GROUP DECISION-MAKING PROCESS FOR SUPPLIER SELECTION USING MULTIMOORA TECHNIQUE UNDER FUZZY ENVIRONMENT

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Abstract
Supplier selection is an important issue in the supply chain so that manufacturers spend 60% of their time providing raw materials, and components. Meanwhile, 70 percent of production costs related to the purchase of goods and services. So choose and determine the most appropriate suppliers in supply chain are an important issue. During recent years, how to select the suitable suppliers in the supply chain has become a key strategic consideration. The nature of supplier selection is a complex issue with multiple criteria simultaneously encompasses both quantitative and qualitative factors; although these criteria may conflict with each other or possibly not possible to comment definitively on it. Therefore, we can use the method of multi-criteria decision making (MCDM) in a fuzzy environment (uncertainty) to overcome this problem. It is clear that the results of decisions made by a group of experienced decision makers from different parts of the organization have been chosen mainly the results of individual decisions is preferred, therefore, the choice of the most appropriate options using the concept of group decision-making, it seems more rational. In this article, to gather expert opinions, linguistic values are used to select the most appropriate method for supplier MULTIMOORA MCDM methods is one of the newest and most powerful, is used.

Keywords: Supplier selection, Group decision-making, MULTIMOORA, Fuzzy logic

1-Introduction
In today's rapidly changing competitive environment that is characterized by low profit margins, high customer expectations of quality and less time waiting for the order, the company must take every opportunity to improve operations, their market. To achieve this goal, experts and practitioners have come to a similar conclusion and that is that if a company wants to stay competitive, you need to improve performance, and its trading partners in the supply chain is working properly. Thus, a key process in the chain flow and its impact on all areas of an
organization and also the purchase of a task will become increasingly important (Sanayei, Musavi & Yazdankhah, 2010).

Now many companies through the supply chain management are strengthening their relationships with partners in the supply chain. They know that success does not depend solely on their function, but success also depends on communication with customers, the success rate of its supply chain against supply chain is rivals. These organizations and their suppliers just as retailers and distributors as customers do not account, rather both as partners in delivering value to the customer to create an account. For instance, Lexus has also worked closely with suppliers that are carefully selected to improve the quality and effectiveness of performance on the other hand it enterprises with vendors to provide the highest level of sales and customer service support, which resulted in a visit to the company and encourage them to return to be re-used, they will work. (Kotler and Armstrong, 1391)

In today's global market, success often depends on the ability of suppliers is selected. Supplier selection process often becomes very complex because of the multitude of unpredictable and uncontrollable factors are included in the decisions that affect. The purpose of this study was to gain a better understanding of the operational areas of strategic decisions is the supplier selection process. The most important concepts such as TQM and JIT manufacturing companies have accepted the role of supply chain management and suppliers has become increasingly important. (Verma & Pullm, 1998) However, supplier selection is an important issue in the supply chain. So that manufacturers spend 60% of their time providing raw materials and components. (Krajewsld, & Ritzman, 1996) In addition, 70 percent of production costs related to the purchase of goods and services. (Ghodsypour, & O'Brien, 1998) Like most decision-making processes, supplier selection involves two main action is distinct. These two acts are the appraisal and selection. General assessment phase consists of identifying relevant features and measures and subsequent decisions, assessment or rating of any of the suppliers. Several formal methods in the literature based on specific approaches for procedural aspects of this concept have been that some of them are mentioned below.

Supply chain management seeks to integrating organizational units along the supply chain and coordinating material flow, information and financial flows in order to gain customer requests and to improve the competitiveness of the supply chain. (Afrazech, 1383) In the supply chain, all activities associated with the flow of goods and materials into the raw material procurement stage till the final delivery to the consumer. Supply chain management is the integration process of the supply chain activities and information flows associated with it, thereby promoting and coordinating activities in the production and supply of the product is achieved. (Shafi Zadeh, 1383) Several factors may affect the performance of a supplier. Dixon (1996), Alram (1990), ROA and Kaiser (1980), Astam and Glar (1993), respectively, 60, 18, 13 and 23 have identified criteria for selecting suppliers. However, since the number of agents is large, several screening is done by decision makers, and ultimately the main criteria in the selection are involved. Thus, supplier selection problem with multiple criteria that must be solved by the method of multi-criteria decision making (MCDM) can be used. Furthermore, in complex decision problems such as selection of supplier companies, rather than usually enjoying views of the opinions of a group of decision makers to use more about the issue and resolve issues raised by the proposed method.
2 - Research literature

1-2 Supplier Selection

Manufacturing organizations to maintain competitive advantage in dynamic environments and activities that are constantly changing needs maximum flexibility. The success of organizations depends on their ability to deliver outputs. Provide satisfactory products according to criteria such as cost, quality, performance, delivery, flexibility and innovation to the organization's ability to manage the flow of materials and information...inside and outside the organization. This process is known as the supply chain. Effective supply chain management is a key factor of survival and overall supply chain Management Company focused on enhancing the adaptability and flexibility and the other has the ability to react and respond quickly and effectively to market changes. Success and failure in the supply chain market will eventually be determined by the customer or end consumer. Delivering the right product, at the right time and price to the consumer, not just the most important factor for competitive success, but also has a key role in the survival of a manufacturing organization. Therefore, in order to establish a supply chain strategy, supply of raw materials and preparation time has a considerable impact. (Shafii, Khodaparasti and Khodaparasti, 1390)

Supplier selection process, often due to uncertainty in practice will be affected. (De Boer, van der Wegen, & Telgen, 1998; Min 1994) due to the strategic importance and involvement of the risks and uncertainties associated with the selection process. Supplier, several decisions from other parts of the purchasing department as (part of) production, financial and marketing decision making process for supplier selection process, highly engaged. Thus, some researchers emphasized the need for a systematic and rational group decision-making process for supplier selection are emphasized. (De Boer et al., 1998) In essence, the supplier selection problem in supply chain system combines decision the group includes several different criteria with different forms of uncertainty. (Chena et al., 2006), so this problem is a problem of multi-criteria decision making MCDM methods for effectively solving the problem requires. Due to the nature of the problem, the integrated management of MCDM techniques is originating. De Boer, Labrv and Morlaky (2001) and Isao, Hayory and Hassini (2007) revised and proper classification of the methods offered to support the selection of suppliers. Our methods can be classified into six main categories: the Multi-Attribute Decision Making (MADM), Decision with multiple objectives and mathematical programming (MP), approaches statistical/probabilistic approaches, intelligent, multi-component approach, and so on. Each of the six categories, along with their respective approaches and examples, are listed in Table 1.

Methods available in the first batch on option selection are concentrated. These methods have a limited number of options, the options are predefined through multiple indicators or criteria are selected. These methods include multiple indicators of utility theory (MAUT), a Narbth methods, analytic hierarchy process (AHP) and its complex version of the analytic network process (ANP) and prioritized based on similarity to ideal solution (TOPSIS) to requirements. (Opricovici & Tzeng, 2007) and non ratings normally are not used for the actual selection of options, but they are pretty good options in the initial screening process (2 categorize Options type acceptable non acceptable). After the screening process, to achieve a perfect rating or actual offer, the option must be used with other methods. (Loken, 2007) AHP and ANP also have their own problems: inversion in the ranking of the difficulty in correcting lots of options. Another approach in this category is TOPSIS. Under this method, is based on the notion that the choice should be the minimum distance from the positive ideal solution and farthest from the negative ideal solution.

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In addition, this method assumes that the utility of each indicator is monotonically increasing or decreasing.

Departments in the latter category, the various elements of interest, due to the limitations of the various topics, such as discounts for multiple or single sourcing and logistics costs, optimize interactions and movement make it to the buyer's allow major and usually the best value / time ordering from supplier / suppliers appropriate, take effective decisions. Several optimization methods such as goal programming, linear programming, integer programming and DEA have been employed in these areas. Equally important, the use of mathematical programming methods is that most of them for practical use by managers are very complex. These backup systems are also on qualitative factors, are lack. Furthermore, the methods in this category are mainly multi-sourcing environment and to determine the order quantities among providers / suppliers are used. Models based on artificial intelligence (AI), a computer-based system that can sort by shopping smart or be guided by historical data, the complexity of the corporate system to efficiently solve the issue, without high-performance applications sophisticated computer is inappropriate.

Five categories of ways in which the creators of innovative, multi-component, one or more methods to combine the advantages of both (a) the methods they use. Although a few minor disadvantages of hybrid models will affect the efficacy. MULTIMOORA method is a method that has recently been introduced to solve multi-criteria decision making (MCDM) disproportionate and incompatible standards (different units) is created and is capable of providing a basis for the development of selected models must be able to cope effectively with this problem. in this paper, the three-member team of experts to form the first set of criteria related to the problem addressed ahead and then taking the linguistic values of fuzzy set theory and the concept of uncertainty and data collection in the form of fuzzy numbers we have discussed. Then after Defuzzification numbers using shannon entropy method, the weight of each of these parameters determine and ultimately, using Action MULTIMOORA ratings available suppliers supply chain system.

Table 1 - Methods and examples to choose supplier

<table>
<thead>
<tr>
<th>Group</th>
<th>Approach</th>
<th>Example</th>
</tr>
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<tbody>
<tr>
<td></td>
<td>ANP</td>
<td>Sarkis and Talvry (2002)</td>
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<td></td>
<td>MAUT</td>
<td>Maine (1994)</td>
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<td></td>
<td>Top ranking method</td>
<td>De Boer and others (1998)</td>
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<tr>
<td></td>
<td>TOPSIS</td>
<td>Chna and others (2006)</td>
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<td></td>
<td>LP</td>
<td>Penn (1989)</td>
</tr>
<tr>
<td>Mathematical programming</td>
<td>GP</td>
<td>Bvfa and Jackson (1983), Karpak and others (1999)</td>
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<td></td>
<td>MIP</td>
<td>Alram Weber (1993), Chavdry and others (1993)</td>
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<td></td>
<td>DEA</td>
<td>Albino and Garavly (1998), Choi and</td>
</tr>
<tr>
<td>Probability/Statistics</td>
<td>Neural</td>
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<tr>
<td>Artificial intelligence</td>
<td>Networks</td>
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<tr>
<td></td>
<td>Argument</td>
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</tbody>
</table>
2.2 Shannon entropy method

Shannon and Weaver (1947) to determine the weight (relative importance) criteria using the concept of entropy proposed by Zeleny (1982) were emphasized. In fact, entropy is a fundamental concept in the physical sciences, social sciences and systems. Entropy represents the amount of uncertainty arising from the content of a message. In this method, the index factor is more important to provide more information to decision makers. The algorithm of this method is as follows:

If the desired data in the form of a decision matrix to summarize:

\[
D = \begin{bmatrix}
C_1 & C_2 & C_3 & \cdots & C_n \\
A_1 & x_{11} & x_{12} & x_{13} & \cdots & x_{1n} \\
A_2 & x_{21} & x_{22} & x_{23} & \cdots & x_{2n} \\
A_3 & x_{31} & x_{32} & x_{33} & \cdots & x_{3n} \\
\vdots & \vdots & \vdots & \vdots & \ddots & \vdots \\
A_m & x_{m1} & x_{m2} & x_{m3} & \cdots & x_{mn}
\end{bmatrix}
\]

Here we have m alternatives and n criteria. The criteria for determining the weight of each operation are as follows:

Information in the decision matrix (D) Scale as follows (normal) to:

\[
P_{ij} = \frac{x_{ij}}{\sum_{i=1}^{m} x_{ij}}
\]

We obtain the level of the jth index:

\[
E_j = -K \sum_{i=1}^{m} \left[ P_{ij} \cdot Ln P_{ij} \right] \forall j, K = \frac{1}{Ln(m)}
\]

ed for the j-th index.
Finally, the weights \( W_j \) of the indicators we have:

\[
W_j = \frac{d_j}{\sum_{j=1}^{n} d_j} ; \forall j
\]

If a certain subjective judgment, such as in relation to the index \( j \), then the weight adjustment is calculated as follows:

\[
W'_j = \frac{\lambda_j W_j}{\sum_{j=1}^{n} \lambda_j W_j} ; \forall j
\]

### 3.2 MULTIMOORA

Multi-objective optimization technique using ratio analysis (MOORA) was introduced initially by Braverz and Zavadskas (2006) and two (2010), a method developed MULTIMOORA MOORA as it were wider. MOORA also form the product in full (Balezentis & Shouzhen, 2013) In other words, the method MOORA based on two systems approach towards and approach the reference point rating options deals, but the way MULTIMOORA the developed method MOORA, the a third approach, an approach called Full multiplied added. This feature can be linear utility methods and decision criteria to separate the positive and negative criteria to optimize the options mentioned. Consider again the decision matrix \( D \). As mentioned previously, here we have \( m \) alternatives \( \{A_i | i = 1, 2, ..., m\} \) and \( n \) criteria \( \{C_j | j = 1, 2, ..., n\} \). Now, knowing the relative weight of each criterion \( (W_j) \) can be covering the steps below rating MULTIMOORA payment method options:

**Step One:** The information contained in the decision matrix \( (D) \) Scale as follows (normal) to:

\[
r_{ij} = \frac{x_{ij}}{\sqrt{\sum_{i=1}^{m} x_{ij}^2}}
\]

**Step Two:** Positive indicators (made from profits) and negative (material costs) and then separated based approach "towards the system" option to descending (from high to low) rating as:

\[
A^+ = \{A_i | \text{Max}(\sum_{j=1}^{g} r_{ij} W_j - \sum_{j=g+1}^{n} r_{ij} W_j)\}
\]

In the above formula, \( j = 1, 2, ..., g \) Positive and \( j = g+1, g+2, ..., g+n \) standards are negative.

**Third step:** In this step, options based on the "reference point approach" upward (from low to high) rating are:

\[
A^- = \{A_i | \text{Min}(\text{Max}(W_j - r_{ij} W_j))\}
\]

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In the above formula $v_j^s$ is:

$$v_j^s = \max_i r_{ij}$$

**Fourth step:** In this step, the options descending (from high to low) based approach "perfect product" rankings are:

$$A^* = \left\{ A_j : \max \left( \frac{\prod_{j=1}^{g} r_{ij} w_j}{\prod_{j=g+1}^{n} r_{ij} w_j} \right) \right\}$$

In the above formula, $j = 1, 2, \ldots, g$ positive indices $j = g+1, g+2, \ldots, g+n$ indices are negative.

**Step Five:** Finally, using the theory of dominance and merger of three approaches to learn the ranking of pay options.

### 4.2 Fuzzy Logic

Faced with the decision-maker with the doubts, difficulties and uncertainties will buckle. To resolve this uncertainty and inaccuracy, he generally relies on the tools provided by the theory of probability. This principle acknowledges that carelessness, of whatever nature which may be affected by the randomness. The actual process of decisions making, we have different types of uncertainty and inaccuracy to check and identify each of them with the help of which a variety of tools will be evaluated. (Bevilacqua, Ciarapica & Giacchetta, 2006) Probability theory could reveal random nature of decision analysis to assess the inaccuracy or uncertainty resulting from human behavior (which is not accidental and is not likely) would not. The issue for decision makers and other individuals involved in the decision-making process, there are problems that are not based on probability theory can be assessed properly. (Zadeh, 1965) can be used to address the problems of fuzzy set theory. Fuzzy theory, a theory is to act in situations of uncertainty. This approach has enabled many of the concepts, variables and systems that are vague, imprecise and, as such, is in reality, in most cases, the mathematical form and grounds for argument, inference, control and decision making under uncertainty provided. (Momeni, 1391)

Tools often rely on logic as the logical consequence of a two-part (yes / no, true / false) is introduced to the problems arising from real-life situations and approaches and processes of the human mind to solve the problem is by no means a double minor. (Tong & Bonissone, 1981) Two-part series based on classic logic, fuzzy logic is based on fuzzy sets. A fuzzy set is a set of objects in which no pre-defined boundaries between objects have real or a member or non-member does not exist. The key concept underpinning this definition is related to membership, each member of the set with a value of a cell that shows how much of an element is a member. The value in the range $[0, 1]$ is that here one and zero, respectively, indicate the minimum and maximum membership degree, and while all intermediate value that represent the relative membership degree. (Bevilacqua et al., 2006) Refer to the following section, some definitions and notations of fuzzy set theory will be reviewed.

If the desired data in the form of fuzzy decision matrix below in our summary:

$$\tilde{D} = \begin{bmatrix}
\tilde{x}_{11} & \tilde{x}_{12} & \cdots & \tilde{x}_{1n} \\
\tilde{x}_{21} & \tilde{x}_{22} & \cdots & \tilde{x}_{2n} \\
\vdots & \vdots & \ddots & \vdots \\
\tilde{x}_{m1} & \tilde{x}_{m2} & \cdots & \tilde{x}_{mn}
\end{bmatrix}$$
Take the case of \( \{x_n\} \) \( X = \{x_1, x_2\} \). A fuzzy set \( \tilde{A} \) of \( X \) is a set of ordered pairs, 
\[
\{(x_1, f_1(x_1)), (x_2, f_2(x_2)), \ldots, (x_n, f_n(x_n))\}, f_i : X \rightarrow [0, 1]
\]
Registration is \( f_\tilde{A} \) function \( \{ f_\tilde{A} \} \) Member of \( x_i \) in \( \tilde{A} \). When the value is closer to 0 degree. When the value \( f_\tilde{A} \) is closer to 1, up high.
A fuzzy set \( \tilde{A} \) of the community in question \( X \) is convex if and only if the whole \( x_2, x_2 \) in \( X \),
\[
f_\tilde{A}(\lambda x_1 + (1-\lambda)x_2) \geq \min [f_\tilde{A}(x_1), f_\tilde{A}(x_2)]
\]
Where: 
\( \lambda \in [0, 1] \), \( x_1, x_2 \in X \)
The size (length) of a fuzzy set is the largest membership degree obtained by each component of the series. In a fuzzy set \( \tilde{A} \) throughout the community in question is called the normal \( X \) is equal to 1. A fuzzy number is a fuzzy subset of \( X \) is discussed, which is convex and normal.

\[
\mu_{\tilde{A}(x)} \begin{cases} 
\frac{x-a}{b-a}, & a \leq x \leq b \\
0, & x > c 
\end{cases}
\]

A trapezoidal fuzzy numbers can be positive (\( a, b, c, d \)) is defined as can be seen in Figure 1. Membership function \( \mu_{\tilde{A}(x)} \) is defined as follows:

\[
\mu_{\tilde{A}(x)} \begin{cases} 
\frac{x-a}{b-a}, & a \leq x \leq b \\
0, & x > c 
\end{cases}
\]

Figure 1 - triangular fuzzy number \( \tilde{A} \)

Figure 2 - trapezoidal fuzzy number \( \tilde{A} \)
In addition, this section follows accordingly, defuzzification process for the main comparison of a fuzzy number. Both positive triangular fuzzy numbers is given as follows. Some basic operations of fuzzy numbers can be expressed as follows: If

\[
\begin{align*}
\mu_A(x) &= 1, & b \leq x \leq c \\
0, & & x > d \\
\end{align*}
\]

Developed through the principle of sum \(\oplus\) and subtraction Fuzzy Fuzzy Fuzzy Two triangular, triangular fuzzy numbers, but multiplication and division \(\otimes\) both the triangular fuzzy number is only an approximation of a fuzzy number. Both positive triangular fuzzy numbers is given as follows. Some basic operations of fuzzy numbers can be expressed as follows:

If

\[
\begin{align*} 
 a &= (a_1, a_2, a_3) \neq b = (b_1, b_2, b_3) \\
 A \oplus B &= (a_1 + b_1, a_2 + b_2, a_3 + b_3) \\
 A \ominus B &= (a_1 - b_1, a_2 - b_2, a_3 - b_3) \\
 A \otimes B &= (a_1 b_1, a_2 b_2, a_3 b_3) \\
 A \oslash B &= (a_1 / b_1, a_2 / b_2, a_3 / b_1) \\
\end{align*}
\]

The main operation on trapezoidal fuzzy numbers is the same way. Fuzzy numbers, often used for comparison or ranking, they need to be converted to real numbers. Such a conversion process, called Defuzzification out. Defuzzification most used approach, Defuzzification is off center as the center of gravity or center of the area is also known Defuzzification. Defuzzification way down the center, as the center of the fuzzy number \(\tilde{A}\) defines Defuzzification itself as the following is displayed. (Yager, 1981)

\[
\text{defuzzy}(\tilde{A}) = \frac{\int_{x} x \mu(x) dx}{\int_{x} \mu(x) dx}
\]

Accordingly, the actual implementation of the triangular fuzzy number \(A = (a, b, c)\) are as follows:

\[
\text{defuzzy}(\tilde{A}) = \frac{a + b + c}{3}
\]

3 - The proposed method for selecting supplier

This section provides a procedure for selecting MULTIMOORA new framework is introduced. In addition to collecting feedback to decision makers triangular fuzzy numbers are used, In fact, the supplier selection in supply chain system, a group of multi-criteria decision making problem which can be described by the following categories:

1. K Set the decision is called \(D_k\) \(\ldots E = \{D_1, D_2\}\)
2. A set of supply available, which is called \(A_m\) \(\ldots A = \{A_1, A_2\}\)
3. A set of n criteria \( c_n \) \(\ldots C = \{c_1, c_2\}\) along with the supplier’s performance is measured.
4 - A set of performance ratings \( A_i, i = 1, 2, \ldots, m \) relative to the benchmark \( c_j, j = 1, 2, \ldots, n \) is called

The main steps of the proposed method are as follows:

1-3 - To identify goals of decision-making process and defines the problem domain

Decision-making process of defining the objectives, gather relevant information and choose the best. So the first step is to define the goals here is to evaluate and select a supplier / suppliers is desirable. It will help to constrain precisely the problem. Provide clear and precise thinking in the first step selection process is vital. The way in which the process is defined all other steps will be definitive characteristic (non-contingent).

In this step, the source of the problem domain in terms of product / service, the time frame for the source of the issue, to justify restrictions on the supplier selection process, the resources available options to select from among them and be defined. The interlocking of the various areas of the organization and the decisions sectors such as assembly line, supplier quality assurance department, financial department, logistics department, etc., purposes, supplier selection, and the inference is (finally) with goals organizations are in a row.

2-3 - Group decision making and thus the set of relevant criteria to define and describe.

As already mentioned, the process of evaluating and selecting suppliers and experts from several employees from different functional areas of the company are involved. So with regard to the scope defined in the previous section and all its aspects, we need to form a group of decision-makers. Supplier selection, firstly to identify the decision criteria, the evaluation standards / measures in order to provide a measure of competence needs. These criteria should be based on the company's strategy, competitive position, will be level of integration supplier - buyer and product sourcing.

3-3 - Fuzzy decision matrix formed by the values in this matrix can Defuzzification.

In this step, each decision-maker with regard to the criteria to evaluate the options is verbal. This evaluation is done by using fuzzy numbers. Membership functions for the linguistic terms in the supplier selection problem can be seen in Figure 3. Then fuzzy numbers using the center method (COA) is Defuzzification.

4-3 - Verbal assessments made by decision makers to integrate.
For this purpose, the geometric mean of the views of decision makers (a) obtains and considers it as the original matrix evaluation.

\[ x'_{ij} = \left( \prod_{k=1}^{N} x_{ij}^{(k)} \right)^{\frac{1}{N}} \]

Here, the component of the evaluation was to compare the decisions I've made regarding my assessment.

5-3 - Shannon entropy weight method using a set of criteria and then ranking procedure MULTIMOORA pay suppliers.

4 - Numerical Example

In this section, for a deeper understanding of how to apply the proposed model in selecting a solution provider provide an application example in industry, as a step to be addressed.

Step One: A company wants to buy parts for your product key, to select a qualified supplier. After initial screening, five providers (S1, S2, S3, S4) remain until further evaluation was done on them, and one must be selected.

Second step: a committee of decision-makers, D1, D2, D3 are formed to choose the most qualified provider. Have been defined:
- Quality of the product (C1)
- providing technological level (C2)
- Lead time to receive per day (C3)
- After a kilometer geographical terms (C4)
- The price per hundred thousand dollars (C5)

It is essential to note that the first and second criteria of gender, income and criteria, third, fourth and fifth charge is made.

Step Three: Decision-makers in the form of linguistic variables ranking fuzzy numbers in Figure 3 to evaluate each option against each criterion shown in use. So, in this step, three fuzzy decision matrix formations (based on the number of decision makers) are. (Table 1)

<table>
<thead>
<tr>
<th>Decision maker</th>
<th>Criterion</th>
<th>Supplier</th>
<th>C1</th>
<th>C2</th>
<th>C3</th>
<th>C4</th>
<th>C5</th>
</tr>
</thead>
<tbody>
<tr>
<td>D1</td>
<td>S1</td>
<td>L</td>
<td>VH</td>
<td>VL</td>
<td>H</td>
<td>L</td>
<td></td>
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<tr>
<td></td>
<td>S2</td>
<td>VH</td>
<td>M</td>
<td>H</td>
<td>M</td>
<td>M</td>
<td></td>
</tr>
<tr>
<td></td>
<td>S3</td>
<td>L</td>
<td>L</td>
<td>H</td>
<td>VH</td>
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<td></td>
<td>S4</td>
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<td>L</td>
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<td>VL</td>
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<td>D2</td>
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<td>S5</td>
<td>VL</td>
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</tbody>
</table>
Table 1 - Verbal assessment made by decision makers, suppliers based on the selection criteria

Fourth step: In this step, the values of the fuzzy decision matrix by using the center method (COA) are Defuzzification and real decision matrix is formed. (Table 2)

<table>
<thead>
<tr>
<th>Decision maker</th>
<th>Criteria</th>
<th>$C_1$</th>
<th>$C_2$</th>
<th>$C_3$</th>
<th>$C_4$</th>
<th>$C_5$</th>
</tr>
</thead>
<tbody>
<tr>
<td>$D_1$</td>
<td>$S_1$</td>
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<td>7</td>
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<tr>
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<tr>
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<td>3</td>
<td>7</td>
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<td>9</td>
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<td>3</td>
<td>1</td>
<td>7</td>
</tr>
<tr>
<td>$D_2$</td>
<td>$S_1$</td>
<td>3</td>
<td>1</td>
<td>3</td>
<td>7</td>
<td>3</td>
</tr>
<tr>
<td></td>
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<td>9</td>
<td>3</td>
<td>7</td>
<td>7</td>
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<td>9</td>
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<td>5</td>
</tr>
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<td>$D_3$</td>
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<td>5</td>
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</tr>
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<td>3</td>
<td>9</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>$S_4$</td>
<td>5</td>
<td>3</td>
<td>9</td>
<td>5</td>
<td>7</td>
</tr>
</tbody>
</table>

Table 2 - Evaluation Defuzzification by decision makers

Fifth step: In this step, the fourth step is to create a real matrix using the formula 24 can be combined to form the decision matrix synthesis. Then, the weight of each criterion is calculated using Shannon entropy method (Table 3)

<table>
<thead>
<tr>
<th>Criteria</th>
<th>$C_1$</th>
<th>$C_2$</th>
<th>$C_3$</th>
<th>$C_4$</th>
<th>$C_5$</th>
</tr>
</thead>
<tbody>
<tr>
<td>$S_1$</td>
<td>2.080</td>
<td>3.557</td>
<td>2.466</td>
<td>5.278</td>
<td>3.979</td>
</tr>
<tr>
<td>$S_2$</td>
<td>7.399</td>
<td>5.130</td>
<td>3.979</td>
<td>6.257</td>
<td>6.804</td>
</tr>
<tr>
<td>$S_3$</td>
<td>6.130</td>
<td>2.080</td>
<td>4.718</td>
<td>8.277</td>
<td>5.130</td>
</tr>
<tr>
<td>$S_4$</td>
<td>3.557</td>
<td>2.080</td>
<td>4.327</td>
<td>2.924</td>
<td>6.257</td>
</tr>
<tr>
<td>$W_j$</td>
<td>0.357</td>
<td>0.265</td>
<td>0.093</td>
<td>0.215</td>
<td>0.070</td>
</tr>
</tbody>
</table>

Table 3 - Matrix combined with the weight of each criterion

Sixth step: In this step, a procedure MULTIMOORA ranking providers are paid. But before you use this method, you should be normalized decision matrix synthesis. (Table 4) More than the alternatives based on the systems approach, the reference point based approach of the ranking is
based on total product approach. Finally, using the theory of dominance and merger of three approaches to learn the ranking selection is discussed. (Table 5)

<table>
<thead>
<tr>
<th>Criteria</th>
<th>( C_1 )</th>
<th>( C_2 )</th>
<th>( C_3 )</th>
<th>( C_4 )</th>
<th>( C_5 )</th>
</tr>
</thead>
<tbody>
<tr>
<td>( S_1 )</td>
<td>0.199</td>
<td>0.515</td>
<td>0.309</td>
<td>0.440</td>
<td>0.352</td>
</tr>
<tr>
<td>( S_2 )</td>
<td>0.708</td>
<td>0.743</td>
<td>0.502</td>
<td>0.521</td>
<td>0.602</td>
</tr>
<tr>
<td>( S_3 )</td>
<td>0.586</td>
<td>0.301</td>
<td>0.595</td>
<td>0.689</td>
<td>0.454</td>
</tr>
<tr>
<td>( S_4 )</td>
<td>0.340</td>
<td>0.301</td>
<td>0.546</td>
<td>0.243</td>
<td>0.554</td>
</tr>
<tr>
<td>( W_f )</td>
<td>0.357</td>
<td>0.265</td>
<td>0.093</td>
<td>0.215</td>
<td>0.070</td>
</tr>
</tbody>
</table>

Table 4 - normalized decision matrix
Step Seven: In the following options, based on the systems approach compared (Table 5), the reference point based approach (Table 6), and finally a complete product based approach (Table 7) is ranked. Finally, using the theory of dominance and merger of three approaches to learn the ranking selection is discussed. (Table 8)

<table>
<thead>
<tr>
<th>Supplier</th>
<th>Score</th>
<th>Ranking</th>
</tr>
</thead>
<tbody>
<tr>
<td>( S_1 )</td>
<td>0.059</td>
<td>2</td>
</tr>
<tr>
<td>( S_2 )</td>
<td>0.250</td>
<td>1</td>
</tr>
<tr>
<td>( S_3 )</td>
<td>0.054</td>
<td>4</td>
</tr>
<tr>
<td>( S_4 )</td>
<td>0.059</td>
<td>2</td>
</tr>
</tbody>
</table>

Table 5 - Ranking taken a systems approach toward

<table>
<thead>
<tr>
<th>Supplier</th>
<th>Score</th>
<th>Ranking</th>
</tr>
</thead>
<tbody>
<tr>
<td>( S_1 )</td>
<td>0.637</td>
<td>3</td>
</tr>
<tr>
<td>( S_2 )</td>
<td>0.546</td>
<td>1</td>
</tr>
<tr>
<td>( S_3 )</td>
<td>0.636</td>
<td>2</td>
</tr>
<tr>
<td>( S_4 )</td>
<td>0.663</td>
<td>4</td>
</tr>
</tbody>
</table>

Table 6 - Ranking been the reference point approach

<table>
<thead>
<tr>
<th>Supplier</th>
<th>Score</th>
<th>Ranking</th>
</tr>
</thead>
<tbody>
<tr>
<td>( S_1 )</td>
<td>144.744</td>
<td>2</td>
</tr>
<tr>
<td>( S_2 )</td>
<td>225.828</td>
<td>1</td>
</tr>
<tr>
<td>( S_3 )</td>
<td>64.057</td>
<td>4</td>
</tr>
<tr>
<td>( S_4 )</td>
<td>94.109</td>
<td>3</td>
</tr>
</tbody>
</table>

Table 7 - Ranking was done with the full product approach
Table 7 - Final ranking was done by integrating the three approaches mentioned

<table>
<thead>
<tr>
<th>Approach</th>
<th>System of ratio</th>
<th>Reference point</th>
<th>Full multiplication</th>
<th>Integration</th>
</tr>
</thead>
<tbody>
<tr>
<td>$S_1$</td>
<td>2</td>
<td>3</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>$S_2$</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>$S_3$</td>
<td>4</td>
<td>2</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>$S_4$</td>
<td>2</td>
<td>4</td>
<td>3</td>
<td>3</td>
</tr>
</tbody>
</table>

5 - Conclusion
Note that the choice of the most appropriate available supply among a group of suppliers, the main loop supply chain, so be cautious when choosing suppliers should be spent hopefully in due course products with competitive price to customers in accordance with existing standards, the modern view of marketing as the most important actor industry are, to be delivered.

In this article the authors have attempted to use the concept of group decision-making and utilization of experts in multi-criteria decision making (MCDM) is paid to the problem of supplier selection. In the context of MULTIMOORA a new method to solve a problem of MCDM is used. According to the aforementioned method, the integrated system approach towards the point of reference and complete multiplication is formed, it looks similar to the method used in other studies may have more capabilities. The approach towards the system, the separation between the optimization criteria, it would be and the reference point approach by making a perfect spot contract as the ideal option and calculated by subtracting the weighted normalized decision matrix to rank the options have been attempted. All multiplication and the approach of optimization (separation of positive and negative criteria) is another form of attention. Finally, these three approaches have been merged and the final result is achieved.

Thus, according to the stated content appears to be a suitable method for choosing a supplier is worthy MULTIMOORA method. On the other hand, it is clear that the results of the decisions of a group of decision makers who have the expertise required, are versatile enough different parts of the organization have been selected mainly on the decision of a qualified person is preferred, therefore, the choice of the most appropriate options using the concept of group decision-making, it seems more rational. The paper then formed groups and determine decision criteria for assessment were rated suppliers available. The results indicate that ranked second supplier ($S_2$) is the best choice among other suppliers, thus providing the first ($S_2$), fourth Supplier ($S_4$) and finally the third supplier ($S_3$) on the next orders fall.

$S_2 > S_1 > S_4 > S_3$

Finally, it should be noted that the use of other methods of family Multi Criteria Decision Making (MCDM) problem can be solved according to the terms of payment issues.

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