

Analysis of Supplier Selection Problem by Using VIKOR and TOPSIS Methods

¹Suyash Sohani, ²Dr. Devendra Singh Verma

¹Research Scholar, ²Professor

^{1,2}Department of Mechanical Engineering

^{1,2}Institute of Engineering & Technology DAVV, Indore, India

Abstract: The supplier selection process, the most important concern is to determine advisable decision making criteria for selecting the right supplier. In this research work TOPSIS and VIKOR methods of Multi-Criteria Decision Making (MCDM) are applied to reach at the decision of selecting the supplier from a number of alternatives in Manufacturing Industry. The results are based on the feedback from manufacturing sector in India. The common questionnaire was used for data collection gathering. The findings can likely be used as a baseline for an organization to strengthen supplier selection activities and to better understanding with its suppliers. Finally, the main findings are about the selection of supplier by giving them weight and score based on some selected criteria.

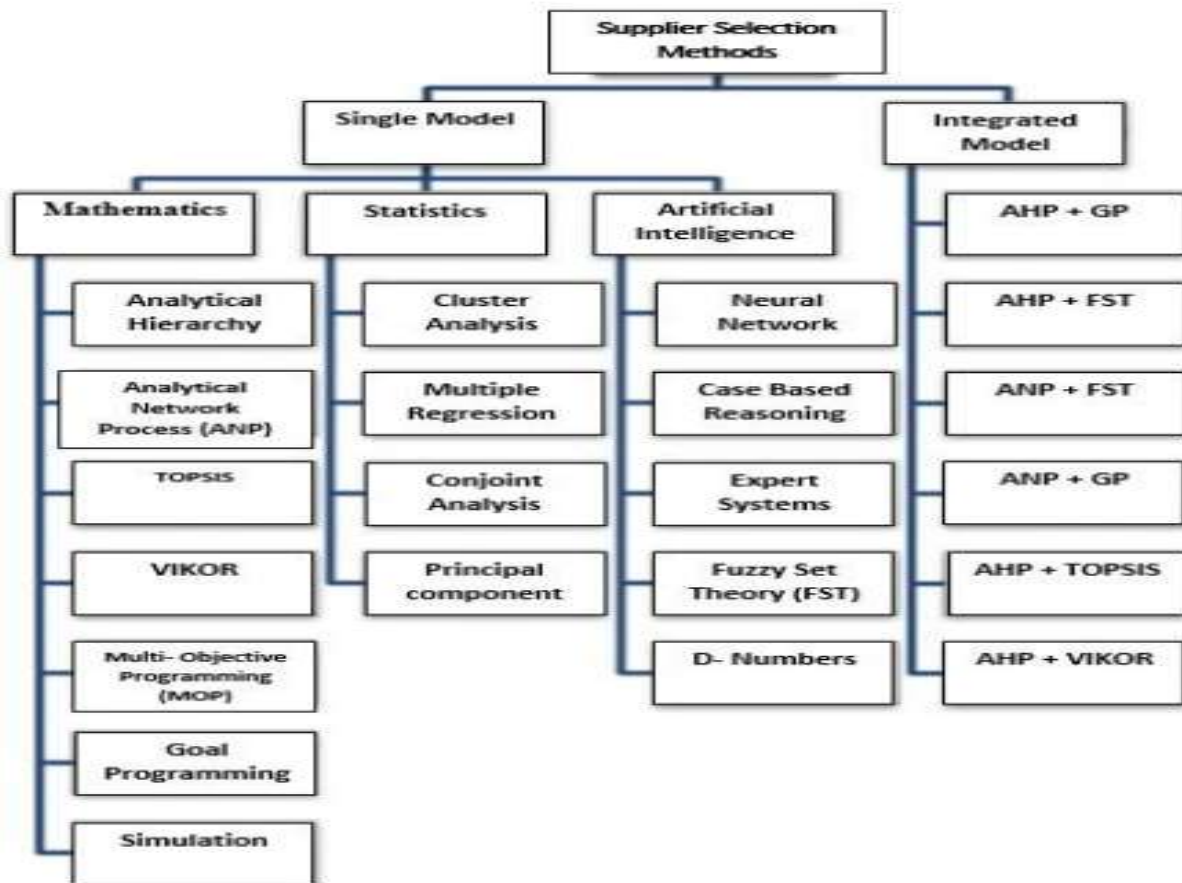
Keywords: – Supplier selection, Multi-criteria decision making, AHP and VIKOR.

I. INTRODUCTION

Supplier selection is one of the major tasks of the purchasing department which contents the acquisition of required materials and equipment for an organization. Generally, the decision of supplier choice depends upon a various number of criteria. Mainly, cost is the foremost criteria considered while choosing a supplier, others such as product quality of the material, delivery time and service quality of the supplier also play a vital role while selecting a suitable supplier. In today's competitive industrial scenario, it is also important to develop closeness and long-term relationships between purchasers and suppliers. A careful assessment of various suppliers with varied traits is required to rank different suppliers. The devaluation in purchasing cost, decrease in supplying risk and improved product quality can be achieved by right supplier selection and determining the appropriate amount of orders to be ordered. Therefore, only the right supplier can contribute the advantages to the manufacturing organization.

II. SUPPLIER SELECTION

The notion that supplier selection is a critical step in developing a competitive supply chain has been around since the early days of the supply chain thinking (Lewis & Irwin, 1943). This importance is rooted in the critical nature of purchasing decisions. In industrial companies, the share of raw material purchasing in the total turnover typically ranges between 50 and 90% (Telgen, 1994). Selecting the right suppliers to form a supply base that allows a company to purchase their raw materials effectively and efficient, is something that will directly support the business continuity. The use of multiple criteria to assess the performance of available suppliers needs to be applied in order to obtain a well-structured approach. Using these criteria can minimize the uncertainty and inaccuracy of selection by experience or gut feeling. The number of criteria available has increased in the last decades. This has widened the focus from obvious business principles that relate directly to the product, quality or price, to more intangible and soft matters like relationships, attitude and commitment (Chai, Liu, & Ngai, 2013). The days of simply using competitive bidding are long gone and the use of multiple criteria with increasing focal areas, complicate the decision-making process. The incorporation of softer criteria into the process is something that should be guided by a supporting method that is able to cope with the complexity. With a successful implementation of a method for supplier selection that incorporates the aforementioned elements, a company is enabled to reap the benefits of an efficient supply chain.



The figure 1.1 below shows the supplier selection methods.

III. MULTI- CRITERIA DECISION-MAKING

Basic leadership is the perceived idea by and large utilized as a part of upstream of the two ventures and the scholarly community bringing about the determination of a game-plan among an arrangement of different situations. In other way, basic leadership is the investigation of diagnosing and picking options in light of the qualities and inclinations of the chiefs. Based on express presumptions investigation of individual choice is worried about the rationale of basic leadership which can be judicious or nonsensical. Calculated basic leadership is a critical piece of all science-based strengths, where authorities utilized their insight in an offered territory to settle on the choices [1].

TOPSIS (Technique for the Order Performance by Similarity to Ideal Solution)

TOPSIS strategy is a most regular method of multi-Attribution Decision Making (MADM) models. "Technique for Order Preference by Similarity to Ideal Solution (TOPSIS)" is a technique for multi-criteria choice investigation and this strategy was presented by Hwang and Yoon in 1981. TOPSIS rationale is sound and reasonable. It picks the elective which has the briefest geometric separation from the positive perfect arrangement and thinks about an arrangement of options by distinguishing weights for every basis, standardizes the scores for every paradigm and ascertains the geometric separation between every option and the perfect option with a specific end goal to give the best score for every foundation. TOPSIS strategy picks the correct providers with a different limited number of criteria.

VIKOR (Vlse Kriterijumska Optimizacija Kompromisno Resenje)

VIKOR (Vlse Kriterijumska Optimizacija Kompromisno Resenje), otherwise called Compromise Ranking technique is a conceivable arrangement that is nearest to the perfect arrangement and the importance of bargain is assertion created by common concession. The VIKOR technique is a successful device in multi-criteria basic leadership, especially in circumstances where the chief isn't capable or does not know to express his/her inclination toward the start of framework outline. The VIKOR technique is stretched out with a security examination deciding the weight soundness interims and with exchange offs investigation.

IV. LITERATURE REVIEW

Sonu Bansal et al. [1] presented comparative analysis of results by VIKOR and TOPSIS method. A real-life case of a manufacturing company of North India is illustrated to demonstrate the steps of the decision support system. Present approach also enables the purchasing managers to better understand the complex relationships of the relevant attributes in the decision-making environment and subsequently improve the reliability of the decision-making process.

P. Murali et al. [2] proposed a proficient multi criteria basic leadership (MCDM) approach for quality assessment and execution examination in provider choice. In arrangement of MCDM issues quantitative criteria esteems were changed over into an identical single execution file called Multi quality execution file. MCDM strategies picks the best options where numerous criteria have appeared, as well as can be expected be gotten by breaking down the diverse extension for the criteria, weights for the criteria.

Shemshadi et al. [3] built up the VIKOR technique was produced to multiple criteria decision making (MCDM) issues with clashing and non-commensurable criteria expecting that bargaining is adequate to determine clashes. On the opposite side target weights in view of Shannon entropy idea could be utilized to manage subjective weights doled out by leaders or notwithstanding considering the end-clients' assessments to multiple criteria decision making (MCDM) issues with clashing and commensurable criteria expecting that trading off is satisfactory to determine clashes. On the opposite side target weights in light of Shannon entropy idea could be utilized to control subjective weights allotted by leaders or notwithstanding considering the end-clients' suppositions.

V. OBJECTIVES

The main aim of this paper is to focus on supplier selection decision-making and decision criteria. To full fill the above aim the objectives of the study are:

- To recognize provider determination criteria.
- To comprehend, show and upgrade the provider determination.
- To pick an appropriate provider.

VI. METHODOLOGY ADOPTED

Systematically approaching supplier selection problems is solved by a general process called multi-criteria decision method (MCDM). The MCDM process consists of four stages:

- Framing of the choice and recognizable proof of the objectives and goals which is accomplished by the leader.
- Identification of all choice options and any related traits that address the basic leadership destinations.
- Specification of inclinations, both for every one of the individual qualities and between the properties in the system.
- Ranking of the choice choices as per the predefined inclinations, given the quality information for every one of the choices.

The Figure given underneath demonstrates the diagram of proposed system.

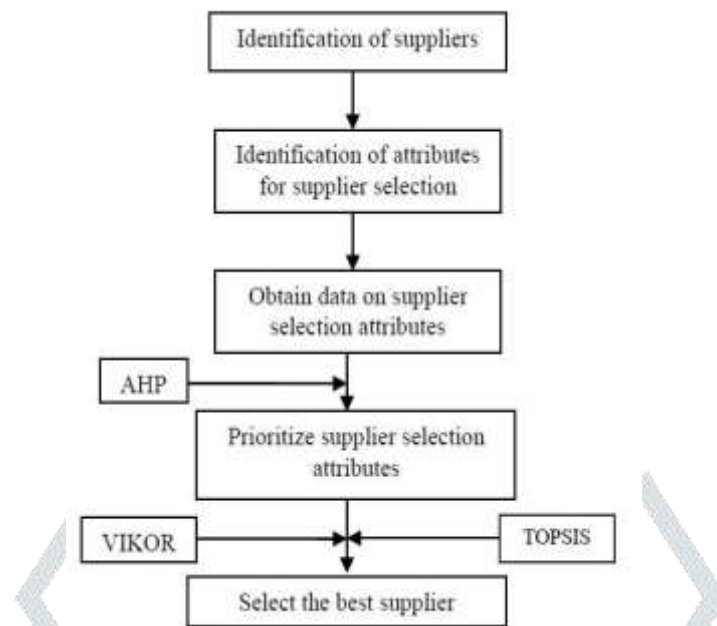


Fig. 2 Outline of Proposed Methodology

VII. DATA COLLECTION AND ANALYSIS

The questionnaire was the main instrument, alongside interviews schedules. For the purpose of this study, the questionnaire was used for the mainly economical, and appropriateness reasons.

There are five criteria in this study which we have to optimize to achieve the selection of best suitable supplier. These are independent variables shown in table 1

Table 1 Selecting criteria for supplier evaluation and Weight

Code	Criteria	Weightages
C1	Material Quality	0.435
C2	Price	0.200
C3	Transportation Cost	0.169
C4	Delivery & Services	0.127
C5	Supplier Reputation	0.068

VIII. RESULTS OF VIKOR METHOD

According to VIKOR method the alternative with the lowest value of VIKOR index is the best alternative among the number of alternatives under consideration. The table 2 below shows the VIKOR Index values and ranking of different suppliers.

Table 2 VIKOR Index values and ranking of different suppliers

Suppliers	VIKOR Index	Rank
Supplier 1	1.000	5
Supplier 2	0.339	2
Supplier 3	0.360	4
Supplier 4	0.343	3
Supplier 5	0.000	1

The suppliers according to VIKOR method in the decreasing order of preference are Supplier 5 > Supplier 2 > Supplier 4 > Supplier 3 > Supplier 1.

It is observed from the table, the supplier 5 has lowest value of VIKOR index, hence supplier 5 is best suited according to VIKOR method.

IX. RESULTS OF TOPSIS METHOD

According to TOPSIS method the alternative with the highest value of relative closeness coefficients is the best alternative among the number of alternatives under consideration. The table 3 below shows the value of relative closeness coefficients and ranking of different suppliers.

Table 3 value of relative closeness coefficients and ranking of different suppliers

Supplier	Closeness Coefficient	Rank
Supplier 1	0.59	4
Supplier 2	0.753	3
Supplier 3	0.753	2
Supplier 4	0.276	5
Supplier 5	0.913	1

When TOPSIS method are apply on same problem it is found that supplier 5 has the best score amongst 5 suppliers. Hence as shown in above table according to TOPSIS method the ranking of suppliers in decreasing order of preference is

Supplier 5 > Supplier 3 > Supplier 2 > Supplier 1 > Supplier 4.

X. CONCLUSION

The conclusions reached are as follows: -

The different criterion for supplier selection problems are product quality, product price, transportation cost, delivery and services, and supplier reputation. The weighted values given to these criteria are

- Weighted value of product quality (C1) =0.435
- Weighted value of product Price (C2) =0.200
- Weighted value of Transportation Cost (C3) =0.169
- Weighted value of Delivery & Services (C4) =0.127
- Weighted value of Suppliers Reputation (C5) =0.068

According to VIKOR method the ranking of suppliers in decreasing order of preference is - Supplier 5 > Supplier 2 > Supplier 4 > Supplier 3 > Supplier 1.

According to TOPSIS method the ranking of suppliers in decreasing order of preference is - Supplier 5 > Supplier 3 > Supplier 2 > Supplier 1 > Supplier 4.

With the help of both the MCDM methods VIKOR and TOPSIS the best suited supplier is supplier 5.

XI. FUTURE SCOPE

Further research can be done by taking other parts or even the whole supply chain into consideration. It can be interesting to take a closer look at the requirements and approaches of different links of the supply chain. A further proposal is to not only research the decision- making process of the supplier selection but to additionally look at the supplier development. Within this area performance evaluation criteria and methods can be of interest in connection with the topic of work. In addition, using other MCDM methods and comparing their results with this method can give better understanding in supplier selection.

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