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A Hybrid GRA-VIKOR Approach for Prioritization of Sales Management Outsourcing Risks (Case : energy company)

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Abstract

Nowadays, outsourcing is increasingly being used as a tool to reduce costs and achieve strategic goals. Marketing and sales outsourcing are also expanding, probably due to the challenges caused by the recession. Therefore, sales outsourcing, like any other outsourcing activity, is associated with risks that must be considered before any decision-making about outsourcing. Success in risk management requires identifying the effect ive factors in risk management. Also, to identify the effective factors in risk management, we need to identify high-probability risks and solutions to them and know the reasons for their outsourcing. For this purpose, we first seek to identify the main reasons and goals of sales outsourcing, and then prioritize and weigh these factors using the three-parameter grey numbers Bullseye method, and finally prioritize the risks involved in sales outsourcing with respect to these factors and using the GRA-VIKOR hybrid method. This research includes six criteria of structural factors, human motivation factors, improvement factors, cost factors, financial factors, human factors and decision options including organizational, environmental, and financial risks. The first 10 risks ranking 1 to 10 are the most important sales risks in this study. Results showed that the decrease in liquidity due to lack of control over credit sales was ranked first in the financial factors risk.

Keywords: *risk outsourcing, Risk management, GRA, VIKOR, Bull's-eye method, Macdm*

Introduction

Today, sales is critical to organizations and various methods are used to have successful sales. In the absence of the required skills in the organization, using outsourcing can be used for access to specialized services. Sales outsourcing is a strategy used by business companies whereby a third-party company is hired to meet the needs of the sales. Since any outsourcing, activity is associated with certain risks, sales outsourcing also has risks, which can lead to the failure of outsourcing and consequent irreparable losses if not considered. Therefore, it is very important for any sales outsourcing company to identify and prioritize sales outsourcing risks and ways to deal with it. This research studied the Holding company include SSpayam & Han energy Company of Tehran, and Oman and United Arab *Emirates* is an investment holding company in the field of new energy development, which includes research and development - refining and production of new

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June 2023
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and renewable energy, as well as the development of new technologies, and active presence in the field of project investment. Low risk and effective risk management creates value while supporting sustainable development in the energy sector. The paper aims to identify the significance of the risks associated with outsourcing sales in this company with MCDM method(Gholamveisy ,et al,2023)

Gra-vikor is one of the Multiple Criteria Decision Making (MCDM) techniques. When assessing and contrasting sustainability to provide different energy strategies or renewable energy technologies are presented choosing the important, appropriate, and sustainable options. Several earlier studies have been utilized in renewable energy fields use VIKOR technique. In this research, a hybrid method based on gra-vikor fuzzy with three-parameter grey numbers Bullseye method(Gholamveisy ,2021)

2. Literature Review

(Kahraman, Öztayşi et al. 2018) used the Fuzzy AHP and TOPSIS Approach to evaluate outsource manufacturers. In this paper, an interval-valued intuitionistic fuzzy Analytic Hierarchy Process and)Technique for Order of Preference by Similarity to Ideal Solution-based methodology was proposed, and an application was provided for the evaluation of outsourced manufacturers. This paper aimed to determine the weight of outsourcing criteria and their key role in ranking the external suppliers in a case study in pipe and fittings production. The findings of this study indicate the importance of the three criteria of business development focus on core activities and order of preference for outsourcing. (Modak, Ghosh et al. 2018) provided a BSC-ANP approach for DSS outsourcing. They proposed an integrated BSC-ANP method of a balanced analytical network for choosing the best outsourcing strategy (human resources, outsourcing and strategic alliance) for coal mining operations in India. (Samantra, Datta et al. 2014) assessed the risk of IT outsourcing using a fuzzy decision approach, identified 63 risks of the previous studies in 11 groups, and used the hierarchical structure for risk assessment between the two assessment levels of fuzzy risk values(El Mokrini, Dafaoui et al. 2016) developed an approach to risk assessment for outsourcing logistics in the pharmaceutical supply chain. They used the ELECTRE TRI method to assess the 18 identified risks from previous studies in six operational, financial, technology, information communication and internal communication. (Tavana, Zareinejad et al. 2016)examined the fuzzy AHP method and the SWOT approach for reverse logistics outsourcing. First, they identified relevant criteria and sub criteria using SWOT analysis. Then, they used Intuitionistic Fuzzy AHP to evaluate relative importance weights among relevant criteria and sub-criteria. presented an (Nazari-Shirkouhi, Ansarinejad et al. 2011). Presented an AHP-based fuzzy decision-making method and fuzzy TOPSIS in a case study for outsourcing decision-making of information systems. Therefore, two MCDM methods including the Integrated Fuzzy Analytic Hierarchy Process (FAHP) and the SWOT method for Order

June 2023
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Performance by Similarity to Ideal Solution (FTOPSIS) are used for evaluating and selecting the appropriate information systems project (ISP). The proposed methodology is practically used in an online bookstore in Iran.

Several previous studies have focused on sustainable and renewable energy from different angles using different MCDM techniques, including the VIKOR method. (Mardani et al, 2015) We selected, analyzed and reviewed 54 articles dealing with decision-making processes and renewable and sustainable energy sources. These 54 articles were written by (Vuˇcijak,2013). Quijano H et al. Evaluated the Viktor method for sustainable hydropower. Using VIKOR (Quijano et al, 2012). Tseng et al. Developed plans for renewable and sustainable energy. VIKOR is used to define how people respond to the quality of the environment, and occupant satisfaction is measured using a prioritization technique by similarity between VIKOR and the ideal solution (TOPSIS). Strategies to improve potency have been identified (Tzeng et al, 2002). (Martin-Utrilas et al., 2015) Selection of optimal infrastructure related to sustainable economy uses VIKOR, fuzzy Delphi and analytical hierarchy process (AHP) for selecting optimal renewable energy sources. Integrate

As sales outsourcing processes have emerged and are increasingly evolving in global commerce in recent years, increased attention has been paid to the processes involved, but no research has been conducted on risk management and prioritization of sales outsourcing. We also note that no studies have examined the hybrid approach of GRA, VIKOR and Bullseye. In this study, we try to use gray numbers with three parameters instead of fuzzy numbers(Gholamveisy, & Heidari,2023). The VIKOR method was first introduced by (Opricovic, 1998) as a well-known MCDM technique focused on selecting and ranking alternatives to a set of competing criteria. In recent years, scientists have further developed this method. A combination of vague criteria and a set of strict criteria. (Opricovic and Tzeng, 2003) proposed a new model based on the VIKOR method and TOPSIS for defuzzification within a multi-criteria decision-making model. Opricovic and Tzeng [2003] used incomplete information to develop fuzzy VIKOR. So et al. To solve environmental problems, Opricovic (2007) extended and applied the fuzzy VIKOR method. Opricovic and Tzeng [2007], Extended VIKOR method for MCDM problems, results of this extended VIKOR compared to three different MCDM methods, including PROMETHEE, TOPSIS, and ELECTRE. Using the VIKOR method and fuzzy sets, Chen and Wang (2009) presented a systematic and logical process for developing the best compromises and alternatives under criterion selection. The results of this study provided a new approach to the fuzzy MCDM problem. Opricovic (2009) used his VIKOR method and game theory for conflict resolution. This study then applies the VIKOR method and game theory to conflict resolution and considers five approaches based on conflict resolution. Huang et al. (2009) developed his VIKOR model of MCDM used to determine preference rankings from a set of alternatives when conflicting criteria are present. Moeinzadeh and Hajfathaliha (2009) presented

June 2023
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a supply chain risk assessment model based on his ANP and VIKOR methods integrating fuzzy set theory. Subjectivity and ambiguity were handled in linguistic terms parameterized by TFN. Sayadhi et al. (2009) proposed his VIKOR method to determine the number of intervals over which ranking is achieved.

Opricovic (2009) applied the VIKOR method to solve decision-making. Water management issues. In this paper, several criteria such as ecological, social, economic and cultural characteristics were considered for the development of the Mlava River reservoir system. Chang (2010) proposed his modified VIKOR method to solve MCDM problems with competing non-comparable criteria. Hydari Al. (2010), Extended VIKOR method and integration for solving problems based on large-scale multi-objective nonlinear programming in a block structure. Sanayei et al. (2010) applied his VIKOR technique under fuzzy set and group decision (DM) methods to select suppliers. Vahadani et al. (2010), using the concept of interval-valued fuzzy sets, he presented a new method to solve the MCDM problem based on interval-valued fuzzy VIKOR with unequal criterion weights. Devi (2011) extended the VIKOR method to fuzzy environments to solve multi-criteria decision-making using criteria and alternative weights as a fuzzy set of triangles. Kuo and Liang (2011) integrated VIKOR with gray relational analysis (GRA) to assess service quality issues. Park etc. (2011) Extending his VIKOR method of multi-criteria group decision (MAGDM) in an interval-valued intuitionistic fuzzy environment (IVIF), whose preference information is represented by DM as his IVIF decision matrix. Liu and Wang (2011) is an extended VIKOR method for solving the MAGDM problem by attribute-valued and weighted generalized IVTF numbers. Du and Liu (2011), Extended VIKOR method for solving decision problems based on ITF numbers. Su (2011) proposed a new hybrid fuzzy method with a modified VIKOR method and a modified GRA method for negative and positive ideal alternatives(Gholamveisy,et .al, 2023)

3. Methodology

Grey relation analysis theory

Gray theory

Gray theory was proposed by Deng in 1982. In multi-criteria decision-making, it is one of the mathematical ideas that has been used extensively. This theory is a very powerful tool for addressing issues with unknown uncertainty. And incomplete information (Lin, Chen et al. 2004) Generally, information about decision-makers' preferences about criteria and for various reasons is based on their qualitative judgment, and the judgment of decision makers is often uncertain in practice and cannot be expressed by exact numerical values. Gray theory is used to study the uncertainty and incompleteness of information and is being increasingly used in the mathematical analysis of systems with incomplete information. If the clear and known information of a system is visualized in white and the entirely unknown information is visualized in black, then the information about most systems Nature is not black (completely unknown) or white (well-known), but rather a mixture. Of the two colors, i.e. in gray color. Such systems are thus called gray systems, the main feature of which is information incompleteness

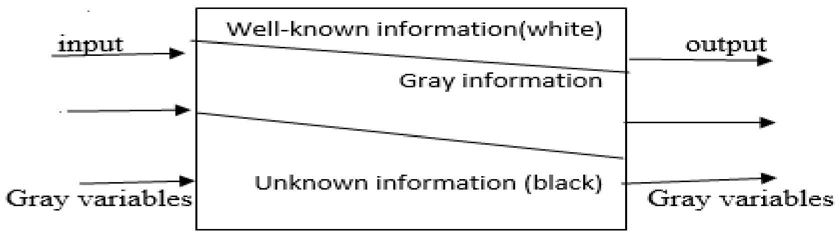

Figure 1: Gray system

3.1. Gray number

The gray number is referred to as an infinitive number with an unknown precise value but known range and interval. It can be defined as a number with uncertain information. For example, the ranking of criteria in decision-making is expressed in terms of linguistic variables that can be expressed by numerical intervals. These numerical intervals will include unknown information.

3.1.1. Interval gray numbers

Interval gray numbers with the lower bounds $\underline{a}$ and upper bounds $\bar{a}$ are written as$\otimes G\epsilon\ [\underline{a}\ ,\bar{a}]$. Although gray numbers seem to be similar to fuzzy numbers, the fundamental difference between them is that in gray numbers, the exact value of the number is unknown, while the range of the number is known(Dang, Liu et al. 2004). In other words, the exact value of the left and right wings of the number is known. However, in a fuzzy number, while the number is defined as an interval, the exact value of its left and right areas is unknown and follows from a membership function. This delicate difference between the gray number and the fuzzy number causes easier calculations with gray numbers than with fuzzy numbers, because the determination of the membership function for the left and right areas of a fuzzy number is associated with complexities and computational operations.

Three-parameter gray number

According to Wang (2012), if ⨂a is a three-parameter gray number, then it will be represented as $\otimes a \in [\underline{a}, \tilde{a}, \bar{a}]$, where $\underline{a}$ represents a lower bound, $\tilde{a}$ is the center of gravity, and $\bar{a}$ is the upper bound. If the center of gravity of a three-parameter gray number is not known, the three-parameter gray number will turn into a normal two-parameter gray number. Wang (2012) defined

June 2023
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the relations between gray numbers in such a way that if we consider ⨂a and ⨂a two three-parameter gray numbers, then we will have:

$$\otimes a + \otimes b = (\underline{a} + \underline{b}, \tilde{a} + \tilde{b}, \bar{a} + \bar{b}) \quad (1)$$

$$\frac{\otimes a}{\otimes b} = [\frac{\underline{\underline{a}}}{\bar{b}}, \frac{\tilde{a}}{\tilde{b}}, \frac{\bar{a}}{\underline{b}}) \quad (2)$$

Distance between two three-parameter gray numbers

The distance between the two gray numbers a (⨂) and b (⨂) is represented by $d(a(\otimes), b(\otimes)$

$$d(a(\otimes), b(\otimes)) \geq 0$$

$$d(a(\otimes), b(\otimes)) = d(a(\otimes), a(\otimes)) \quad 3$$

$$d(a(\otimes), b(\otimes)) \leq d(a(\otimes), c(\otimes)) + d(c(\otimes), b(\otimes))$$

$$L(a(\otimes),b(\otimes))=3^{\frac{-1}{2}}\sqrt{(\underline{a} - \underline{b})^2 + (\tilde{a} - \tilde{b})^2 + (\bar{a} - \bar{b})^2}$$

Normalization of three-parameter gray numbers matrix

If we define the decision matrix as:

$$s = \left\{\mu_{ij}(\otimes) | \mu_{ij}(\otimes) \epsilon \left(\underline{\mu}_{ij}, \tilde{\mu}_{ij}, \bar{\mu}_{ij}\right), 0 \leq \underline{\mu}_{ij} \leq \tilde{\mu}_{ij} \leq \bar{\mu}_{ij}, i = 1,2, \ldots. n, j = 1,2, \ldots m\right\} \quad 4$$

The following equations are used for descaling:

If the values are of a type of profit:

$i = 1,2, \ldots. m; j = 1,2, \ldots, n$

$$\underline{x}_{ij} = \frac{\underline{\mu}_{ij} - \underline{\mu}_j^{\nabla}}{\bar{\mu}_j^{*} - \underline{\mu}_j^{\nabla}}$$

$$\tilde{x}_{ij} = \frac{\mu_{ij} - \underline{\mu}_j}{\bar{\mu}_j^{*} - \underline{\mu}_j^{\nabla}} \qquad \bar{x}_{ij} = \frac{\bar{\mu}_{ij} - \underline{\mu}_j^{\nabla}}{\bar{\mu}_j^{*} - \underline{\mu}_j^{\nabla}} \quad (5)$$

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And for values of cost type:

$\mathrm{i} = 1,2, \ldots \ldots, \mathrm{m}\ \mathrm{j} = 1,2, \ldots, \mathrm{n}$(6)

$$\underline{x}_{ij} = \frac{\bar{\mu}_j^* - \bar{\mu}_{ij}}{\bar{\mu}_j^* - \underline{\mu}_j^{\nabla}} \qquad \tilde{x}_{ij} = \frac{\bar{\mu}_j^* - \bar{\mu}_{ij}}{\bar{\mu}_j^* - \underline{\mu}_j^{\nabla}}\ \bar{x}_{ij} = \frac{\bar{\mu}_j^* - \underline{\mu}_{ij}}{\bar{\mu}_j^* - \underline{\mu}_{ij}^{\nabla}}$$

In these equations, $\underline{\mu}_j^{\nabla} = min_{1\le i\le n}\left\{\underline{\mu}_{ij}\right\}$ and$\bar{\mu}_j^* = max_{1\le i\le n}\{\bar{\mu}_{ij}\}$. Also, if$\bar{\mu}_j^* - \underline{\mu}_j^{\nabla} = 0$, this index is an effectless index and can be eliminated from the matrix. By descaling the initial matrix, the standard decision matrix will be as follows

$$R = \begin{pmatrix} x_{11} & \cdots & x_{1n} \\ \ldots & \cdots & \cdots \\ x_{m1} & \cdots & \cdots \end{pmatrix} \qquad (7)$$

Where $x_{ij} \in \left(\underline{x}_{ij}, \tilde{x}_{ij}, \bar{x}_{ij}\right)$ is a three-parameter gray number in the interval [0,1].

Bull’s-eye method

This method was used by two researchers named Dang & Wang 2012 for weighting and ranking in the three-parameter gray decision matrix. In his recent research, (Kamfiroozi and Naeini 2013) also used the bull's-eye method for weighting.

Bull's-eye Weighting Method

The algorithm of this method is summarized in the following steps:

Step 1: Descaling the initial decision matrix using equations 5 and 6.

Step 2: Determining the positive Bullseye: Determining the positive Bullseye means the set $z^+ = (z_1^+, z_1^+, \ldots \ldots z_n^+)$ which is determined as follows:

$$z_j^+ \in \left(\underline{x}_j^+, \tilde{x}_j^+, \bar{x}_j^+\right) \qquad \tilde{x}_j^+ = max_{1\le i\le m}\{\tilde{x}_{ij}\}, \qquad (8)$$

$$\bar{x}_j^+ = max_{1\le i\le m}\{\bar{x}_{ij}\} \qquad \underline{x}_j^+ = max_{1\le i\le}\{\underline{x}_{ij}\}$$

so that …

Step 3: In the last step, we compute the adjusted weight of the indices using the following equations: (9)

$$w_j^* = b_j\left[\alpha w_j^0 - \left(\sum_{j=1}^{n} \alpha w_j^0 b_j - 1\right) / \sum_{j=1}^{n} b_j\right]$$

Volume: 8, No: 4, pp. 3214 - 3245
ISSN: 2059-6588 (Print) | ISSN: 2059-6596 (Online)

In the above equation, b_j equals:

$$b_j = \frac{1}{\alpha+\beta\sum_{i=1}^{m}\left[\left(\underline{x}_{ij}-\underline{x}_{ij}^{+}\right)^2+\left(\tilde{x}_{ij}-\tilde{x}_{ij}^{+})^2\right)+\left(\bar{x}_{ij}-\bar{x}_{ij}^{+}\right)^2\right]}$$

The α and β values in Equation 10 determine the importance of external and internal weights, and the result of the two equals one and both are non-negative. The decision maker or expert panel usually determines these values.

In Equation 10, w_j^0 are external weights determined by experts and can be shown as follows:

$$w_j^0 = (w_1^0\ , w_2^0\ , \ldots\ldots w_n^0) \qquad (10)$$

3.1.2.Gray Relational Analysis

The Gray Relational Analysis (GRA) is not necessarily based on gray data. Gray data is data whose actual value is unknown but whose range is known. The main idea of the GRA analysis, which is a quantitative analysis method, is to suggest that the proximity and correlation of the equation between two different factors is in a growing dynamic process, which should be measured, based on the degree of similarity of their curves. The greater the degree of this similarity, the greater the degree of relation between the orders and vice versa. To determine the degree of this similarity, the gray relational grade is used. According to the definition, if $m+1$ is assumed, the behavioral orders of a system are obtained as Equation 14:

$$X_i = (x_i(1), x_i(2), \ldots\ldots, x_i(n)) \qquad i = 1,2,\ldots\ldots, m \quad (11)$$

Assuming$\zeta \in (0,1)$, the gray relational coefficient and grade are defined using Equations 12 and 13 , respectively:

$$\gamma_{0i} = \gamma(x_0(k), x_i(k)) = \frac{\min_i \min_k |x_0(k)-x_i(k)| + \zeta \max_i \max_k |x_0(k)-x_i(k)|}{|x_0(k)-x_i(k)| + \zeta \max_i \max_k |x_0(k)-x_i(k)|} \quad (12)$$

$$\gamma(x_0, x_i) = \frac{1}{n}\sum_{k=1}^{n}\gamma(x_0(k) < x_i(k)) \quad (13)$$

In the above equations, ζ is called the coefficient of differentiation. Gray relational grade $\gamma(x_0, x_i)$ is often shown as γ_{0i} and the gray coefficient $\gamma\big(x_0(k), x_i(k)\big)$ at k point is often shown as $\gamma_{0i}(k)$ (Kuo and Liang 2011)

Combining the GRA and Fuzzy VIKOR

The purpose of this study is to provide an effective approach to supply chain assessment. Given that the present problem is a multi-criteria decision-making problem, this study presents a new multi-criteria decision framework by combining the GRA and Fuzzy VIKOR. Using this hybrid

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approach is an effective tool for coping with decision-making issues, including subjective evaluations in fuzzy environments. Using the combination of the GRA and Fuzzy VIKOR in uncertainty conditions, this study ranks the factors influencing the risks caused by suppliers. …

Combining the GRA and Fuzzy theory is a new, multi-criteria decision-making method that leads to access to all vague and inaccurate information. This study uses a combination of the GRA and Fuzzy VIKOR to create a complete and accurate evaluation model in ranking the factors affecting supplier risk. The GRA is used to calculate the gray relational grade used in the Fuzzy VIKOR method.

In the following, the steps of combining the two GRA and Fuzzy VIKOR methods.

After normalizing the scale of different criteria, the ideal positive and negative solution $\left(A^{-} \text{ و } A^{+}\right)$is calculated using Equation 15.

$$A^{-} = \min_{I}\left(\tilde{r}_{ij}\right) \quad , \quad j = 1,2,\ldots\ldots\ldots n \quad A^{+} = \max_{I}\left(\tilde{r}_{ij}\right)(\quad (14)$$

To calculate the distance between each option of the ideal positive and negative solution, we used the weighted fuzzy gray relational coefficient, which is defined as Equation 13.

$$\gamma\left(\tilde{r}_{0\,j}^{\,u}\ ,\tilde{r}_{ij}\right), \quad u =*,- \qquad (15)$$

$$\gamma\left(\tilde{r}_{0\,j}^{\,u}\ ,\tilde{r}_{ij}\right) = \frac{min_i\ min_j\ \tilde{d}_{ij}^{wu} + \zeta max_i\ max_j\ \tilde{d}_{ij}^{wu}}{\tilde{d}_{ij}^{u} + \zeta max_i\ max_j\ \tilde{d}_{ij}^{wu}}\ ,$$
$$= \frac{min_i\ \ min_j\ d\left(\widetilde{w}_j\tilde{r}_{0\,j}^{\,u}\ ,\widetilde{w}_j\tilde{r}_{ij}\right) + \zeta max_i\ max_j\ d\ \left(\widetilde{w}_j\ \tilde{r}_{0\,j}^{\,u}\ ,\widetilde{w}\ \tilde{r}_{i\,j}\right)}{d\left(\tilde{r}_{0\,j}^{\,u}\ ,\tilde{r}_{ij}\right) + \zeta max_i\ max_j\ d\left(\tilde{r}_{0\,j}^{\,u}\ ,\tilde{r}_{ij}\right)}$$

$u =*,-$ and ζ are the differentiation coefficients$(\zeta\epsilon[0\ ,1])$. In the next step, $\tilde{S}_i$and $\tilde{R}_i$ are calculated using Equation 14

(16)

$$\tilde{S}_i = \sum_{j=1}^{n}\gamma\left(\tilde{r}_{0\,j}^{*}\ ,\tilde{r}_{ij}\right), \tilde{R}_i = \max_{j}\gamma\left(\tilde{r}_{0\,j}^{-}\ ,\tilde{r}_{ij}\right), i = 1,2,3,\ldots.m \ \ ,\ \ j = 1,2,3\ldots n \quad (17)$$

The value of Q is calculated using the values obtained from Equation 14

$$\tilde{Q}_i = \nu\left(\frac{\tilde{S}^{*} - \tilde{s}_i}{\tilde{S}^{*} - \tilde{s}^{-}}\right) + (1+\nu)\left(\frac{\tilde{R}_i - R^{*}}{\tilde{R} - \tilde{R}^{*}}\right), \quad i = 1,2,3,\ldots\ldots m \ (18)$$

$$\tilde{S}^{*} = \max_{i}\tilde{S}_i\ ,\tilde{S}^{-} = \min_{I}\tilde{S}_i\ , \quad \tilde{R}^{*} = \ \min_{i}\tilde{R}_i\ ,\tilde{R}^{*} = \ \max_{I}\tilde{R}_I$$

ν is the maximum group utility, which is typically considered equal to 0.5. Finally, the options are ranked based on the Q values obtained.

In the final step of the VIKOR technique, the options are arranged in three groups ranging from small to large, based on the values of Q, R and S. The best option is the one having the smallest Q if these two conditions are met:

Condition 1: If option A1 and A2 have the first and second rank among the m options, the following equation must be true:

(19) $Q(A_2) - Q(A_1) \geq \frac{1}{m-1}$

If this condition is not met, a set of options will be selected as the better options.

The maximum value of m is calculated using the following equation

If this condition is not met, a set of options will be selected as the better options.

best alternative=A1, A2, …, Am

The maximum value of m is calculated using the following equation:

Q(Am)-Q(A1)<1/(n-1)→ Q(Am)<(1/n-1)+Q(A1) (20)

3.2.Research criteria and options

This study consists of six criteria of human motivation factors (C1), human structural factors (C2), performance improvement factors (C3), performance motivational factors (C4), cost factors (C5) and operational factors (C6). Also, the research options (risks) were determined after a survey of sales experts as 26 risks, as presented in Table 1 and 2

Table1.group and subgroup of Outsourcing Factors

Human factors	**Motivational (C1)**	**Increasing employees' enthusiasm**
		Employees' change and transfer
		Improving responsibility acceptance/ overseeing performance / reducing user risk
	Structural (C2)	Key individuals' leaving the project
		Lack of sufficient manpower
		Experts' shortage of skills
		Proper management of human resources/ cost reduction
		Key individuals' leaving the project
		Lack of sufficient manpower
		Experts' shortage of skills

Volume: 8, No: 4, pp. 3214 - 3245
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		Adequate size of human resources/ cost reduction
Operational factors	Improvement (C3)	Management and control improvement
		Management and risk improvement
		Accelerating the capacity growth and development
		Operation performance improvement
		Quality improvement
	Motivational (C4)	Increasing commitment and mobility in non-key areas
		Achieving sustainable competitive advantage
		Offering a better career path
Financial factors	Cost (C5)	Changing the fixed costs to variable costs
		Loss due to inability to collect product sales
		Cost reduction (saving/ economy to scale)
	Operational (C6)	Liquidity improvement
		Creating liquidity through the transfer of assets to service providers
		Reducing investment on assets and releasing them for other goals
		Further attention to value added/ quality/ value for money

Table2: risk factors

Group	**Risk**	**Code**
Organizational risks	Insufficient commitment of senior management	A1
	Lack of coordination due to different management styles of parties	A2
	Inaccurate way of transferring technical knowledge (know-how)	A3
	Non-compliance with intellectual ownership rights	A4
	Non-supply of the interests of one of the parties in contract development	A5
	Lack of transparency of capital returns in contract development	A6
	Insufficient experience in similar collaborations	A7
	Weakness in individuals' social and communicative skills in cooperation	A8
	Inability to fulfill the determined goals and budgets of the sales	A9
	Lack of transparent information	A10
	Improper flexibility of key individuals in cooperation	A11
	Lack of planning for presenting sufficient training to outsourcing personnel	A12
	Outsourcer's lack of familiarity with the company's products	A13
	Manager's lack of awareness of probable risks of the project	A14
	Lack of mutual trust	A15
	Loss of customer satisfaction due to outsourcer's profit-seeking behavior	A16
	Personnel's lack of sense of belonging towards the products	A17
Environmental risks	Changes in the laws	A18
	Inflation and increased interest rates	A19
	Changes in the market demand rate	A20
	Fluctuations in exchange rates	A21
Financial risks	Outsourcer's abuse of liquidity for product sales	A22

June 2023
Volume: 8, No: 4, pp. 3214 - 3245
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	Inability to control and manage the discounts and promotions	A23
	Costs due to lack of on-time sales of perishable products due to inability for sales	A24
	Reduced liquidity due to lack of control of credit sales	A25
	Non-controllable enhancement of outsourcer's debts due to credit sales	A26

4. Results of the Bull's-eye method

The Bullseye technique is used to weigh the three-variable gray number. The first step in this technique is to create a decision matrix. The decision matrix of this method is a criterion-option matrix, where the criteria are in the column and the options are in the row, and each cell is the score of each option relative to each criterion. In this study, the research options were ranked based on the criteria presented in Table3.

Table 3: Gray scale for assessment of options (Koo and Liang, 2011)

Linguistic terms	Very poor(VP)	Poor(p)	Medium poor(MP)	Fair(F)	Medium good(MG)	Good(G)	Very good(VG)
Three-variable gray number	(0,0,1)	(0,1,3)	(1,3,5)	(3,5,7)	(5,7,9)	(7,9,10)	(9,10,10)

The number of experts in this study is 7. Each expert first rated the options according to the scale of Table 3. Then their opinions were integrated with the arithmetic average method and a merged decision matrix was formed, as presented in Table 4.

Table 4: average method and a merged decision matrix

	C1	**C2**	**C3**	**C4**	**C5**	**C6**
A1	(2.714,4.286,6.143)	(4.571,6,7.429)	(3.571,5.143,6.571)	(2,3,4.429)	(3,4.143,5.857)	(0.857,1.857,3.571)
A2	(0.857,1.714,3.571)	(1.714,2.714,4.286)	(3.571,4.714,6.143)	(3.857,5.571,7.286)	(2.143,3.286,5.286)	(2.429,4,5.571)
A3	(3.429,5.286,7)	(2.571,3.571,5.571)	(1.571,3,4.714)	(1,2,3.571)	(2.714,4.143,6)	(2.429,3.571,5.143)
A4	(1,2,3.857)	(3.857,5.857,7.571)	(3,4.571,6.286)	(1.286,1.857,3.429)	(4.571,6.286,7.714)	(2,2.857,4.571)
A5	(1.286,2.429,4)	(3.286,4.857,6.429)	(0.857,1.429,3)	(2.857,3.857,5.286)	(2.857,4.286,5.857)	(3.857,5.571,7.286)
A6	(1.143,2,3.429)	(1,2.571,4.429)	(2.714,4.429,6.429)	(2.857,4.571,6.286)	(2.857,3.857,5.286)	(2.857,4.429,6.429)
A7	(2.143,3.714,5.571)	(1.857,3.429,5.143)	(2.714,4.286,6)	(2.286,3.429,5.143)	(1.429,2.429,3.286)	(1.429,3,5)

Volume: 8, No: 4, pp. 3214 - 3245
ISSN: 2059-6588 (Print) | ISSN: 2059-6596 (Online)

A8	(2.857,4,5.571)	(2.429,3.571,5.143)	(3,4.571,6.286)	(1.714,2.571,4.429)	(1.143,2,3.571)	(1.143,2,3.571)
A9	(2.714,4,5.714)	(2.286,3.286,5.143)	(5,5.857,3.571)	(3.743,5.357,6.143)	(5.571,7.286,8.714)	(1.286,2,3.857)
A10	(1.857,3.143,5)	(1.571,2.714,4.714)	(2.429,3.714,5.571)	(2,3.286,4.857)	(4.571,6.143,7.714)	(3.857,5.571,7.143)
A11	(1,2,3.857)	(2.286,3.429,5.143)	(0.429,1.143,7)	(1.857,2.714,4.286)	(2.571,4,5.571)	(1.429,2.286,3.857)
A12	(1,2.429,4.143)	(3,4.286,5.857)	(4.429,6.429,8)	(3.429,4.857,6.429)	(2,3.286,5)	(1.714,1.286,2.714)
A13	(3.714,5.429,7)	(1.714,2.571,4.429)	(3.143,4.714,6.429)	(1.429,2.571,4.429)	(2,3.429,5.143)	(3,4,5.571)
A14	(1.286,2.714,4.714)	(1.429,2.429,4)	(3.857,5.571,7.143)	(3.429,4.857,6.429)	(3.286,5,6.857)	(2.857,4.429,6.286)
A15	(2.714,3.857,5.429)	(2.857,4.286,6)	(1.714,3,5)	(3.143,5,6.857)	(1.286,2,3.429)	(3.714,4.857,6.429)
A16	(4.429,6.143,7.857)	(2.857,3.429,4.143)	(1.571,2.571,4.429)	(3.857,5.429,7)	(3.857,5.857,7.571)	(1.714,2.714,4.429)
A17	(4.429,6.429,8.143)	(2.143,3.286,4.714)	(3.143,4.429,6)	(3.143,4.571,6.286)	(2.143,3.429,5.143)	(2,3,5)
A18	(2.857,4.286,6.143)	(2.286,3.571,5.143)	(1.857,3.571,5.429)	(2.143,3.143,4.857)	(3,4.286,6.143)	(2.143,3.571,5.429)
A19	(1.143,2.571,4.429)	(1.571,2.714,4.286)	(4.286,6,7.429)	(2.143,3,4.857)	(4.143,5.857,7.571)	(3.286,4.857,6.429)
A20	(2.571,4,5.571)	(1.714,2.571,4.143)	(1.429,3,5)	(3.429,4.714,6.286)	(5,7,8.429)	(2,2.714,4.286)
A21	(2.857,3.857,5.286)	(3,4.429,5.286)	(4.143,6.143,8)	(1.714,3,4.714)	(4,5.714,7.143)	(4.571,6.286,7.714)
A22	(2.286,3.857,5.714)	(3.714,5.286,6.857)	(2.286,3.714,5.429)	(1.714,2.714,4.429)	(3.714,5.143,6.571)	(4,5.571,7.143)
A23	(2.571,5.714,3.286)	(3,4.571,6.286)	(4.429,6.429,8.286)	(2.429,4,5.857)	(3.143,4.571,6.143)	(3.571,5.286,7)
A24	(3.571,4.286,6.143)	(5,7,8.714)	(4.286,6.143,7.857)	(1.714,2.714,4.429)	(1.714,2.714,4.286)	(1.857,3,4.571)
A25	(4.143,5.429,7.429)	(6.143,7,8.571)	(4.312,5.714,7.571)	(3.286,4.714,6.286)	(3.143,4.286,5.857)	(4.714,5.286,6)
A26	(3,5.374,5)	(3.429,5.143,6.714)	(1,1.571,5.376)	(2.429,3.429,4.857)	(3.571,5.286,7)	(2.857,4.714,6.571)

In the second step, using Equations 3-5 and 3-6, we normalize the decision matrix. In this research, all criteria are positive, so Equation 3-5 is used for normalization. The normalized matrix is presented in Table 5

Table 5: The normalized matrix

	C1	C2	C3	C4	C5	C6
A1	(0.255,0.471,0.725)	(0.463,0.648,0.833)	(0.4,0.6,0.782)	(0.159,0.318,0.545)	(0.245,0.396,0.623)	(0.255,0.471,0.725)
A2	(0,0.118,0.373)	(0.093,0.222,0.426)	(0.4,0.545,0.727)	(0.455,0.727,1)	(0.132,0.283,0.547)	(0,0.118,0.373)
A3	(0.353,0.608,0.843)	(0.204,0.333,0.593)	(0.145,0.327,0.545)	(0,0.159,0.409)	(0.208,0.396,0.642)	(0.353,0.608,0.843)
A4	(0.02,0.157,0.412)	(0.37,0.63,0.852)	(0.327,0.527,0.745)	(0.045,0.136,0.386)	(0.453,0.679,0.868)	(0.02,0.157,0.412)
A5	(0.059,0.216,0.431)	(0.296,0.5,0.704)	(0.055,0.127,0.327)	(0.295,0.455,0.682)	(0.226,0.415,0.623)	(0.059,0.216,0.431)
A6	(0.039,0.157,0.353)	(0,0.204,0.444)	(0.291,0.509,0.764)	(0.295,0.568,0.841)	(0.226,0.358,0.547)	(0.039,0.157,0.353)
A7	(0.176,0.392,0.647)	(0.111,0.315,0.537)	(0.291,0.491,0.709)	(0.205,0.386,0.659)	(0.038,0.17,0.283)	(0.176,0.392,0.647)

June 2023
Volume: 8, No: 4, pp. 3214 - 3245
ISSN: 2059-6588 (Print) | ISSN: 2059-6596 (Online)

A8	(0.275,0.431,0.647)	(0.185,0.333,0.537)	(0.327,0.527,0.745)	(0.114,0.25,0.545)	(0,0.113,0.321)	(0.275,0.431,0.647)
A9	(0.255,0.431,0.667)	(0.167,0.296,0.537)	(0.582,0.691,0.4)	(0.436,0.693,0.818)	(0.585,0.811,1)	(0.255,0.431,0.667)
A10	(0.137,0.314,0.569)	(0.074,0.222,0.481)	(0.255,0.418,0.655)	(0.159,0.364,0.614)	(0.453,0.66,0.868)	(0.137,0.314,0.569)
A11	(0.02,0.157,0.412)	(0.167,0.315,0.537)	(0,0.091,0.836)	(0.136,0.273,0.523)	(0.189,0.377,0.585)	(0.02,0.157,0.412)
A12	(0.02,0.216,0.451)	(0.259,0.426,0.63)	(0.509,0.764,0.964)	(0.386,0.614,0.864)	(0.113,0.283,0.509)	(0.02,0.216,0.451)
A13	(0.392,0.627,0.843)	(0.093,0.204,0.444)	(0.345,0.545,0.764)	(0.068,0.25,0.545)	(0.113,0.302,0.528)	(0.392,0.627,0.843)
A14	(0.059,0.255,0.529)	(0.056,0.185,0.389)	(0.436,0.655,0.855)	(0.386,0.614,0.864)	(0.283,0.509,0.755)	(0.059,0.255,0.529)
A15	(0.255,0.412,0.627)	(0.241,0.426,0.648)	(0.164,0.327,0.582)	(0.341,0.636,0.932)	(0.019,0.113,0.302)	(0.255,0.412,0.627)
A16	(0.49,0.725,0.961)	(0.241,0.315,0.407)	(0.145,0.273,0.509)	(0.455,0.705,0.955)	(0.358,0.623,0.849)	(0.49,0.725,0.961)

Volume: 8, No: 4, pp. 3214 - 3245
ISSN: 2059-6588 (Print) | ISSN: 2059-6596 (Online)

A17	(0.49,0.765,1)	(0.148,0.296,0.481)	(0.345,0.509,0.709)	(0.341,0.568,0.841)	(0.132,0.302,0.528)	(0.49,0.765,1)
A18	(0.275,0.471,0.725)	(0.167,0.333,0.537)	(0.182,0.4,0.636)	(0.182,0.341,0.614)	(0.245,0.415,0.66)	(0.275,0.471,0.725)
A19	(0.039,0.235,0.49)	(0.074,0.222,0.426)	(0.491,0.709,0.891)	(0.182,0.318,0.614)	(0.396,0.623,0.849)	(0.039,0.235,0.49)
A20	(0.235,0.431,0.647)	(0.093,0.204,0.407)	(0.127,0.327,0.582)	(0.386,0.591,0.841)	(0.509,0.774,0.962)	(0.235,0.431,0.647)
A21	(0.275,0.412,0.608)	(0.259,0.444,0.556)	(0.473,0.727,0.964)	(0.114,0.318,0.591)	(0.377,0.604,0.792)	(0.275,0.412,0.608)
A22	(0.196,0.412,0.667)	(0.352,0.556,0.759)	(0.236,0.418,0.636)	(0.114,0.273,0.545)	(0.34,0.528,0.717)	(0.196,0.412,0.667)
A23	(0.235,0.667,0.333)	(0.259,0.463,0.685)	(0.509,0.764,1)	(0.227,0.477,0.773)	(0.264,0.453,0.66)	(0.235,0.667,0.333)
A24	(0.373,0.471,0.725)	(0.519,0.778,1)	(0.491,0.727,0.945)	(0.114,0.273,0.545)	(0.075,0.208,0.415)	(0.373,0.471,0.725)
A25	(0.451,0.627,0.902)	(0.667,0.778,0.981)	(0.494,0.673,0.909)	(0.364,0.591,0.841)	(0.264,0.415,0.623)	(0.451,0.627,0.902)

June 2023
Volume: 8, No: 4, pp. 3214 - 3245
ISSN: 2059-6588 (Print) | ISSN: 2059-6596 (Online)

A26	(0.294,0.62,0.569)	(0.315,0.537,0.741)	(0.073,0.145,0.63)	(0.227,0.386,0.614)	(0.321,0.547,0.774)	(0.294,0.62,0.569)

In step 3, we determine the normalized matrix of positive Bullseye using Equation 3-7. The positive bull's-eye equals the largest item in each column.

Table6: positive Bullseye equals

	C1	C2	C3	C4	C5	C6
Z^{+}	(0.49,0.608,0.843)	(0.463,0.648,0.852)	(0.4,0.6,0.782)	(0.455,0.727,1)	(0.453,0.679,0.868)	(0.49,0.608,0.843)

In step 4, the adjusted weight of the criteria should be determined using Equation 8. However, before that, the weights of the criteria (external weights) should also be obtained by expert opinions. Table 7 presents the rating of the criteria by the experts based on Likert's 1 to 5 scale.

Volume: 8, No: 4, pp. 3214 - 3245
ISSN: 2059-6588 (Print) | ISSN: 2059-6596 (Online)

Table 7: Expert's' weights for the criteria

	C1	C2	C3	C4	C5	C6	
Expert1	3	4	5	5	4	4	
Expert2	3	4	4	4	3	3	
Expert3	4	5	5	4	3	4	
Expert4	3	3	4	5	4	5	
Expert5	4	4	4	4	3	4	
Expert6	5	4	5	4	3	3	
Expert7	3	4	5	5	4	4	
MEAN	3.571	4	4.571	4.428	3.428	3.857	23.857
weight	0.150	0.168	0.192	0.186	0.144	0.160	

Also, the importance of external weights (α) and internal weights (β) is considered to be 0.5.

At the end, using Equation 8, the adjusted weights of the criteria are measured as follows:

$$w^* = (0.127;\ 0.122; 0.249; 0.111; 0.130; 0.262)$$

According to the results, the financial operating factor (C6) is ranked first with a weight of 0.262, performance improvement factors (C3) is ranked second with a weight of 0.249, the cost factors with is ranked third with a weight of 0.130, the human motivation factors is ranked fourth with a weight of 0.127, the human structural factors is ranked fifth with a weight of 0.122, and motivational factor is ranked sixth with a weight of 0.111.

Criteria Weight Sensitivity Analysis

By changing the values of external weights (α) and internal weights (β), new weights are obtained, the results of which are presented in Table 8. In the second and third scenarios, the financial operating factors (C6) is ranked first, performance improvement factors (C3) is ranked second, cost factors is ranked third, human motivation factors is ranked fourth, human structural factors is ranked fifth, and performance motivational factors is ranked sixth. In the first scenario, only the ranks of financial operations and performance improvements have been changed. Fig. 2 presents the schematic weights of the criteria in different scenarios.

Table8: Weights of the criteria based on different scenarios

	$\alpha = 0.25$	$\beta = 0.75$	$\alpha = 0.5$	$\beta = 0.5$	$\alpha = 0.75$	$\beta = 0.25$
	Senario1		Senario2		Senario3	
W_{C1}	0.135		0.127		0.122	
W_{C2}	0.134		0.122		0.115	
W_{C3}	0.235		0.249		0.255	
W_{C4}	0.128		0.111		0.103	
W_{C5}	0.136		0.13		0.126	
W_{C6}	0.232		0.262		0.279	

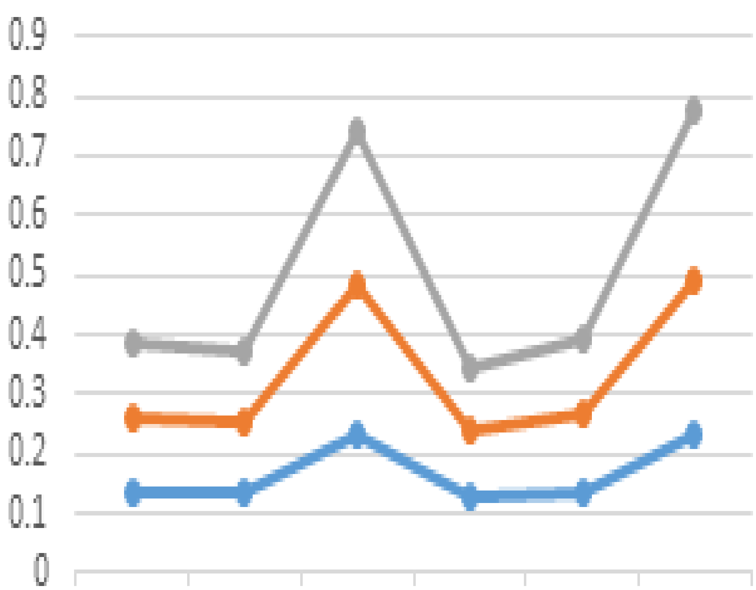

Fig 2: Weights of the criteria based on different scenarios

4.1.Results of the GRA-VIKOR method

Using the three-parameter GRA-VIKOR method and GRA relation, we rank the research options (risks) in this section.

Step 1: the formation of the decision matrix

The first step in this method is to form the decision matrix. The decision matrix is the matrix presented in Table 4, that is the Bullseye decision matrix.

Step 2: Normalizing the decision matrix

In this step, using Equations 12 and 13, we normalize the decision matrix. The normalized decision matrix of this step is also the normalized matrix of the Bullseye method (Table 5).

Step 3: Weighting the normal matrix

In this step, we must multiply the weights of the criteria $w^* = (0.127;\ 0.122; 0.249; 0.111; 0.130; 0.262)$ in the normal matrix.

The weighting matrix is presented in Table 9.

Remittances Review
June 2023
Volume: 8, No: 4, pp. 3214 - 3245
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Table 9: Vikor Weighted Normal Matrix

	C1	C2	C3	C4	C5	C6
A1	(0.032,0.06,0.092)	(0.056,0.079,0.101)	(0.1,0.149,0.195)	(0.018,0.035,0.061)	(0.032,0.051,0.081)	(0.032,0.06,0.092)
A2	(0,0.015,0.047)	(0.011,0.027,0.052)	(0.1,0.136,0.181)	(0.05,0.081,0.111)	(0.017,0.037,0.071)	(0,0.015,0.047)
A3	(0.045,0.077,0.107)	(0.025,0.041,0.072)	(0.036,0.081,0.136)	(0,0.018,0.045)	(0.027,0.051,0.083)	(0.045,0.077,0.107)
A4	(0.002,0.02,0.052)	(0.045,0.077,0.104)	(0.081,0.131,0.186)	(0.005,0.015,0.043)	(0.059,0.088,0.113)	(0.002,0.02,0.052)
A5	(0.007,0.027,0.055)	(0.036,0.061,0.086)	(0.014,0.032,0.081)	(0.033,0.05,0.076)	(0.029,0.054,0.081)	(0.007,0.027,0.055)
A6	(0.005,0.02,0.045)	(0,0.025,0.054)	(0.072,0.127,0.19)	(0.033,0.063,0.093)	(0.029,0.047,0.071)	(0.005,0.02,0.045)
A7	(0.022,0.05,0.082)	(0.014,0.038,0.065)	(0.072,0.122,0.177)	(0.023,0.043,0.073)	(0.005,0.022,0.037)	(0.022,0.05,0.082)
A8	(0.035,0.055,0.082)	(0.023,0.041,0.065)	(0.081,0.131,0.186)	(0.013,0.028,0.061)	(0,0.015,0.042)	(0.035,0.055,0.082)
A9	(0.032,0.055,0.084)	(0.02,0.036,0.065)	(0.145,0.172,0.1)	(0.048,0.077,0.091)	(0.076,0.105,0.13)	(0.032,0.055,0.084)
A10	(0.017,0.04,0.072)	(0.009,0.027,0.059)	(0.063,0.104,0.163)	(0.018,0.04,0.068)	(0.059,0.086,0.113)	(0.017,0.04,0.072)
A11	(0.002,0.02,0.052)	(0.02,0.038,0.065)	(0,0.023,0.208)	(0.015,0.03,0.058)	(0.025,0.049,0.076)	(0.002,0.02,0.052)
A12	(0.002,0.027,0.057)	(0.032,0.052,0.077)	(0.127,0.19,0.24)	(0.043,0.068,0.096)	(0.015,0.037,0.066)	(0.002,0.027,0.057)
A13	(0.05,0.079,0.107)	(0.011,0.025,0.054)	(0.086,0.136,0.19)	(0.008,0.028,0.061)	(0.015,0.039,0.069)	(0.05,0.079,0.107)
A14	(0.007,0.032,0.067)	(0.007,0.023,0.047)	(0.109,0.163,0.213)	(0.043,0.068,0.096)	(0.037,0.066,0.098)	(0.007,0.032,0.067)
A15	(0.032,0.052,0.079)	(0.029,0.052,0.079)	(0.041,0.081,0.145)	(0.038,0.071,0.103)	(0.002,0.015,0.039)	(0.032,0.052,0.079)
A16	(0.062,0.092,0.122)	(0.029,0.038,0.05)	(0.036,0.068,0.127)	(0.05,0.078,0.106)	(0.047,0.081,0.11)	(0.062,0.092,0.122)
A17	(0.062,0.097,0.127)	(0.018,0.036,0.059)	(0.086,0.127,0.177)	(0.038,0.063,0.093)	(0.017,0.039,0.069)	(0.062,0.097,0.127)
A18	(0.035,0.06,0.092)	(0.02,0.041,0.065)	(0.045,0.1,0.158)	(0.02,0.038,0.068)	(0.032,0.054,0.086)	(0.035,0.06,0.092)
A19	(0.005,0.03,0.062)	(0.009,0.027,0.052)	(0.122,0.177,0.222)	(0.02,0.035,0.068)	(0.051,0.081,0.11)	(0.005,0.03,0.062)
A20	(0.03,0.055,0.082)	(0.011,0.025,0.05)	(0.032,0.081,0.145)	(0.043,0.066,0.093)	(0.066,0.101,0.125)	(0.03,0.055,0.082)
A21	(0.035,0.052,0.077)	(0.032,0.054,0.068)	(0.118,0.181,0.24)	(0.013,0.035,0.066)	(0.049,0.078,0.103)	(0.035,0.052,0.077)
A22	(0.025,0.052,0.084)	(0.043,0.068,0.092)	(0.059,0.104,0.158)	(0.013,0.03,0.061)	(0.044,0.069,0.093)	(0.025,0.052,0.084)
A23	(0.03,0.084,0.042)	(0.032,0.056,0.083)	(0.127,0.19,0.249)	(0.025,0.053,0.086)	(0.034,0.059,0.086)	(0.03,0.084,0.042)

June 2023
Volume: 8, No: 4, pp. 3214 - 3245
ISSN: 2059-6588 (Print) | ISSN: 2059-6596 (Online)

A24	(0.047,0.06,0.092)	(0.063,0.095,0.122)	(0.122,0.181,0.235)	(0.013,0.03,0.061)	(0.01,0.027,0.054)	(0.047,0.06,0.092)
A25	(0.057,0.079,0.114)	(0.081,0.095,0.119)	(0.123,0.167,0.226)	(0.04,0.066,0.093)	(0.034,0.054,0.081)	(0.057,0.079,0.114)
A26	(0.037,0.078,0.072)	(0.038,0.065,0.09)	(0.018,0.036,0.157)	(0.025,0.043,0.068)	(0.042,0.071,0.101)	(0.037,0.078,0.072)

Selection of preference order

In this step, positive ideals (A^*) and negative ideals (A^-) should be determined. The positive ideal, based on Equation 14 equals the largest item in the criteria column, and the negative ideal equals the smallest item of that column, as shown in Table 10:

Table 10: Positive and negative ideals

	C1	C2	C3	C4	C5	C6
(A)	(0.062,0.077,0.107)	(0.056,0.079,0.104)	(0.1,0.149,0.195)	(0.05,0.081,0.111)	(0.059,0.088,0.113)	(0.062,0.077,0.107)
(A)	(0,0.015,0.042)	(0,0.023,0.047)	(0,0.023,0.081)	(0,0.015,0.043)	(0,0.015,0.037)	(0,0.015,0.042)

Calculation of Fuzzy Gray Relational Coefficient

In this step, the Fuzzy Gray Relational Coefficient is calculated using Equation 15. In this equation, the distance of each option in the weighted matrix from the positive and negative ideals must be obtained. This distance is obtained using Equation 4. The distance of the options from the positive and negative ideals is presented in Table 11 and Table 12, respectively.

For example, the A11 item is a weighted normalized matrix (0.002, 0.02, 0.052) and the distance of this gray number from the positive ideal (0.062.0.077.0.107) and the negative ideal (0, 0.015, 0.042) are calculated as follows.

June 2023
Volume: 8, No: 4, pp. 3214 - 3245
ISSN: 2059-6588 (Print) | ISSN: 2059-6596 (Online)

Table 11: Distance of the options from the positive ideal

d+	C1	C2	C3	C4	C5	C6	min	max
A1	0.022	0.001	0.000	0.044	0.032	0.073	0.000	0.073
A2	0.061	0.050	0.011	0.000	0.045	0.000	0.000	0.061
A3	0.010	0.023	0.063	0.060	0.033	0.013	0.010	0.063
A4	0.057	0.007	0.016	0.061	0.000	0.035	0.000	0.061
A5	0.053	0.019	0.107	0.049	0.032	0.060	0.019	0.107
A6	0.059	0.053	0.021	0.018	0.038	0.033	0.018	0.059
A7	0.031	0.041	0.025	0.035	0.066	0.034	0.025	0.066
A8	0.025	0.037	0.016	0.048	0.068	0.069	0.015	0.069
A9	0.025	0.039	0.062	0.012	0.017	0.063	0.012	0.063
A10	0.039	0.048	0.038	0.039	0.001	0.058	0.001	0.058
A11	0.057	0.038	0.093	0.047	0.047	0.058	0.037	0.093
A12	0.053	0.026	0.038	0.012	0.047	0.088	0.012	0.088
A13	0.007	0.050	0.011	0.049	0.046	0.013	0.007	0.050
A14	0.047	0.054	0.013	0.012	0.020	0.021	0.012	0.054
A15	0.027	0.026	0.059	0.010	0.068	0.039	0.010	0.068
A16	0.012	0.042	0.071	0.003	0.008	0.041	0.003	0.071
A17	0.016	0.042	0.018	0.016	0.045	0.027	0.016	0.045
A18	0.021	0.038	0.047	0.039	0.030	0.012	0.012	0.047
A19	0.050	0.050	0.046	0.040	0.006	0.033	0.006	0.050
A20	0.027	0.051	0.062	0.014	0.011	0.041	0.011	0.062
A21	0.027	0.029	0.034	0.043	0.010	0.084	0.010	0.084
A22	0.029	0.012	0.041	0.047	0.018	0.060	0.012	0.060
A23	0.042	0.023	0.042	0.026	0.027	0.049	0.023	0.049
A24	0.016	0.014	0.033	0.047	0.057	0.034	0.014	0.057
A25	0.005	0.019	0.025	0.015	0.031	0.059	0.005	0.059
A26	0.025	0.015	0.083	0.036	0.016	0.029	0.015	0.083

June 2023
Volume: 8, No: 4, pp. 3214 - 3245
ISSN: 2059-6588 (Print) | ISSN: 2059-6596 (Online)

min(min)	0.000	
max(max)		0.107

Table 12: Distance of the options from the negative ideal

d-	C1	C2	C3	C4	C5	C6	min	max
A1	00.43	0.056	0.114	0.019	0.038	0.023	0.019	0.114
A2	0.003	0.007	0.104	0.062	0.026	0.094	0.003	0.104
A3	0.058	0.023	0.051	0.002	0.038	0.081	0.002	0.008
A4	0.007	0.052	0.099	0.003	0.070	0.059	0.003	0.099
A5	0.011	0.038	0.009	0.034	0.030	0.153	0.009	0.153
A6	0.004	0.004	0.096	0.046	0.032	0.116	0.004	0.116
A7	0.033	0.016	0.090	0.027	0.005	0.064	0.005	0.090
A8	0.038	0.020	0.099	0.014	0.003	0.025	0.003	0.099
A9	0.038	0.018	0.121	0.015	0.057	0.031	0.018	0.121
A10	0.025	0.009	0.076	0.023	0.069	0151	0.009	0.151
A11	0.007	0.018	0.073	0.015	0.033	0.036	0.007	0.073
A12	0.011	0.030	0.152	0.050	0.023	0.019	0.011	0.152
A13	0.060	0.008	0.103	0.013	0.025	0.099	0.008	0.103
A14	0.018	0.004	0.127	0.050	0.051	0.114	0.004	0.127
A15	0.036	0.030	0.055	0.052	0.002	0.130	0.002	0.130
A16	0.073	0.019	0.042	0.059	0.063	0.053	0.019	0.073
A17	0.077	0.015	0.095	0.046	0.025	0.068	0.015	0.095
A18	0.043	0.019	0.068	0.023	0.041	0.083	0.019	0.083
A19	0.015	0.006	0.139	0.022	0.064	0.126	0.006	0.139
A20	0.037	0.007	0.053	0.048	0.081	0.053	0.007	0.081
A21	0.036	0.028	0.146	0.019	0.061	0.176	0.019	0.176
A22	0.035	0.044	0.073	0.015	0.052	0.153	0.015	0.153

Volume: 8, No: 4, pp. 3214 - 3245
ISSN: 2059-6588 (Print) | ISSN: 2059-6596 (Online)

A23	0.044	0.034	0.121	0.036	0.043	0.142		0.034	0.155
A24	0.047	0.070	0.146	0.057	0.013	0.060		0.003	0.143
A25	0.065	0.075	0.138	0.047	0.039	0.142		0.039	0.142
A26	0.046	0.041	0.045	0.026	0.055	0.122		0.026	0.122
							min(min)	0.002	
							max(max)		0.176

After calculating distances from positive and ideal ideals, the gray relation coefficient must be calculated for the positive and negative states.

For example, the Gray relation coefficient for the positive state for A11 is calculated as follows. Also, the coefficient of determination (ξ)in this research is considered 0.5.

According to Table 11, the minimum (min) value equals 0 and the maximum (max) value equals 0.107. Also, the value of d11 is 0.057. So the Gray Relational Coefficient equals:

The Gray Relational Coefficient for the negative state for A11 is calculated as follows. Also, the coefficient of determination (ξ) in this research is considered 0.5.

According to Table 12, the minimum (min) value equals 0.002 and the maximum (max) value equals 0.176. Also, the value of d11 is 0.007. So the Gray Relational Coefficient equals:

Gray relation coefficients for positive and negative states are presented in Tables 13 and 14 respectively.

Table 13: Gray relation coefficient for the positive state

$\gamma(r^*_{01}.r_{11})$	**C1**	**C2**	**C3**	**C4**	**C5**	**C6**
A1	0.711	0.976	1.000	0.550	0.624	0.421
A2	0.465	0.517	0.828	1.000	0.541	1.000
A3	0.842	0.611	0.456	0.470	0.619	0.799
A4	0.484	0.889	0.773	0.468	1.000	0.605
A5	0.505	0.739	0.333	0.650	0.625	0.470
A6	0.476	0.499	0.721	0.751	0.583	0.697
A7	0.630	0.567	0.685	0.605	0.447	0.613
A8	0.682	0.591	0.773	0.528	0.439	0.437

June 2023
Volume: 8, No: 4, pp. 3214 - 3245
ISSN: 2059-6588 (Print) | ISSN: 2059-6596 (Online)

A9	0.680	0.576	0.461	0.817	0.756	0.457
A10	0.577	0.525	0.583	0.578	0.974	0.478
A11	0.483	0.581	0.363	0.532	0.591	0.480
A12	0.501	0.469	0.580	0.814	0.529	0.376
A13	0.879	0.517	0.824	0.521	0.538	0.809
A14	0.533	0.496	0.791	0.814	0.728	0.741
A15	0.661	0.669	0.473	0.838	0.438	0.578
A16	0.814	0.559	0.428	0.942	0.864	0.565
A17	0.767	0.558	0.742	0.767	0.542	0.663
A18	0.722	0.586	0.529	0.576	0.643	0.819
A19	0.516	0.514	0.647	0.571	0.896	0.619
A20	0.665	0.510	0.460	0.790	0.831	0.564
A21	0.661	0.647	0.613	0.553	0.845	0.389
A22	0.649	0.815	0.546	0.533	0.746	0.470
A23	0.560	0.702	0.558	0.671	0.663	0.519
A24	0.772	0.788	0.621	0.533	0.485	0.613
A25	0.909	0.735	0.680	0.784	0.636	0.476
A26	0.684	0.778	0.390	0.596	0.772	0.650

Table 14: Gray relation coefficient for the negative state

$\gamma(r_{01}^{-}.r_{11})$	**C1**	**C2**	**C3**	**C4**	**C5**	**C6**
A1	0675	0.615	0.438	0.828	0.701	0.797
A2	0.970	0.924	0.460	0.589	0.777	0.487
A3	0.606	0.797	0.636	0.979	0.703	0.523
A4	0.933	0.630	0.473	0.970	0.560	0.600
A5	0.891	0.703	0.905	0.725	0.700	0.367
A6	0.955	0.957	0.479	0.667	0.736	0.434
A7	0.729	0.849	0.497	0.767	0.947	0.580
A8	0.700	0.820	0.473	0.861	0.971	0.778

June 2023
Volume: 8, No: 4, pp. 3214 - 3245
ISSN: 2059-6588 (Print) | ISSN: 2059-6596 (Online)

A9	0.699	0.836	0.424	0.626	0.505	0.740
A10	0.784	0.912	0.539	0.795	0.563	0.470
A11	0.933	0.831	0.548	0.855	0.728	0.713
A12	0.888	0.767	0.369	0.640	0.796	0.825
A13	0.597	0.923	0.462	0.871	0.783	0.473
A14	0.832	0.960	0.411	0.640	0.636	0.438
A15	0.714	0.767	0.617	0.630	0.980	0.406
A16	0.548	0.823	0.677	0.600	0.584	0.628
A17	0.536	0.860	0.482	0.660	0.779	0.567
A18	0.672	0.826	0.586	0.796	0.686	0.516
A19	0.860	0.935	0.389	0.802	0.580	0.414
A20	0.708	0.941	0.625	0.649	0.524	0.625
A21	0.714	0.759	0.378	0.825	0.596	0.335
A22	0.715	0.667	0.548	0.854	0.632	0.368
A23	0.672	0.724	0.364	0.711	0.674	0.384
A24	0.653	0.559	0.379	0.854	0.870	0.597
A25	0.578	0.541	0.492	0.652	0.693	0.384
A26	0.660	0.682	0.662	0.773	0.619	0.421

Calculation of R and S coefficients and Q index

In this step, using 16, 17 and 18, we calculate the R and S coefficients and Q index. The S coefficient for each option equals the sum of the items of each row in 13, and the R coefficient for each option equals the largest item of each row in Table 14. For example, it is calculated for A1 as follows:

$$S_{A1} = 0.711 + 0.976 + 1 + 0.55 + 0.624 + 0.421 = 4.282$$

$$R_{A1} = Max\{0.675 + 0.615 + 0.438 + 0.828 + 0.701 + 0.797\} = 0.828$$

To calculate the Q value for the A1 option as follows:

S*	4.352	0.693	R*

June 2023
Volume: 8, No: 4, pp. 3214 - 3245
ISSN: 2059-6588 (Print) | ISSN: 2059-6596 (Online)

S- 3.030 0.98 R-

$$Q_{A1} = 0.5\frac{4.282-3.030}{4.352-3.030} + (1-0.5)\frac{0.828-0.693}{0.98-0.693} = 0.539$$

Table 15 presents the R, S and Q values of the options are calculated in it. The options are also ranked based on the descending values R, S and Q. Also, the V value (group utility index of Vikor) is considered 0.5.

Table 15. R, S, and Q indices of Vikor

alternative	Si	rank	Ri	rank	Qi	rank
A1	4.282	25	0.828	7	0.262	2
A2	4.352	26	0.970	23	0.484	10
A3	3.797	14	0.979	25	0.709	21
A4	3.217	23	0.970	22	0.536	14
A5	3.332	2	0.905	13	0.760	23
A6	3.378	10	0.957	20	0.697	20
A7	3.574	5	0.947	19	0.748	22
A8	3.450	3	0.971	23	0.846	25
A9	3.748	11	0.830	8	0.478	9
A10	3.714	9	0.912	14	0.623	17
A11	3.034	1	0.933	17	0.918	26
A12	3.469	4	0.888	12	0.675	19
A13	3.088	21	0.922	15	0/498	12
A14	4.082	20	0.960	21	0.567	15
A15	3.657	6	0.980	26	0.763	24
A16	4.172	22	0.823	4	0.294	3
A17	4.039	19	0.860	10	0.410	6
A18	3.875	18	0.826	6	0.312	7
A19	3.761	13	0.935	18	0.633	18
A20	3.840	16	0.931	16	0.616	16
A21	3.708	8	0.825	5	0.473	8
A22	3.771	12	0.854	9	0.498	11

A23	3.674	7	0.724	2	0.311	4
A24	3.811	15	0.870	11	0.513	13
A25	4.220	24	0.639	1	0.005	1
A26	3.870	17	0.773	2	0.312	5

According to Table 15, the best option is one with the lowest Q value, if Equation 19 is true. We now check this equation. Options A25 and A1 are the first and second options in Q, respectively. The condition $0.05 - 0.0262 = 0.131 > \frac{1}{26-1}$ is met. Therefore, the ranking of options is based on the Q values; that is, A25 has the first rank and A1 has the second rank. Also, A11 has the last rank.

Conclusion

In this research, after identifying and evaluating the risks, we prioritized and weighted the most important risks of sales outsourcing in sanat sobat payam Company of Tehran using the three-parameter gray number bull's-eye method. Finally, considering these factors and using the GRA-VIKOR hybrid method, we prioritized the risks associated with outsourcing sales. Six criteria including structural factors, human motivation factors, improvement factors, cost factors, financial factors, and human factors are the research criteria, and decision options include organizational risks, environmental risks, and financial risks. According to the results of the Vikor method and the experts' opinions, the first 10 risks, which ranked 1 to 10, were the most important sales risks: 1) reduced liquidity due to lack of control of credit sales, 2) insufficient commitment of senior management, 3) loss of customer satisfaction due to outsourcer's profit-seeking behavior, 4) inability to control and manage the discounts and promotions, 5) non-controllable enhancement of outsourcer's debts due to credit sales, 6) personnel's lack of sense of belonging towards the products, 7) Changes in the laws, 8) fluctuations in exchange rates, 9) inability to fulfill the determined goals and budgets of the sales, and 10) lack of coordination due to different management styles of parties.

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References

Dang, Y.-g.,D,parkson. (2004). "Study on incidence decision making model of multi-attribute interval number." Journal of Nanjing University of aeronautics & astronautics **3**.

El Mokrini, A.S,alio. (2016). "An approach to risk assessment for outsourcing logistics: case of pharmaceutical industry." IFAC-PapersOnLine **49**(12): 1239-1244.

Kahraman, C. f.saeti. (2018). "An integrated intuitionistic fuzzy AHP and TOPSIS approach to evaluation of outsource manufacturers." Journal of Intelligent Systems.

Kamfiroozi, M. H. and A. B. Naeini (2013). "Supplier Selection in Grey Environment: A Grey, AHP, Bulls-Eye and ELECTRE Approach." International Journal of Information, Security and Systems Management **2**(1): 110-116.

Kuo, M.-S. and G.-S. Liang (2011). "Combining VIKOR with GRA techniques to evaluate service quality of airports under fuzzy environment." Expert Systems with Applications **38**(3): 1304-1312.

Lin, Y., et al. (2004). "Theory of grey systems: capturing uncertainties of grey information." Kybernetes **33**(2): 196-218.

Modak, M., et al. (2018). "A BSC-ANP approach to organizational outsourcing decision support-A case study." Journal of Business Research.

Nazari-Shirkouhi, S., et al. (2011). "Information systems outsourcing decisions under fuzzy group decision making approach." International Journal of Information Technology & Decision Making **10**(06): 989-1022.

Samantra, C., et al. (2014). "Risk assessment in IT outsourcing using fuzzy decision-making approach: An Indian perspective." Expert Systems with Applications **41**(8): 4010-4022.

Tavana, M., et al. (2016). "An integrated intuitionistic fuzzy AHP and SWOT method for outsourcing reverse logistics." Applied Soft Computing **40**: 544-557.

Mardani, A.; Jusoh, A.; Zavadskas, E.K.; Cavallaro, F.; Khalifah, Z. (2015) Sustainable and Renewable Energy: An Overview of the Application of Multiple Criteria Decision-Making Techniques and Approaches. Sustainability, 7, 13947–13984

Vuˇcijak, B.; Kupusovi´c, T.; Midži´c-Kurtagi´c, S.; Ceri´c, A. (2013) Applicability of multicriteria decision aid to ´ sustainable hydropower. Appl. Energy, 101, 261–267.

Quijano, H.R.; Botero, B.S.; Domínguez, B.J. (2012) MODERGIS application: Integrated simulation platform to promote and develop renewable sustainable energy plans, Colombian case study. Renew. Sustain. Energy Rev. 16, 5176–5187.

Tzeng, G.-H.; Tsaur, S.-H.; Laiw, Y.-D.(2002); Opricovic, S. Multicriteria analysis of environmental quality in Taipei: Public preferences and improvement strategies. J. Environ. Manag., 65, 109–120.

Martin-Utrillas, M.; Juan-Garcia, F.; Canto-Perello, J.; Curiel-Esparza, J.(2015), Optimal infrastructure selection to boost the regional sustainable economy. Int. J. Sustain. Dev. World Ecol, 22, 30–38

Opricovic, S.(1998), Multicriteria optimization of civil engineering systems. Fac. Civ. Eng. Belgrade, 2, 5–21. 32.

Opricovic, S.; Tzeng, G.H.(2002), Multicriteria planning of post-earthquake sustainable reconstruction. Comput. Aided Civ. Infrastruct. Eng., 17, 211–220

Opricovic, S. A (2009) .compromise solution in water resources planning. Water Resour. Manag, 23, 1549–1561.

Huang, J.-J.; Tzeng, G.-H.; Liu, H.-H. (2009) A revised VIKOR model for multiple criteria decision making—The Perspective of Regret Theory. In Cutting-Edge Research Topics on Multiple Criteria Decision Making; Springer: Berlin, Germany; pp. 761–768.

Moeinzadeh, P.; Hajfathaliha, A. A, (2009) .combined fuzzy decision-making approach to supply chain risk assessment. World Acad. Sci. Eng. Technol, 60, 519–535.

Sayadi, M.K.; Heydari, M.; Shahanaghi, K. (2009) Extension of VIKOR method for decision-making problem with interval numbers. Appl. Math. Model, 33, 2257–2262

Chang, C.-L. A modified VIKOR method for multiple criteria analysis. Environ. Monit.(2010) Assess, 168, 339–344

Heydari, M.; Kazem Sayadi, M.; Shahanaghi, K. (2010). Extended VIKOR as a new method for solving Multiple Objective Large-Scale Nonlinear Programming problems. RAIRO Oper. Res. 44, 139–152.

Sanayei, A.; Mousavi, S.F.; Yazdankhah, A. (2010). Group decision-making process for supplier selection with VIKOR under fuzzy environment. Expert Syst. Appl, 37, 24–30.

Vahdani, B.; Hadipour, H.; Sadaghiani, J.S.; Amiri, M.(2010) Extension of VIKOR method based on interval-valued fuzzy sets. Int. J. Adv. Manuf. Technol, 47, 1231–1239.

Devi, K. (2011) Extension of VIKOR method in intuitionistic fuzzy environment for robot selection. Expert Syst. Appl. 2011, 38, 14163–14168.

Kuo, M.-S.; Liang, G.-S. (2011), Combining VIKOR with GRA techniques to evaluate service quality of airports under fuzzy environment. Expert Syst. Appl., 38, 1304–1312.

Park, J.H.; Cho, H.J. ;(2011), Kwun, Y.C. Extension of the VIKOR method for group decision making with interval-valued intuitionistic fuzzy information. Fuzzy Optim. Decis. Mak. 10, 233–253.

Liu, P.; Wang, M. (2011). An extended VIKOR method for multiple attribute group decision making based on generalized interval-valued trapezoidal fuzzy numbers. Sci. Res. Essays, 6, 766–776.

Du, Y.; Liu, P. (2011). Extended fuzzy VIKOR method with intuitionistic trapezoidal fuzzy numbers. Inf. Int. Interdiscip. J. 14, 2575–2583.

Su, Z.-X. A. (2011), hybrid fuzzy approach to fuzzy multi-attribute group decision-making. Int. J. Inf. Technol. Decis. Mak. , 10, 695–711.

Nabavieh, A., et al., 2019. Assessing productivity changes using the bootstrapped Malmquist index: the case study of the Iranian construction industry. In: International conference on industrial engineering and operations management. Bangkok, Thailand\

Gholamiangonabadi,D, J Shahrabi, Hosseinioun, S, Nakhodchi,S, Gholamveisy, S,Customer churn prediction using a new criterion and data mining; A case study of Iranian banking industry.Proceedings of the International Conference on Industrial Engineering and Operations Management (2019), pp. 5-7

Gholamveisy , S,2021, DISCOVERING HIDDEN CLUSTER STRUCTURES IN CITIZEN COMPLAINT CALL VIA SOM AND ASSOCIATION RULE TECHNIQUE, > Journal JOURNAL OF MECHANICS OF CONTINUA AND

MATHEMATICAL SCIENCES,Vol – 16 No -7, https://doi.org/10.26782/jmcms.2021.07.00007

Gholamveisy, S. (2021). GASOLINE CONSUMPTION PREDICTION VIA DATA MINING TECHNIQUE. JOURNAL OF MECHANICS OF CONTINUA AND MATHEMATICAL SCIENCES. Vol.-16, No.-9, September (2021) pp 74-84 ISSN (Print) 0973-8975, DOI: 10.26782/jmcms.2021.09.00007

Gholamveisy, S., & Heidari, H. Designing a Hybrid MCDM Model for Risk Management of Supply Chain. International Journal of Innovative Science and Research Technology, Volume 8, Issue 2, February – 2023

Gholamveisy, S., Momen, A., Hatami, M., Sekhavat, M., & Homayooni, S. (2023). The effect of perceived social media marketing activities on brand loyalty. *Apuntes Universitarios*, *13*(3), 105–118. https://doi.org/10.17162/au.v13i3.1374