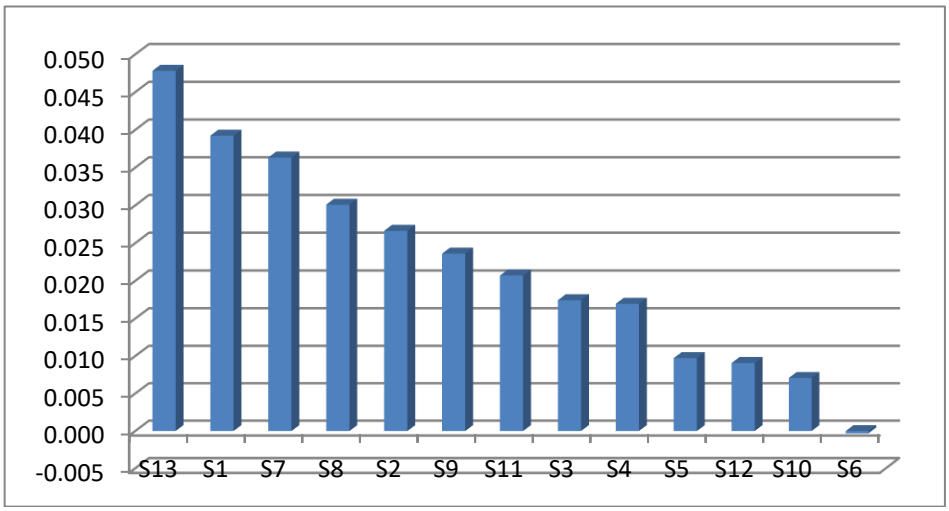

Figure 10. Final Rankings for Matrix No. 4 Rank Respectively

Table 39. Product Decision Matrix No. 5

R&D under sanctions	Financial risks in the context of currency market upheavals and sanctions	keeping compliance with quality standards and standards under sanctions	Safety under sanctions	Management capabilities, especially crisis management under sanctions	Timely accountability	Proper Public Relationship	The decision matrix
6	4	5	3	5	6	5	S1
4	4	4	8	3	9	5	S2
8	4	3	3	4	3	8	S3
3	5	5	9	4	4	5	S4
2	3	2	3	6	2	1	S5
7	6	7	2	2	5	2	S6
6	5	5	3	4	3	4	S7
2	9	6	6	5	7	5	S8
3	4	8	4	5	2	7	S9
6	4	5	4	7	3	3	S10
7	4	8	6	3	3	4	S11
3	6	4	4	3	3	3	S12
6	5	4	7	5	4	8	S13

Table 40. Square matrix for product no.5

R&D unde	Financial risks in the context of	keeping compliance with	Safety	Management capabilities,	Timely	Proper Public	

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r sanctions	currency market upheavals and sanctions	quality standards and standards under sanctions	under sanctions	especially crisis management under sanctions	accountability	Relationship	
36	16	25	9	25	36	25	S1
16	16	16	64	9	81	25	S2
64	16	9	9	16	9	64	S3
9	25	25	81	16	16	25	S4
4	9	4	9	36	4	1	S5
49	36	49	4	4	25	4	S6
36	25	25	9	16	9	16	S7
4	81	36	36	25	49	25	S8
9	16	64	16	25	4	49	S9
36	16	25	16	49	9	9	S10
49	16	64	36	9	9	16	S11
9	36	16	16	9	9	9	S12
36	25	16	49	25	16	64	S13

Table 41. Normal matrix for product no.5

R&D under sanctions	Financial risks in the context of currency market upheavals and sanctions	keeping compliance with quality standards and standards under sanctions	Safety under sanctions	Management capabilities, especially crisis management under sanctions	Timely accountability	Proper Public Relationship	Normal Matrix
0.017	0.012	0.013	0.008	0.019	0.022	0.015	S1
0.011	0.012	0.011	0.023	0.011	0.033	0.015	S2
0.022	0.012	0.008	0.008	0.015	0.011	0.024	S3
0.008	0.015	0.013	0.025	0.015	0.014	0.015	S4
0.006	0.009	0.005	0.008	0.023	0.007	0.003	S5

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0.020	0.018	0.019	0.006	0.008	0.018	0.006	S6
0.017	0.015	0.013	0.008	0.015	0.011	0.012	S7
0.006	0.027	0.016	0.017	0.019	0.025	0.015	S8
0.008	0.012	0.021	0.011	0.019	0.007	0.021	S9
0.017	0.012	0.013	0.011	0.027	0.011	0.009	S10
0.020	0.012	0.021	0.017	0.011	0.011	0.012	S11
0.008	0.018	0.011	0.011	0.011	0.011	0.009	S12
0.017	0.015	0.011	0.020	0.019	0.014	0.024	S13
0.938	0.827	0.109	0.756	0.107	0.090	0.220	Wi

Table 42. Weighted normal matrix for product no.5

R&D under sanctions	Financial risks in the context of currency market upheavals and sanctions	keeping compliance with quality standards and standards under sanctions	Safety under sanctions	Management capabilities, especially crisis management under sanctions	Timely accountability	Proper Public Relationship	Normal *Weighted* Matrix
0.016	0.010	0.001	0.006	0.002	0.002	0.003	S1
0.011	0.010	0.001	0.017	0.001	0.003	0.003	S2
0.021	0.010	0.001	0.006	0.002	0.001	0.005	S3
0.008	0.012	0.001	0.019	0.002	0.001	0.003	S4
0.005	0.007	0.001	0.006	0.002	0.001	0.001	S5
0.018	0.015	0.002	0.004	0.001	0.002	0.001	S6
0.016	0.012	0.001	0.006	0.002	0.001	0.003	S7
0.005	0.022	0.002	0.013	0.002	0.002	0.003	S8
0.008	0.010	0.002	0.009	0.002	0.001	0.005	S9
0.016	0.010	0.001	0.009	0.003	0.001	0.002	S10
0.018	0.010	0.002	0.013	0.001	0.001	0.003	S11
0.008	0.015	0.001	0.009	0.001	0.001	0.002	S12

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0.016	0.012	0.001	0.015	0.002	0.001	0.005	S13

Table 43. Final Ranking for Product No. 5

score	Sum Negative	Sum Positive	Final ranking
0.021	0.010	0.031	S1
0.026	0.010	0.036	S2
0.026	0.010	0.036	S3
0.022	0.012	0.035	S4
0.009	0.007	0.016	S5
0.014	0.015	0.028	S6
0.016	0.012	0.029	S7
0.005	0.022	0.027	S8
0.016	0.010	0.026	S9
0.022	0.010	0.032	S10
0.028	0.010	0.038	S11
0.007	0.015	0.022	S12
0.028	0.012	0.040	S13

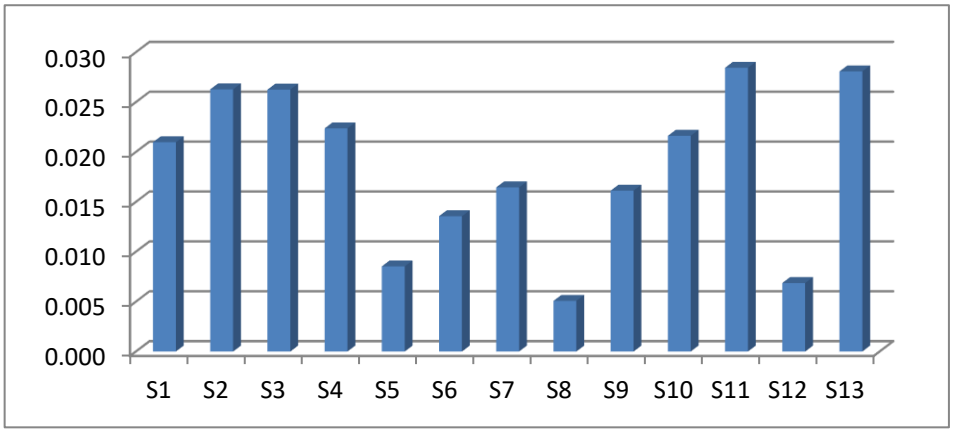

Figure 11. Final rating for product # 5

Table 44. Final Rankings for Product # 5 Rank Respectively

score	Sum Negative	Sum Positive	Final ranking
0.028	0.010	0.038	S11
0.028	0.012	0.040	S13
0.026	0.010	0.036	S2
0.026	0.010	0.036	S3
0.022	0.012	0.035	S4
0.022	0.010	0.032	S10
0.021	0.010	0.031	S1
0.016	0.012	0.029	S7

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0.016	0.010	0.026	S9
0.014	0.015	0.028	S6
0.009	0.007	0.016	S5
0.007	0.015	0.022	S12
0.005	0.022	0.027	S8

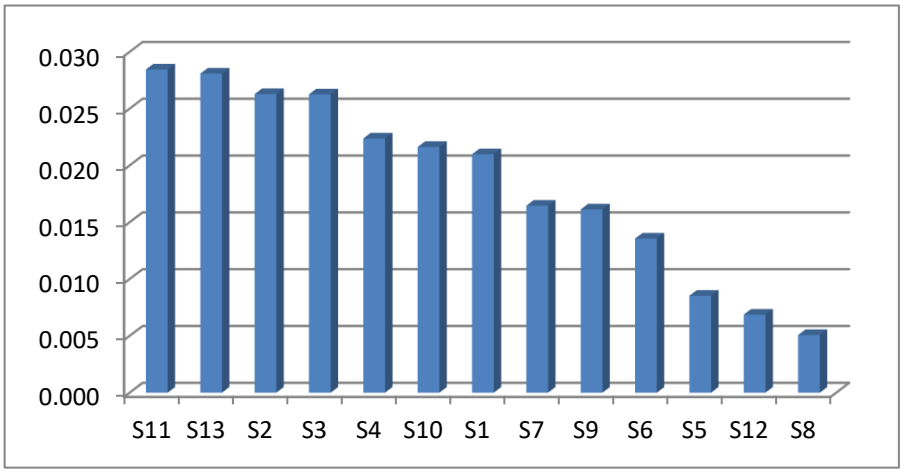

Figure 12. Final Rankings for Product # 5 Rank Respectively

After completing the calculations for the Mora method, the final ranking results can be presented to 13 suppliers in 5 products.

The table is as follows

Table 45. Final Ranking by 5 Products for 13 Suppliers

Product No. 5	Product No. 4	Product No. 3	Product No. 2	Product No. 1	Final ranking
0.021	0.039	0.051	0.041	0.032	S1
0.026	0.027	0.042	0.039	0.020	S2
0.026	0.017	0.027	0.018	0.019	S3
0.022	0.017	0.032	0.019	0.018	S4
0.009	0.010	0.018	0.028	0.017	S5
0.014	0.000	0.020	0.011	0.037	S6
0.016	0.036	0.043	0.034	0.025	S7
0.005	0.030	0.002	0.000	-0.006	S8
0.016	0.024	0.034	0.025	0.012	S9
0.022	0.007	0.015	0.031	0.014	S10
0.028	0.021	0.011	0.016	0.008	S11
0.007	0.009	0.016	0.014	0.002	S12
0.028	0.048	0.036	0.035	0.014	S13

As can be seen, the parameters obtained in Table 4-45 indicate the reliability values of each supplier. By obtaining the above values, we can solve the designed integer programming model using the heuristic algorithm.

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Model solving using heuristic algorithm

By obtaining reliability values for each supplier separately for each product, one can solve the designed model algorithm. The results in the tables are presented in steps of the algorithm.

Table 46. Matrix T Formed Using Azarspahan Asia Company Information on Average Delivery Time of Each Product by Each Supplier

T	p1	p2	p3	p4	p5
s1	32	11	14	20	26
s2	14	16	32	12	16
s3	35	30	19	34	20
s4	16	32	15	33	31
s5	25	18	19	11	23
s6	23	21	10	29	22
s7	25	10	25	33	27
s8	35	33	27	34	21
s9	12	16	14	18	30
s10	10	16	16	32	14
s11	17	33	21	23	28
s12	28	10	26	31	23
s13	14	25	18	26	22
sum	286	271	256	336	303

Table 47. Reliability Normalized Matrix or R

Normalized R	p1	p2	p3	p4	p5
s1	0.151	0.132	0.147	0.137	0.088
s2	0.094	0.125	0.121	0.095	0.108
s3	0.090	0.058	0.078	0.060	0.108
s4	0.085	0.061	0.092	0.060	0.092
s5	0.080	0.090	0.052	0.035	0.038
s6	0.175	0.035	0.058	0.000	0.058
s7	0.118	0.109	0.124	0.126	0.067
s8	-0.028	0.000	0.006	0.105	0.021
s9	0.057	0.080	0.098	0.084	0.067
s10	0.066	0.100	0.043	0.025	0.092
s11	0.038	0.051	0.032	0.074	0.117
s12	0.009	0.045	0.046	0.032	0.029
s13	0.066	0.113	0.104	0.168	0.117
sum	1.000	1.000	1.000	1.000	1.000

Table 48. Alpha Matrix or Expert opinion on the Importance of Supplier Reliability

Alpha	p1	p2	p3	p4	p5

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s1	9	2	1	10	6
s2	7	2	3	4	1
s3	6	7	4	9	7
s4	5	9	4	10	2
s5	4	8	9	1	1
s6	10	4	3	8	7
s7	5	6	2	1	2
s8	9	5	3	6	5
s9	2	7	2	3	7
s10	4	2	2	7	2
s11	3	8	1	5	9
s12	3	4	7	6	8
s13	4	7	5	1	7

Table 49. Matrix Normalized T or Average Product Delivery Time by Each Supplier

Normalized T	p1	p2	p3	p4	p5
s1	0.112	0.041	0.055	0.060	0.086
s2	0.049	0.059	0.125	0.036	0.053
s3	0.122	0.111	0.074	0.101	0.066
s4	0.056	0.118	0.059	0.098	0.102
s5	0.087	0.066	0.074	0.033	0.076
s6	0.080	0.077	0.039	0.086	0.073
s7	0.087	0.037	0.098	0.098	0.089
s8	0.122	0.122	0.105	0.101	0.069
s9	0.042	0.059	0.055	0.054	0.099
s10	0.035	0.059	0.063	0.095	0.046
s11	0.059	0.122	0.082	0.068	0.092
s12	0.098	0.037	0.102	0.092	0.076
s13	0.049	0.092	0.070	0.077	0.073
sum	1.000	1.000	1.000	1.000	1.000

Table 50. Matrix 1 - Normalized Matrix T

1- Normalized T	p1	p2	p3	p4	p5
s1	0.888	0.959	0.945	0.940	0.914
s2	0.951	0.941	0.875	0.964	0.947
s3	0.878	0.889	0.926	0.899	0.934
s4	0.944	0.882	0.941	0.902	0.898
s5	0.913	0.934	0.926	0.967	0.924
s6	0.920	0.923	0.961	0.914	0.927
s7	0.913	0.963	0.902	0.902	0.911
s8	0.878	0.878	0.895	0.899	0.931

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s9	0.958	0.941	0.945	0.946	0.901
s10	0.965	0.941	0.938	0.905	0.954
s11	0.941	0.878	0.918	0.932	0.908
s12	0.902	0.963	0.898	0.908	0.924
s13	0.951	0.908	0.930	0.923	0.927

Table 51. Beta Matrix or Expert Importance of Product Delivery Time

Beta	p1	p2	p3	p4	p5
s1	10	6	2	6	2
s2	6	1	4	9	7
s3	1	10	9	7	9
s4	10	9	3	6	1
s5	4	6	4	2	7
s6	10	3	7	3	6
s7	3	5	6	10	4
s8	9	4	8	1	5
s9	8	7	3	9	2
s10	4	1	3	7	10
s11	7	1	5	9	6
s12	9	6	6	4	3
s13	2	8	2	7	6

Table 52. Multiplication of the Normalized R Matrix in the Alpha Matrix

Normalized R*Alpha	p1	p2	p3	p4	p5
s1	1.358	0.264	0.147	1.368	0.525
s2	0.660	0.251	0.363	0.379	0.108
s3	0.538	0.405	0.311	0.537	0.758
s4	0.425	0.550	0.369	0.596	0.183
s5	0.321	0.720	0.467	0.035	0.038
s6	1.745	0.141	0.173	0.000	0.408
s7	0.590	0.656	0.248	0.126	0.133
s8	-0.255	0.000	0.017	0.632	0.104
s9	0.113	0.563	0.196	0.253	0.467
s10	0.264	0.199	0.086	0.172	0.183
s11	0.113	0.412	0.032	0.368	1.050
s12	0.028	0.180	0.323	0.189	0.233
s13	0.264	0.788	0.519	0.168	0.817

Table 53. Matrix Multiplication 1 - Normalized T in Beta Matrix

1-Normalized T*Beta	p1	p2	p3	p4	p5

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s1	8.881	5.756	1.891	5.643	1.828
s2	5.706	0.941	3.500	8.679	6.630
s3	0.878	8.893	8.332	6.292	8.406
s4	9.441	7.937	2.824	5.411	0.898
s5	3.650	5.601	3.703	1.935	6.469
s6	9.196	2.768	6.727	2.741	5.564
s7	2.738	4.815	5.414	9.018	3.644
s8	7.899	3.513	7.156	0.899	4.653
s9	7.664	6.587	2.836	8.518	1.802
s10	3.860	0.941	2.813	6.333	9.538
s11	6.584	0.878	4.590	8.384	5.446
s12	8.119	5.779	5.391	3.631	2.772
s13	1.902	7.262	1.859	6.458	5.564

Table 54. Mean Matrix 1 Minus T-normalized in Beta and R-normalized in Alpha

Average(1-Normalized T*Beta,Normalized R*beta)	p1	p2	p3	p4	p5
s1	5.120	3.010	1.019	3.506	1.177
s2	3.183	0.596	1.932	4.529	3.369
s3	0.708	4.649	4.322	3.414	4.582
s4	4.933	4.244	1.597	3.004	0.541
s5	1.986	3.161	2.085	0.985	3.253
s6	5.471	1.455	3.450	1.371	2.986
s7	1.664	2.736	2.831	4.572	1.888
s8	3.822	1.756	3.587	0.765	2.379
s9	3.889	3.575	1.516	4.385	1.134
s10	2.062	0.570	1.449	3.253	4.861
s11	3.349	0.645	2.311	4.376	3.248
s12	4.074	2.979	2.857	1.910	1.503
s13	1.083	4.025	1.189	3.313	3.191

Table 55. Normalized Matrix Mean Matrix 1 Minus T-normalized in Beta and R-normalized in Alpha

Normalized(Average(1-Normalized T*Beta,Normalized R*beta))	p1	p2	p3	p4	p5
s1	0.124	0.090	0.034	0.089	0.034
s2	0.077	0.018	0.064	0.115	0.099
s3	0.017	0.139	0.143	0.087	0.134
s4	0.119	0.127	0.053	0.076	0.016

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s5	0.048	0.095	0.069	0.025	0.095
s6	0.132	0.044	0.114	0.035	0.088
s7	0.040	0.082	0.094	0.116	0.055
s8	0.092	0.053	0.119	0.019	0.070
s9	0.094	0.107	0.050	0.111	0.033
s10	0.050	0.017	0.048	0.083	0.142
s11	0.081	0.019	0.077	0.111	0.095
s12	0.099	0.089	0.095	0.049	0.044
s13	0.026	0.121	0.039	0.084	0.094

Table 56. Values Calculated From the Sum of Values Below 0.1 for Each Supplier

	p1	p2	p3	p4	p5
Sum of values below 0.1	0.625	0.506	0.623	0.546	0.723
The number of values exceeds 0.1	3	4	3	4	2
Values to be added	0.208	0.127	0.208	0.137	0.362

Table 57. Calculates the Amount of Each Supplier's Final Share for Each Product

final	p1	p2	p3	p4	p5
s1	0.332	0.000	0.000	0.000	0.000
s2	0.000	0.000	0.000	0.252	0.000
s3	0.000	0.266	0.351	0.000	0.496
s4	0.327	0.254	0.000	0.000	0.000
s5	0.000	0.000	0.000	0.000	0.000
s6	0.340	0.000	0.322	0.000	0.000
s7	0.000	0.000	0.000	0.253	0.000
s8	0.000	0.000	0.327	0.000	0.000
s9	0.000	0.234	0.000	0.248	0.000
s10	0.000	0.000	0.000	0.000	0.504
s11	0.000	0.000	0.000	0.248	0.000
s12	0.000	0.000	0.000	0.000	0.000
s13	0.000	0.247	0.000	0.000	0.000
	1.000	1.000	1.000	1.000	1.000

5.Findings and Discussion

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Table 4-57 shows the calculation of each supplier's final share value for each product. As can be seen in this table. Each supplier's share is provided to supply each product. If we want to identify the best suppliers based on this ranking, we can almost say that supplier # 3 has been identified in supplying 3 products out of 5 eligible products and can be considered as the best supplier. However, the main purpose of this research is not to rank suppliers, but simply to fulfill their percentage of supply. But at a glance it can be seen that supplier # 5 and supplier # 12 failed to allocate any percentage of products so even company management can consider removing these suppliers because of the criteria under consideration. Suppliers have not even obtained 10% of a product's supply. Suppliers 4, 6, and 9 can almost be considered as good suppliers even though they have failed to gain a share in the three products but have at least two in the supply. If the management of the company wishes to consider a criterion other than the above, such as the share of supply of at least 3 of the 5 products available, only company No. 3 can continue to operate as a supplier to the company under study.

Overall, it cannot be said that the performance appraisal of companies is high in terms of delivery time criteria as well as reliability, as the overall situation does not show good conditions. For example, supplier No. 11 and supplier No. 13 obtained only 24.8 percent and 24.7 percent, respectively, of the five products that do not represent the desired value. It should be noted, however, that in this study, 10% is considered as the minimum share of product supply for each supplier, as most companies have less than 10% share, which leads to their elimination from the circle. Compete. This has led to the participation of only two suppliers as an example for product No. 5, and the share of this product is divided between company No. 3 with 49.6 percent and company No. 10 with 50.4 percent and 11 other companies in the circle. Eliminate competition by determining at least ten percent stake. The researcher, however, believes that this share can be increased or decreased which can be attributed to the management perspective of the company being investigated.

6.Conclusions and Suggestions

This study aimed to optimize the supplier selection basket under sanctions. A combination of qualitative and quantitative techniques was used to perform the task, and the selection criteria were the appropriate delivery time as well as the reliability of the delivery time using the database of the company under study and the reliability using the Mora method. While the integer model was designed, the input of this model had reliability values as well as delivery times. The specific heuristic algorithm of the model was presented which sought to optimize the portfolio using conventional methods. Overall, the results showed that the product portfolio was optimized and the optimal allocation of supply to each supplier was that between 2 and 4 suppliers were selected for each product that were able to supply more than 10% of the product. The threshold for acceptance of supply in this study was assumed to be 10%. Subsequent research can extend the present research model by considering other parameters such as quality, resource failure, commitment, social responsibility, sustainability or greenness, and provide a new model to optimize the supplier selection portfolio based on new assumptions.

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