



processes, technology and capability to enhance competitive advantage.”

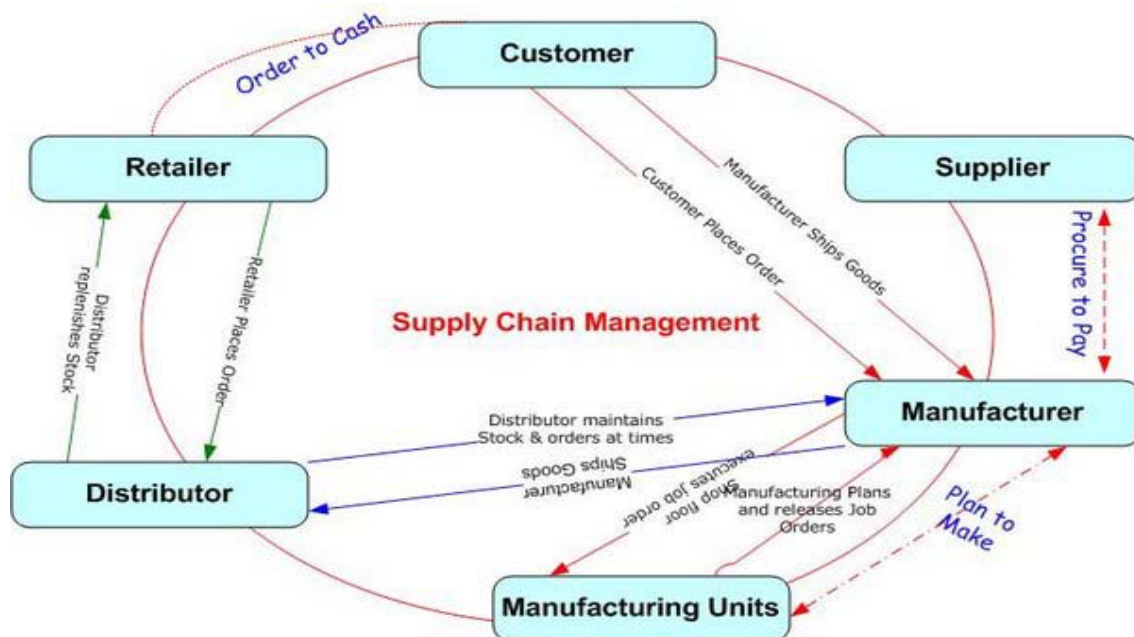


Figure 2: Supply Chain Management

## 2. Literature Review

Weber, C. A. et al. [1] reviewed, annotated, and classified 74 related articles which have appeared since 1966. Specific attention was given to the criteria and analytical methods used in the vendor selection process. In response to the increased interest in Just-In-Time (JIT) manufacturing strategies, and analysis of JIT's impact on vendor selection was also discussed by the authors.

Degraeve, Z. et al. [2] focused on a combinatorial auction where a bidder can express his preferences by means of a so called ordered matrix bid. Authors gave an overview of how this auction works and elaborated on the relevance of the matrix bid auction. The methods to verify whether a given matrix bid satisfies a number of properties related to microeconomic theories were developed. Finally, authors investigated how a collection of arbitrary bids can be represented as a matrix bid.

Weber and Ellram [3] explore the use of a multi-objective programming approach as a method for supplier selection in a just-in-time (JIT) setting. Based on a case study, develops a model of JIT supplier selection which allows for simultaneous trade-offs of price, delivery and quality criteria. A multi objective programming decision support system is seen as advantageous because such an environment allows for judgment in decision making while simultaneously trading off-key supplier selection criteria.

Lewis [4] suggested that of all the responsibilities that related to purchasing, none was more important than the selection of a proper source. As long as supplier relationship management (SRM) concept is concerned, Companies are trying to build long-term and profitable relationships with suppliers. There has been an evolution in the role and structure of the purchasing function through the nineties. The purchasing function has gained great importance in the

supply chain management due to factors such as globalization, increased value added in supply, and accelerated technological change.

Zeng, A. Z. [5] developed an integrated optimization framework for joint decisions of sourcing and lot sizing for sustaining time-based competitiveness. Author developed an optimization procedure that can be conveniently implemented on a spreadsheet to determine the optimal number of sources and the lot size and the sensitivity analysis shows that the impact of transportation on the sourcing and lot sizing decisions is significant.

Aissaoui, et al. [6] extended previous survey papers by presenting a literature review that covers the entire purchasing process, considers both parts and services outsourcing activities, and covers internet-based procurement environments such as electronic marketplaces auctions. In view of its complexity, authors focused especially on the final selection stage that consists of determining the best mixture of vendors and allocating orders among them so as to satisfy different purchasing requirements.

Sharland et al. [7] empirically examined the impact of cycle time on supplier selection and on the effectiveness of long-term relationships with suppliers, as reflected in the commitment and trust developed. Authors observed that initial cycle time is not a significant predictor of trust and commitment in the context of supplier-buyer long-term relationships. However, cycle time reduction along with consistently high quality were found to be significant predictors of trust and commitment in long-term relationships.

Lee et al. [8] proposes a methodology which identifies the managerial criteria using information derived from the supplier selection processes and makes use of them in the

supplier management process. For this methodology, authors propose the supplier selection and management system (SSMS) that includes purchasing strategy system, supplier selection system, and supplier management system, and explained how the SSMS is applied to a real supply chain. The methodology identifies the managerial criteria using information derived from supplier selection process and makes use of them in the supplier management process. The effectiveness of supplier management with managerial criteria was verified by a t-test and a correlation analysis.

Humphreys et al. [9] presented a framework for integrating environmental factors into the supplier selection process. Traditionally, companies consider factors like quality, flexibility, etc. when evaluating supplier performance. However; environmental pressure is increasing, resulting in many companies beginning to consider environmental issues and the measurement of their suppliers performance. Authors developed a decision support tool which should help companies to integrate environmental criteria into their supplier selection process. Finally, a knowledge-based system is constructed based on the proposed framework.

Weber and Ellram [10] explored the use of a multi-objective programming approach as a method for supplier selection in a just-in-time (JIT) setting. Based on a case study, develops a model of JIT supplier selection which allows for simultaneous trade-offs of price, delivery and quality criteria. A multiobjective programming decision support system is seen as advantageous because such an environment allows for judgment in decision making while simultaneously trading off-key supplier selection criteria

### 3. Supplier Selection Process

Experts agree that no best way exists to evaluate and select suppliers, and thus organizations use a variety of approaches. The overall objective of the supplier evaluation process is to reduce risk and maximize overall value to the purchaser. An organization must select suppliers it can do business with over an extended period of time.[9] Supplier evaluations often follow a rigorous, structured approach through these of a survey. An effective supplier survey should have certain characteristics such as comprehensiveness, objectiveness, reliability, flexibility and finally, has to be mathematically straightforward.

The methods chosen are extremely important to the overall selection process and can have a significant influence on the selection results. It is important to understand why a firm chooses one method (or a combination of different methods) over another. Several well-known selection methods have been developed and classified by numerous scholars over the years. [6] Certain methods have been popular selection choices for years, while other methods have only emerged recently. Usually when a company sets out to develop or choose a supplier selection method, the result is a combination of several different methods with different strengths suited to meet the company's specific selection needs. Therefore, it is important to explore a range of different selection methods and to discuss their different applications.

### 4. Supplier Selection

A range of portfolio models have been proposed in the literature in order to support purchasing decisions and supplier selection. Kraljic's (1983) seminal paper on purchasing strategy classifies purchases according to a four box portfolio analysis model. The dimensions of the four box model are segmented by 'importance of purchasing' and 'complexity of supply market'. A four by four matrix is then used to determine four categories of supplier including 'strategic' (high profit impact, high supply risk), 'bottleneck' (low profit impact, high supply risk), 'leverage' (high profit impact, low supply risk) and 'non-critical' (low profit impact, low supply risk). Individual plans are then offered for each category of supplier. [10]

Olsen and Ellram (1997) build on Kraljic's portfolio model. They argue that supplier relationships can be categorized based on the relative supplier attractiveness and the strength of the relationship between the buyer and supplier and propose more detailed guidelines for the factors influencing supplier attractiveness and strength of relationship. A three by three model is developed. De Boer et al. (2001) also propose a classification to describe the diversity of purchasing situations. They plot present day purchasing practice 'new task', 'modified rebuy' (leverage items), 'straight rebuy' (routine items) and straight rebuy (strategic/bottleneck) against different phases in the supplier selection process: problem definition, formulation of criteria, qualification and choice. The implications for the different phases are then explored for each situation.[13]

### 5. Various Supplier Selection Methods

Various supplier selection methods as observed in the literatures have been classified in to a number of broader categories. Presents various supplier selection methods but here only AHP method is discussed. The Analytic Hierarchy Process (AHP) is a structured technique for helping people deal with complex decisions. Rather than prescribing a "correct" decision, the AHP helps people to determine one. Based on mathematics and human psychology, it was developed by Thomas L. Saaty in the 1970s and has been extensively studied and refined since then.

The AHP approach, as applied to the supplier selection problem, consists of the following five steps (Nydick and Hill, 1992):

- 1) Specify the set of criteria for evaluating the supplier's proposals.
- 2) Obtain the pair wise comparisons of the relative importance of the criteria in achieving the goal, and compute the priorities or weights of the criteria based on this information.
- 3) Obtain measures that describe the extent to which each supplier achieves the criteria.
- 4) Using the information in step 3, obtain the pair wise comparisons of the relative importance of the suppliers with respect to the criteria, and compute the corresponding priorities.
- 5) Using the results of steps 2 and 4, compute the priorities of each supplier in achieving the goal of the hierarchy.

## 6. Merits and Limitations of AHP

### Merits

- The merits of AHP over other multi criteria methods are its flexibility, intuitive appeal to the decision makers and its ability to check inconsistencies
- Additionally, the AHP method has the distinct advantage that it decomposes a decision problem into its constituent parts and builds hierarchies of criteria. Here, the importance of each element (criterion) becomes clear.
- AHP helps to capture both subjective and objective evaluation measures. While providing a useful mechanism for checking the consistency of the evaluation measures and alternatives, AHP reduces bias in decision making.
- The AHP method supports group decision-making through consensus by calculating the geometric mean of the individual pair wise comparisons.
- AHP is uniquely positioned to help model situations of uncertainty and risk since it is capable of deriving scales where measures ordinarily do not exist.

### Limitations

The AHP-method can be considered as a complete aggregation method of the additive type. The problem with such aggregation is that compensation between good scores on some criteria and bad scores on other criteria can occur. Detailed, and often important, information can be lost by such aggregation.

With AHP the decision problem is decomposed into a number of subsystems, within which and between which a substantial number of pair wise comparisons need to be completed. This approach has the disadvantage that the number of pair wise comparisons to be made, may become very large ( $n(n-1)/2$ ), and thus become a lengthy task.

## 7. Uses and Application of AHP

As a method of measuring intangible factors, the AHP has many areas of application. Among them are:

- Conflict Resolution
- Environmental Applications
- General Resource Allocation & Optimization
- Group Decision Making
- Human Resources
- Marketing Decisions
- Medical Decision Making
- Military Applications [1]

## 8. Conclusion

The issues of supplier selection have attracted the interest of researchers since the 1960s, and research studies in this area have increased. The contribution of this paper was the identification of the importance the supplier selection process and methods in SCM. Through reviewing relevant literature and research projects on supplier selection methods are helpful to select the best supplier for any industry. In this paper the various steps of supplier selection process and AHP method are also described.

Supplier selection is crucial in supply chain management in today's global environment. In supply chains, co-ordination between a manufacturer and suppliers is typically a difficult and important link in the channel of distribution.

## 9. Future Scope

As like above and method we can developed more quantitative t to measure the performance & we can also calculate the carbon emissions of any particular process, product or any organizations etc by simple mathematical calculations work . We can also take any particular case study of any bigger organization to do more work efficiently in cast effective and cost benefit way towards supply chain future.

The method discussed provides an appropriate tool for ranking new vendor alternatives for outsourcing. Existing methods do not consider all important vendors attributes like Buyer-Supplier Relationship and attributes for foreign vendors. The model discussed can include maximum no. of vendor performance attributes and can be customized for particular industry. Future work can also include validation of this methodology using other examples from industry.

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## Author Profile



**Mr. Vishal Vijay Chahare** received his Bachelor of Engineering in 2012 degree from Babasaheb Naik College of Engineering Pusad, Maharashtra, India. He is Master of Engineering student in Mechanical Engg [CAD/CAM] in same College. Presently he is working as Asst Prof in Deogiri Institute of Engg & Mgmt Studies Aurangabad. His research interests are Supplier Selection Methods in automobile industry