# VENDOR SELECTION PRACTICES IN AUTOMOBILE INDUSTRY

**Dissertation submitted to College of Management & Economic Studies for the partial fulfillment of the degree of**

## MBA (LOGISTICS AND SUPPLY CHAIN MANAGEMENT)

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# DECLARATION BY SUPERVISOR

This is to certify that the project titled "**Vendor Selection Practices In Automobile Industry"** submitted to University of Petroleum & Energy Studies, Dehradun, by **Palav Bhardwaj**, in partial fulfillment of the requirement for the award of degree of Masters of Business Administration (Logistics & Supply Chain Management), is a bonafide work carried out by him under my supervision and guidance. This work has not been submitted anywhere else for any other degree.

To the best of my knowledge, he has made an earnest and dedicated effort to accomplish this project.

Date:

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# UNDERTAKING

I hereby declare that the Dissertation entitled "**Vendor Selection Practices In Automobile Industry**" submitted in partial fulfillment of the requirements for the award of the Degree of Masters in Business Administration is a record of original research work done by me under the supervision & guidance of Dr. Saurabh Tiwari and the Dissertation has not formed the basis for the award of any Degree/Diploma/ Associate ship / Fellowship or similar title to any candidate of this or any other University.

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# ACKNOWLEDGEMENT

# EXECUTIVE SUMMARY

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With the increasing growth in demand on back of rising income, expanding middle class and young population base, in addition to a large pool of skilled manpower and growing technology, will propel India to be among the world's top five auto-producers by 2015. The automobile industry accounts for 22 per cent of the country's manufacturing gross domestic product (GDP). The auto sector is one of the biggest job creators, both directly and indirectly. It is estimated that every job created in an auto company leads to three to five indirect ancillary jobs. India is expected to become a major automobile manufacturing hub and the third largest market for automobiles by 2020, according to a report published by Deloitte. India is currently the seventh-largest automobiles producer in the world with an average annual production of 17.5 million vehicles, and is on way to become the fourth largest automotive market by volume, by 2015. While the industry is highly capital intensive in nature in case of four-wheelers, capital intensity is a lot less for two-wheelers. Though three-wheelers and tractors have low barriers to entry in terms of technology, four wheelers is technology intensive. Costs involved in branding, distribution network and spare parts availability increase entry barriers.

Supplier selection in supply chain management becomes more important due to the competition between supply chains rather than companies. Managing the supply chain is an important but complex issue for automotive manufacturers. This increases the importance of effective supplier selection in automotive industry.

An effective supplier selection process is very important to the success of any manufacturing organization. The main objective of supplier selection process is to reduce purchase risk, maximize overall value to the purchaser, and develop closeness and long-term relationships between buyers and suppliers in today's competitive industrial scenario. The literature on supplier selection criteria and methods is full of various analytical and heuristic approaches. Some researchers have developed hybrid models by combining more than one type of selection methods. It is felt that supplier selection criteria and method is still a critical issue for the manufacturing industries, the most important issue is to determine suitable decision making criteria for selecting the right supplier. This research aimed to identify the most important criteria to be used as a baseline for a supplier selection process of automobile sector in India. The results are based on the feedback from automobile sector in India. The findings can potentially be used as a baseline for an organization to strengthen supplier selection activities and to better understanding with its suppliers. Finally, the main findings about most important criteria are compared with previous studies.

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# INTRODUCTION

# INTRODUCTION

Across industries, firms increasingly assign greater responsibility to suppliers in order to produce innovative, high–quality products at a competitive cost. Increasingly demanding customers, globalization, accelerated competition, technological advances in the communication of information, decreased governmental regulation worldwide manufacturing firms toward adoption of the supply chain management (SCM) philosophy. The supply chain encompasses all activities associated with the flow and transformation of goods from the raw materials stage through to the end user, as well as the associated information flows. Material and information flow both up and down the supply chain. Supply chain management is the integration of these activities through improved supply chain relationships to achieve a sustainable competitive advantage.

The great benefit of supply chain management is that when all of the channel members – including suppliers, manufacturers, distributors, and customers – behave as if they are part of the same company, they can enhance performance significantly across the board.

Greater dependence on suppliers increases the need to effectively manage suppliers.

Three dimensions underlie supplier management:

(1) Effective supplier selection;

(2) Innovative supplier development strategies; and

(3) Meaningful supplier performance assessment mechanisms.

Supply chain management can be define as the task of integrating organizational units along a supply chain and coordinating materials, information and financial flows in order to fulfill (ultimate) customer demands with the aim of improving competitiveness of supply chain as a whole.

The choice of partners starts with analyzing the activities associated with generating a product or service for a certain market segment. Successful supply chain approaches are built on strategic alliances with the best suppliers. Selection criteria should not be based solely on costs, but on the future potential of a partner to support the competitiveness of the supply chain. A suitable organizational culture and a commitment to contribute to the aims of the supply chain will be of great importance. A possible partner may bring in specialized know – how regarding a production process or know – how of products and its development.

Supplier selection process is a multi-criteria problem, which includes both qualitative and quantitative factors. In order to select the best supplier in the automotive industry it is necessary to make a tradeoff between tangible and intangible factors some of which may conflict.

Traditionally, the selections of suppliers are often based on the price criterion. The cheapest supplier is usually selected without taking into consideration additional costs this supplier may introduce in the value

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chain of the purchasing organization. Thus, the costs related to unreliable delivery, limited quality of goods supplied, and poor communication are not involved in the selection process.

Supplier decisions are one of the most important aspects that firms must incorporate into their strategic processes. With the increasing importance of the purchasing function, supplier management decisions have become more strategic. As organization become more dependent on suppliers, the direct and indirect consequences of poor decision making become critical.

Selecting the most appropriate suppliers is considered an important strategic management decision that impacts all areas of an organization. Because this reason, this study describes the extent to which factors are using as supplier selection criteria in the Indian automotive industry by using a survey. It presents a factor analysis that describes which factors are using by the Indian automotive manufacturer companies as supplier selection criteria.

# LITERATURE REVIEW

# LITERATURE REVIEW

| Authors | Context | Inferences/ Parameters |
|---|---|---|
| Damian Beil Stephen M. Ross School of Business | Supplier Selection | This article describes the typical steps of supplier selection processes: identifying suppliers, soliciting information from suppliers, setting contract terms, negotiating with suppliers, and evaluating suppliers. |
| Manish Kumar Sagar | Supplier Selection Criteria: Study of Automobile Sector in India | This research aimed to identify the most important criteria to be used as a baseline for a supplier selection process of automobile sector in India. The results are based on the feedback from automobile sector in India. |
| Om Pal, Amit Kumar Gupta, R. K. Garg | Supplier Selection Criteria and Methods in Supply Chains: A Review | The aim of this paper is to critically analyse the supplier selection issues and provide analytical heuristic approaches to these issues. |
| Ahmete baskese | A model proposal for supplier selection in Automotive industry | *This study aims at proposing A model for supplier selection in automotive industry. Since it requires a detailed comparison among the suppliers from several different facets, multi-attribute decision making methods should be preferred.* |
| Abraham mendoza | Effective methodologies for supplier selection And order quantity allocation | The aim of this study is to give the prevalence to both supplier selection and inventory control problems In supply chain management, and addresses these problems simultaneously by developing a mathematical model |

# RESEARCH METHODOLOGY

## OBJECTIVES

- To determine suitable decision making criteria for supplier selection in the automobile industry.
- To determine appropriate methods for supplier evaluation in the automobile industry.
- Create uniformity in the vendor selection process being followed in the automobile industry.

## SCOPE OF STUDY

The focused on effectiveness and efficiency of selecting supplier selection method determination of quality performance supplier selection criteria and the between supplier selection techniques and quality performance of organization

## RESEARCH DESIGN

This is a kind of empirical research study, in which comprehensive efforts have been made to develop decision methods and techniques for supplier selection.

## TYPE OF DATA

Data used for this research is secondary data

## METHOD OF DATA COLLECTION

The study is carried out through secondary sources of data through research papers, industry reports, business journals, published articles, business magazines, newspaper articles etc. In depth analysis of indicator, reporting of inferences and recommendations has been carried out. A primary research was conducted with industry experts to better understand the practical issues associated. No standard questionnaire has been prepared as the people don't feel comfortable to answer formal questionnaire directly.

## SAMPLING DESIGN

As per objectives of the study; theoretical sampling technique will be adopted.

## TOOLS FOR DATA ANALYSIS

Simple conventional methods of tabular analysis, observation and also by drawing inferences, this study has been done to understand the supplier selection process, determinants of quality performance of organization, and the relationship between suppliers selection technique and quality performance in automobile industry.

## SIGNIFICANCE OF THE STUDY

- To contribute to the field of knowledge about supplier selection and quality performance.

- The research will benefit the automotive industry to recognize the importance of supplier selection in enhancing quality performance.

- The study will provide automotive industry with the various tools of supplier selection that can enhance quality performance

## LIMITATION OF THE RESEARCH

- The inadequacy of the research instrument to capture all the required information, and failure of some respondents to fill the, and the inherent weakness in the research design.

- The findings in this study might not be adequate representation of the supplier selection determinants; hence the results cannot be generalized to all.

# RECENT TRENDS IN SUPPLIER SELECTION

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Most recently, the internet and related information technology systems began impacting purchasing operations. Internet-based procurement, commonly referred to as e-procurement, is being used by both suppliers and buyers to manage their procurement relationships. E-procurement involves the use of the internet for activities such as procuring materials, transportation, and warehousing. In addition, e-procurement is concerned with selecting suppliers among different alternatives and determining the nature of contracts with them.

A typical e-procurement system consists of the following major steps:

    (1) Request-for-quote (RFQ) generation and distribution by the buyer company to all potential suppliers;

    (2) The submission of bids by interested suppliers, and

    (3) The evaluation of bids to determine the winning bids.

The business logic used in current e-procurement systems is broadly categorized as:

**Reverse Auctions** are auctions in which the auctioneer, on behalf of a buyer, solicits bids from a group of potential suppliers". The primary objective is to drive purchase prices down allowing the lowest bidder to win. Typically, reverse auctions have focused on price as a single attribute.

**Multi-attribute auctions** combine multi-criteria decision analysis and auction mechanisms. In which bidders can specify price and levels of quality and lead-time. The performance of this mechanism is compared to a price-only auction mechanism.

**Optimizations techniques** take into account various business rules and constraints, e.g. exclusion constraints, aggregation constraints, exposure constraints, business objectives constraints. Companies like Emptoris uses optimization techniques in their commercial bid software.

**Configurable bids** enable suppliers to specify multiple values and price markups for each attribute".
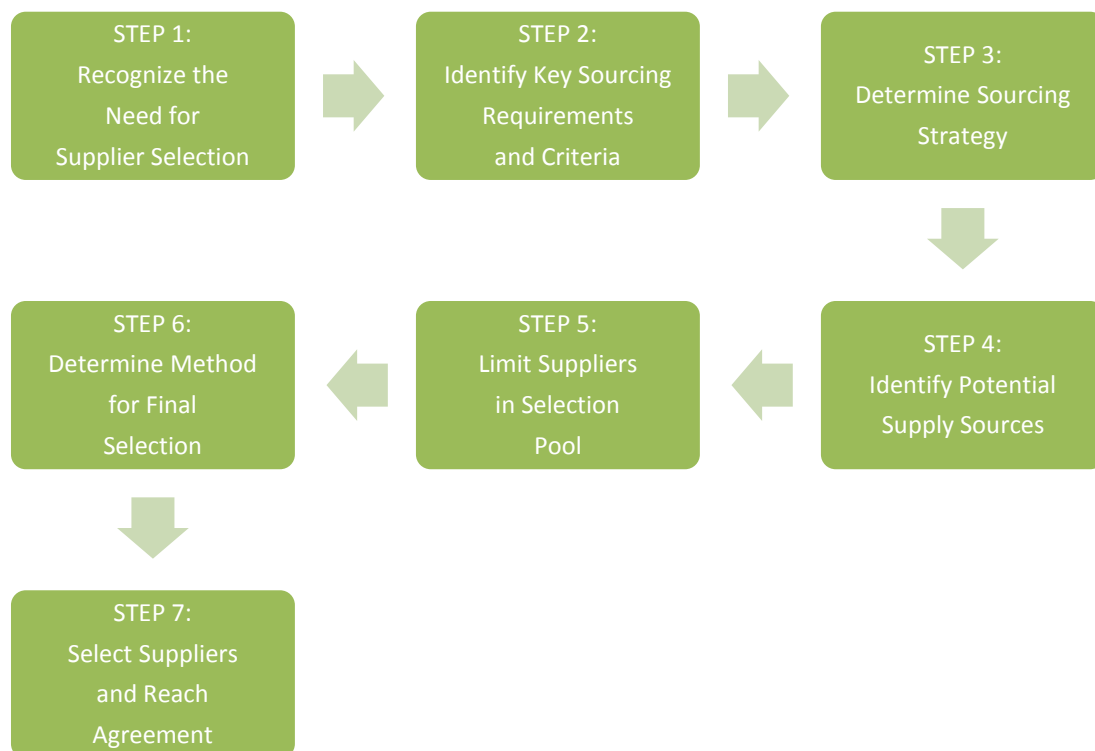
# SUPPLIER SELECTION PROCESS

# SUPPLIER SELECTION PROCESS

Automotive sector quality management system standards, requires the organization to evaluate and select suppliers based on their ability to supply product in accordance with the organization's requirements and to establish criteria for selection, evaluation and re-evaluation.

The supplier selection process varies depending on the nature of the products and services to be procured. The selection process usually consists of a number of stages some of which do not apply to simple purchases. At each stage the number of potential suppliers is whittled down to end with the selection of what is hoped to be the most suitable that meets the requirements. Each company must first meet the order qualifiers. After that, the selection process goes on with evaluating the potential suppliers against order winners.

For one-off purchases periodic re-evaluation would not be necessary. Where a commitment from both parties is made to supply products and services continually until terminated, some means of reevaluation is necessary as a safeguard against deteriorating standards. The re-evaluation may be based on supplier performance, duration of supply, quantity, risk or changes in requirements and conducted in addition to any product verification that may be carried out.

## Supplier Evaluation and Selection Process

STEP 1: Recognize the Need for Supplier Selection → STEP 2: Identify Key Sourcing Requirements and Criteria → STEP 3: Determine Sourcing Strategy → STEP 4: Identify Potential Supply Sources → STEP 5: Limit Suppliers in Selection Pool → STEP 6: Determine Method for Final Selection → STEP 7: Select Suppliers and Reach Agreement

**Step 1: Recognize the Need for Supplier Selection**

The first step in supplier selection usually implies the identification of the need for a specific product or service. Different situations may trigger the need for supplier selection. For example, new product development, modification to a set of existing suppliers due to a bad performance, the end of a contract, expansion to different markets, current suppliers' capacity is not sufficient to satisfy increases in demand. These situations are particular to every company.

**Step 2: Identify Key Sourcing Requirements and Criteria**

Supplier selection is complicated because of the multiple criteria involved in the decision process. Additionally, many times these criteria may conflict each other. Therefore, defining the proper criteria becomes critical.

Some of the most widely used criteria in supplier selection are supplier's capacity, quality, and purchasing price. However, the set of criteria to be chosen largely depends on the company's objectives and the type of industry in which the company competes.

**Step 3: Determine Sourcing Strategy**

Sourcing requires that companies clearly define the strategy approach to be taken during the supplier selection process. Examples of sourcing strategies are: single versus multiple suppliers, domestic versus international and short term versus long term supplier contracts.

This research assumes that single sourcing may not be an appropriate strategy in most purchasing situations. Single sourcing tends to minimize total costs by determining the best supplier for each purchased part or product. However, dependency on a single supplier exposes the buying company to a greater risk of supply interruption.

Multiple sourcing strategies provide a greater flexibility due to the diversification of the firm's total requirements. In addition to ensuring product availability, working with multiple suppliers is important because suppliers are motivated to be competitive in factors such as price and quality.

**Step 4: Identify Potential Supply Sources**

The importance of the item under consideration influences the resources spent on identifying potential suppliers. For example, major resources are spent when potential suppliers are needed for an item of high strategic importance.

**Step 5: Limit Suppliers in Selection Pool**

Given the limited resources of a company, a purchaser needs to pre-screen the potential suppliers to reduce their number before proceeding with a more detailed analysis and evaluation. The supplier selection criteria determined in Step 2 plays a key role in this reduction process.

**Step 6: Determine Method for Final Selection**

There exists many different ways to evaluate and select suppliers. Since this research is devoted to developing effective decision-making methodologies and models capturing important aspects of the supplier selection problem.

**Step 7: Select Suppliers and Reach Agreement**

The final step of the supplier evaluation and selection process is to clearly select those suppliers that best meet the company's sourcing strategy. This decision is often accompanied with determining the order quantity allocation to selected suppliers.

# MODEL PROPOSAL FOR SUPPLIER SELECTION

# VARIOUS CRITERIA FOR SUPPLIER SELECTION

On the basis of the literature reviewed above it has been observed that the basic criteria typically utilized for selecting the suppliers are pricing structure, delivery, product quality, and service etc. While most buyers still consider cost to be their primary concern, few more interactive and interdependent selection criteria are increasingly being used by the manufacturers. The various important criteria for the supplier selection as observed from the literature reviewed above are:

☐ Price

☐ Quality

☐ Delivery

☐ Performance History

☐ Warranties & Claims Policies

☐ Production Facilities and Capacity

☐ Technical Capability

☐ Financial Position

☐ Procedural Compliance

☐ Reputation and Position in Industry

☐ Desire for Business

☐ Repair Service

☐ Attitude

☐ Packaging Ability

☐ Labor Relations Record

☐ Geographical Location

☐ Amount of Past Business

☐ Reciprocal Arrangement

# VARIOUS SUPPLIER SELECTION METHODS

Some of the most commonly used methods for supplier selection are discussed briefly here:
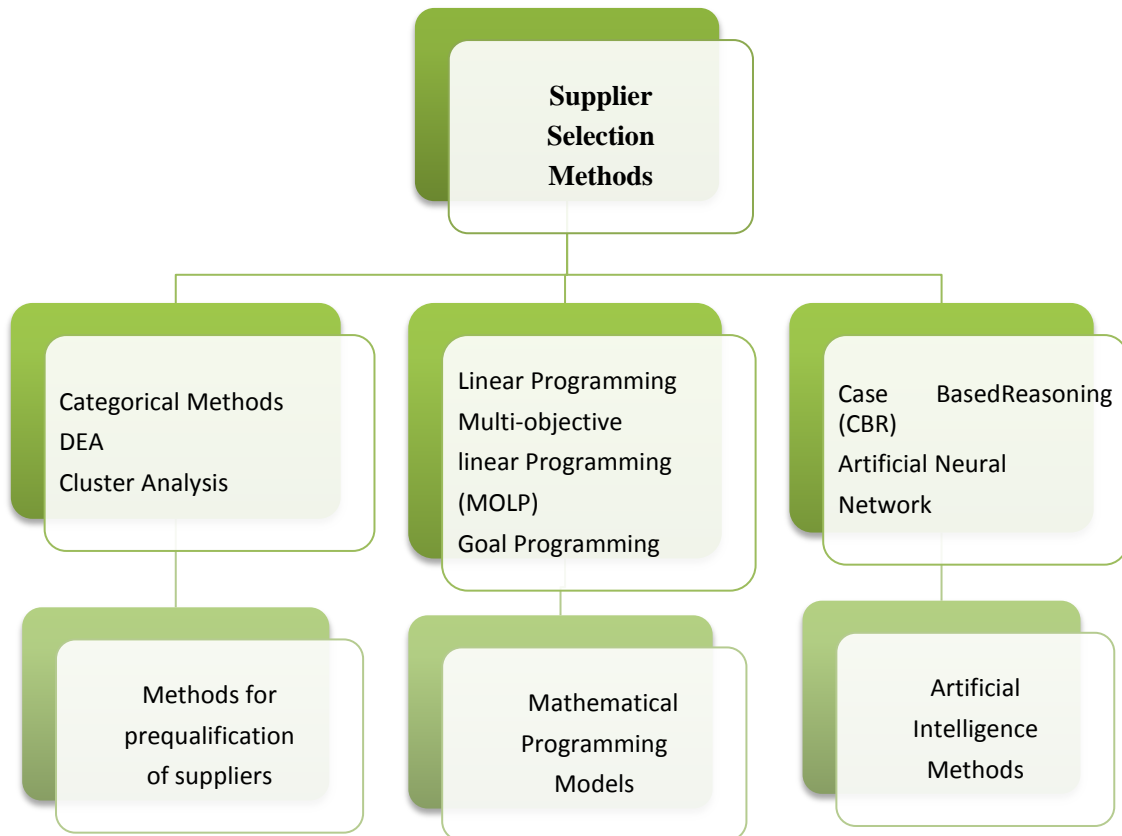


## METHODS FOR PREQUALIFICATION OF SUPPLIERS

Prequalification is the process of reducing the set of all suppliers to a smaller set of acceptable suppliers. The various methods available under this category are:

### A. Categorical Methods

Basically, categorical methods are qualitative models. Based on historical data and the buyer's experience, current or familiar suppliers are evaluated on a set of criteria. After a supplier has been rated on all criteria, the buyer gives an overall rating. The primary advantage of the categorical approach is that it helps structure the evaluation process in a clear and systematic way.

### B. Data Envelopment Analysis (DEA)

DEA is a classification system that splits suppliers between two categories, 'efficient' or 'inefficient'. Suppliers are judged on two sets of criteria, i.e. outputs and inputs. DEA considers a supplier to have a relative efficiency of 100% if he produces a set of output factors that is not produced by other suppliers with a given set of input factors.

*C. Cluster Analysis (CA)*

CA is a basic method from statistics which uses a classification algorithm to group a number of items which are described by a set of numerical attribute scores into a number of clusters such that the differences between items within a cluster are minimal and the differences between items from different clusters are maximal. This classification is used to reduce a larger set of suppliers into smaller more manageable subsets.

## MATHEMATICAL PROGRAMMING (MP) MODELS

Mathematical programming models often consider only the quantitative criteria. Mathematical programming models allow decision makers to consider different constraints in selecting the best set of suppliers. Most importantly, mathematical programming models are ideal for solving the supplier selection problem because they can optimize results using either single objective models or multiple objective models.

*A. Multi-Objective Models*

These models deal with optimization problems involving two or more coinciding criteria.

*B. Goal Programming Models*

Another important tool is Goal Programming (GP). Unlike most mathematical programming models, goal programming provides the decision maker (DM) with enough flexibility to set target levels on the different criteria and obtain the best compromise solution that comes as close as possible to each one of the defined targets.

## ARTIFICIAL INTELLIGENCE METHODS

Artificial Intelligence (AI) models are computer-based systems trained by the decision maker using historical data and experience. These systems usually cope very well with the complexity and uncertainty involved in the supplier selection process. Some of the AI models are:

*A. Case-Based-Reasoning (CBR) Systems*

CBR systems fall in the category of the so-called artificial intelligence (AI) approach. Basically, a CBR system is a software-driven database which provides a decision-maker with useful information and experiences from similar, previous decision situations. CBR is still very new and only few systems have been developed for purchasing decision making.

# UNCERTAINTY IN SUPPLIER SELECTION

# UNCERTAINTY IN SUPPLIER SELECTION

Supplier selection in supply chain systems is made even more difficult because supply chains are operated in uncertain environments where disruptions can affect the short and long-term performance of a company. Supply chain risk management (SCRM) is the area concerned with the study of supply chain risks. SCRM is defined as the management of supply chain risks through coordination or collaboration among the supply chain partners so as to ensure profitability and continuity"

Risks affect supply chain management in two ways:

(1) <u>Operational risks</u> arising from coordinating supply and demand (e.g., uncertain customer demand), and

(2) <u>Disruption risks</u> arising from disruptions to normal activities (e.g., natural disasters).

One way to account for risks in supply management, particularly in the supplier selection process, is to model these when determining the order allocation in the final choice step. The following operational risks have been modeled in the literature:

**Uncertain demands** occur due to markets' changing conditions.

**Uncertain supply yields** occur when order quantities from selected suppliers are received incomplete due to disruptions in a supplier's production or manufacturing system.

**Uncertain supply lead times** arise due to disruptions that occur in the gap between the time the order is placed and is received.

**Uncertain supply costs** occur when a cost is imposed by an upstream supply chain partner or when uncertain currency exchange rates take place.

Even though risks can be modeled quantitatively, it is difficult to completely avoid disruptions in practice. Successful companies are those that are able to positively react to disruptions in a quick manner

# RECOMMENDATION

# RECOMMENDATION

For further improvement in supplier selection process, the following supplier score list is suggested to be implemented while selecting the vendor in automobile manufacturing industry.

The supplier score list also help in increasing effectiveness and efficiency of selecting supplier, selection method determination of quality performance of the automobile industry.

| | REQUIREMENT CATEGORIES | SCORE | Comments | Audit Observation |
|---|---|---|---|---|
| **I** | **Business Capabilities** | | | |
| **A** | **Quality System Capability** | | | |
| 1 | Is the supplier's quality system third party registered to ISO TS 16949? | | | |
| 2 | Is there an robust plan implemented to achieve ISO TS16949? | | | |
| **B** | **Technical Capability** | | | |
| 1 | The supplier shall demonstrate production experience in the part(s) or commodity being considered | | | |
| 2 | Do the supplier's current processes require improvement or development to manufacture the part(s) or commodities being considered? | | | |
| 3 | The supplier shall demonstrate they conform to agreed specifications with current customers | | | |
| 4 | Does the supplier have access to product or tooling development in-house or with a parent company | | | |
| **C** | **Production Capacity** | | | |
| 1 | Does the supplier demonstrate producing similar parts at similar volumes? | | | |
| 2 | The supplier shall demonstrate that their production planning methodology is capable of satisfying customer demands. | | | |
| 3 | Does the supplier base production capacity analysis on surrogate production data? | | | |
| 4 | Are there open days and open shifts that can allow for more capacity or are there robust financial plans to expand | | | |

| | | | | |
|---|---|---|---|---|
| 5 | Is the supplier's weekly production plan over committed, ie more than 5 days 3 shifts? | | | |
| **D** | **Management Capability** | | | |
| 1 | Does the management have a defined business plan? | | | |
| 2 | Is there an organisation chart that identifies key personnel, accountabilities and responsibilities? | | | |
| 3 | Is there a clearly defined process for identifying key skills for particular tasks? | | | |
| 4 | Is there a clearly defined process that identifies and validates training for personnel performing a task is adequate? | | | |
| 5 | Is there English speaking personnel at all levels of the business? | | | |
| 6 | Does the supplier's premises demonstrate goood housekeeping? | | | |
| **II** | **Production Capabilities** | | | |
| **A** | **Process Planning** | | | |
| 1 | Does the supplier have a defined feasibility study process before a new component is accepted? | | | |
| 2 | Is there a clearly defined APQP process that manages the project from inception to launch? | | | |
| 3 | PFMEAs are effectively used and reviewed annually | | | |
| 4 | Error proofing techniques should be used wherever possible | | | |
| 5 | Do production lines follow logical process flows? | | | |
| 6 | The supplier uses run at rate calculations to verify CPV | | | |
| 7 | The supplier uses PPAP for validating conformance to customer requirements | | | |
| **B** | **Process Control** | | | |
| 1 | Operator set-up or works instructions are available and used | | | |

| | | | | |
|---|---|---|---|---|
| 2 | Control plans conform to the requirements of ISO TS16949 and are generated from the PFMEA, drawing and/or ES requirements | | | |
| 3 | Appropriate inspection tools are available and used | | | |
| 4 | Is there a clear process for traceability from raw materials to finished goods? | | | |
| 5 | Does the supplier demonstrate a clearly defined and implemented process for non-conforming product including initial isolation and disposition? | | | |
| **C** | **Process Verification** | | | |
| 1 | The supplier demonstrates use of process audit techniques and follows an established audit plan | | | |
| 2 | Gauges and other measuring devices are calibrated to a defined schedule and traceable to national standards | | | |
| 3 | Planned preventative maintenance is employed to ensure equipment effectiveness | | | |
| **D** | **Statistical Methodologies** | | | |
| 1 | Capability studies shall be used to demonstrate process stability | | | |
| 2 | Appropriate statistical process control techniques have been identified | | | |
| 3 | Does the supplier show evidence that SPC charts are used properly and out of control and corrective actions are identified and implemented? | | | |
| 4 | Gauge R+R studies are used on appropriate equipment and repeated according to a defined schedule | | | |
| 5 | OEE studies are performed and used as a tool for improvement | | | |
| **III** | **Performance Capabilities** | | | |
| **A** | **Continuous Improvement** | | | |
| 1 | Incoming, in-process and outgoing defect data is recorded, analysed and actions generated | | | |

| | | | | |
|---|---|---|---|---|
| 2 | The supplier operates a QOS continuous improvement process | | | |
| 3 | Is the supplier committed to a "Zero Defect" philosophy and demonstrate actions to work towards this | | | |
| **B** | **Customer Satisfaction and Problem Solving** | | | |
| 1 | Does the supplier have a process for obtaining data and for achieving customer satisfaction? | | | |
| 2 | Does the suppliers current customer performance have the potential to meet Visteon's expectations? | | | |
| 3 | Does the supplier have a process for managing customer complaints? | | | |
| 4 | Is there evidence that failure analysis is completed timely? | | | |
| 5 | Does the supplier use recognized problem solving processes? | | | |
| 6 | Does the supplier implement the same processes with their suppliers as they do to their customers? | | | |
| **IV** | **SUMMARY OF SCORES** | | | |
| **I** | Business Capabilities | | | |
| A | Quality System Capability | | | |
| B | Technical Capability | | | |
| C | Production Capacity | | | |
| D | Management Capability | | | |
| **II** | Production Capabilities | | | |
| A | Process Planning | | | |
| B | Process Control | | | |
| C | Process Verification | | | |
| D | Statistical Methodologies | | | |
| **III** | Performance Capabilities | | | |
| A | Continuous Improvement | | | |
| B | Customer Satisfaction and Problem Solving | | | |
| | TOTAL | | | |

# CONCLUSION

# CONCLUSION

The biggest challenge the most of the automobile industries is change of mindset of the purchasing and traditional business approach. Supplier selection starts with setting of the strategic goal or strategic decision about the single sourcing and multiple sourcing. After deciding the strategic goal, organization has to decide the various selection criteria based on organization's requirement.

Above issues of supplier selection have attracted the interest of researchers since the 1960s, and research studies in this area have increased. Several authors have pointed out the importance of supplier selection by emphasizing the impact that decisions throughout the entire supply chain have, from procurement of raw materials to delivery of finished products to final customers. In order to help decision makers or purchasers make sound decisions with respect to supplier selection, researchers have developed different criteria and decision methods and models dealing with different aspects of the supplier selection process. This paper throws light on supplier selection criteria and methods. Based on review, it would not be irrational to suggest that the supplier selection issues need further attention in order to harmonize the combination of qualitative and quantitative criteria to develop the best criteria and methods for the selection of the best suppliers.

# FUTURE RESEARCH

# FUTURE RESEARCH

For future research, these two aspects, supplier selection criteria and methods, will continue to be the focus. For supplier selection criteria, combining supply chain performance measurement and supplier selection seems to be an important area. Although some articles are on SCM environment, little attention has been paid on the influences on the whole supply chain if a certain supplier is selected. Some new criteria to reflect the whole supply chain performance should be developed in the process of supplier selection. The methods mentioned in this study have shortcomings in dealing with the selection problem. New methods to simulate the process of human decision making, such as neural network, seems to be promising, and the computer programming for supplier selection should also be developed.

In addition to a wide variety of deterministic extensions to this research, future research would include extending the proposed models to the case of stochastic demand and lead times. This would give a more accurate approach to real world environments in which uncertainty is always present.

Finally, due to the conflicting criteria considered in the supplier selection problem, the single-objective models for order quantity allocation developed in this research could be extended as multi-criteria inventory models where the tradeoffs associated with these criteria can be quantified.

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