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Supplier Evaluation and Selection in Automobile Industry

Lokpriya Gaikwad and Vivek Sunnapwar

Abstract

In automobile industry, to operate effectively the supply chain management, the purchasing function is very important to perform effectively. It is the responsibility of purchasing department to choose the correct suppliers to purchase the required products for their company. Thus, supplier evaluation technique is essential for purchase manager's point of view to choose the best supplier among available suppliers. The literature addresses quality, delivery, technology, value and service as the five most common criteria used for supplier quality evaluation. In this chapter, approach of evaluation and selection of supplier has been presented as per the ISO 9000/TS16949 standards. Considering the most important criteria for evaluating the quality of suppliers based on a review of the literature and observation in practice. Finally, these organizations continuously review and implement effective quality systems following the rigorous ISO 9000/TS16949 series of standards and most automobile companies have developed in-house procedures and software for the supplier selection process.

Keywords: supplier assessment, supplier selection and performance evaluation, supplier quality cost, supplier rating, part per million equivalents

1. Introduction

Conventionally firms have been divided in operational functions and each department take care of their own responsibility and manufacturing functions from procurement of raw material to dispatch of final products to the customer. Due to this reason, most of the organization purchasing commands a significant role, since purchased parts and components represent 40–60% of the sales [1] of its end products. This means with small cost saving in the acquisition of materials can have a greater impact on profits of the organization.

There has been an evolution in the role and structure of the purchasing function that gained great importance in the supply chain management due to the globalization and accelerated technological amend. It involves buying the raw materials and components for the organization to meet current need. The actions connected with it include selecting and qualifying suppliers, rating supplier performance, negotiating contracts, comparing price, quality and service, sourcing goods and service, timing purchases, selling terms of sale, evaluating the value received, predicting price, service, etc. Main responsibility of the purchasing department is the selection and evaluation of capable suppliers which brings

financial benefits for the organization. The main objective of the supplier selection process is to reduce peril and maximize the total worth for the buyer organization considering strategic variables such as the choice between domestic and international suppliers, and the number of suppliers.

1.1 Literature reviews

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 buyer. **Figure 1** presents the steps to follow when developing such a system [2].

Step 1: Identify key supplier evaluation categories

The first step in this process is identifying supplier evaluation criteria such as cost, quality, and on time delivery which are the important primary critical criteria that affect on the buyer. However, for critical items the supplier's in depth analysis related to their process capability or machine capability and ability to do a business is essential. For these reasons more supplier evaluation study is required. These criteria are typically the following:

A. Supplier managing capability

This is an essential way to assess, since management runs the business and makes the decisions that influence the future competitiveness of the vendor.

1. Overall workforce capabilities

This measurement requires an evaluation of third party personnel outside the organization. The reason is that well-known, self-motivated, stable employees should not be underestimated.

2. Cost composition

Accepting a supplier's total cost configuration helps a purchaser to determine how competently a supplier can produce things. A cost breakdown helps to identify probable areas of cost improvement.

3. Total quality management system

In supplier evaluation process, quality management systems at supplier end, their systems as well strategies must be address.

4. Technology and process capability, together with the supplier's design capability

This step helps to understand the technology, resource skill and capital requirement of the supplier during selection process.

5. Ecological regulation conformity

This is important given that purchasers do not want to be connected with be known ecological polluters from a public relations stand point.

6. Economic capability and steadiness

To check the economical capability of the supplier is essential for preliminary condition that the supplier must pass before a detailed evaluation can begin.

7. Production planning and control systems, including supplier on time delivery performance

The purpose behind this step is to evaluate the supplier from planning, scheduling and on time delivery point of view.

8. Information technology capability

Evidence that the supplier must use latest technology in their plant so that they can update their work environment.

9. Supplier purchasing strategies

These criteria are together one way to expand greater imminent and accepting of the supply chain of the suppliers.

10. Longer-term relationship probable

Supplier should be selected on the base of long term relationship, i.e., collaboration or partnership with the supplier. This will help both supplier and buyer to exchange ideas as well as technology with each other.

Step 2: Evaluation category weightage

The performance categories having weight reflect the relative importance of that category. The total of each weight must equal 1.0. That helps the management during the supplier selection and evaluation process.

Step 3: Identify and weight subcategories

In this, first identify performance subcategories within broader category in which the total sum of the subcategory weight must be equal to the total weight of the performance category.

Step 4: Identify scoring system for categories and subcategories

Scoring system takes criteria that may be highly skewed and develops a quantitative scale for measurement. Scoring system is effective if different individuals infer and score the same performance categories under assessment. For illustrative purposes, an example is a 5-point scale where 1 = poor, 2 = weak, 3 = marginal, 4 = qualified, and 5 = outstanding.

Step 5: Assess suppliers directly

A buyer can compare the scores of different suppliers for the same order and select one based on the evaluation score. It may be possible that supplier does not qualify at this time for further purchase consideration. Purchaser should have minimum acceptable performance necessities that suppliers must assure before they can become part of the supply base [3].

Step 6: Make selection based on evaluation results review

The major output from this step is a proposal about whether to accept a supplier for a business. A buyer may evaluate several suppliers who might be competing for a purchaser contract. The intention of the evaluation is to qualify potential suppliers for current or future business requirements.

Step 7: Review supplier performances constantly

After selecting a supplier, the supplier must perform as per buyer requirements to fulfill their needs. The prominence shifts from the initial evaluation and selection of suppliers to continuous improvement by suppliers into their process and product to fulfill buyer requirement.

Few authors have acknowledged criteria for supplier selection, such as the price, quality, and delivery, past supplier performance, capacity, information systems, service, and geographic location, among others [4–6]. These criteria are a key issue in the supplier measurement process since it deals the performance of the suppliers.

1.2 Methodology

In most of the research which is based on supplier selection and evaluation, authors opined that the purchasing organizations use different approaches for evaluating and selecting supplier as per their requirements because of no best way is there.

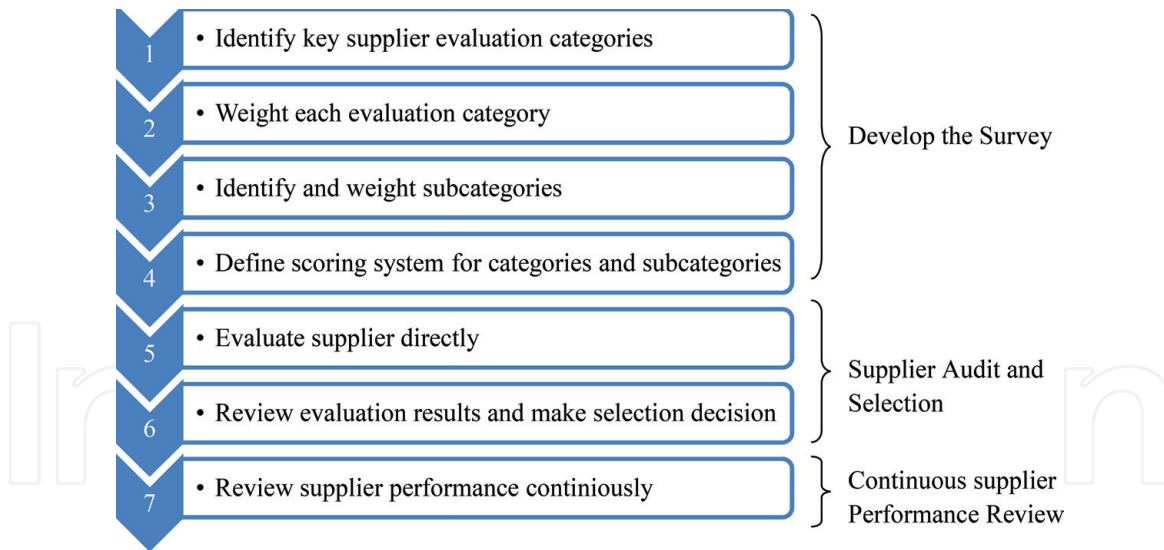


Figure 1.
Initial supplier evaluation and selection.

Supplier selection is based on a relative assessment using an exploratory case study approach which is generally used in most of the OEMs (Original Equipment Manufacturers).

2. Supplier evaluation and selection in auto industry

2.1 Rejected parts per million (PPM) level

PPMeq is a pointer for inward part quality by monitoring the performance of inward parts during on-going production, once parts is handed over by Component Development Materials Management (CDMM) to Supplier Quality Assurance (SQA) and procured by Supply Chain Management (SCM). This guideline sets the procedure of calculating the PPM Equivalent (PPMeq) and declaring non-conforming parts in the supplier deliveries. The suppliers' performance has assessed by the index PPM which has based only on rejection of parts at receiving stage and on line. But this index did not reflect the performance of the suppliers whose parts has mostly reworked on lines, the parts for which deviations/concessions were sought. Also much effort has been put in for segregating parts if any non-conformity has found in a lot. Some supplier parts also get rejected at the final assembly stage due to which the whole assembly faces rejection. To capture the effect of all the above conditions, a new index PPMeq has been formed.

Formula:

Supplier RPPM (rejected parts per million) is calculated on the basis of the amount of rejected parts versus the total amount of parts received in a given fiscal month. This computation is then normalized to replicate a continuous basis of one million units received.

- PPMeq can be calculated as:
 - Auto Sector-wise PPMeq
 - Plant-wise PPMeq
 - Supplier-wise PPMeq
 - Supplier Part-wise PPMeq

The agreement on PPM values does not signify a quality level accepted by Customer. All purchasing parts which are recognized as defective basically not be accepted and has been charged to the supplier.

PPMeq for a period is calculated as shown in Eq. (1)

$$\text{PPMeq} = \frac{N_{\text{rej}} + N_{\text{rew}} + N_{\text{rej } 951} + 0.5N_{\text{dev}} + 0.5N_{\text{conc}} + 5.0N_{\text{rej at F.A.}}}{N_{\text{Total}}} \times 1000000 \quad (1)$$

where N_{rej} is the total inspection and line rejected quantity; N_{rew} is the total inspection and line quantity reworked; N_{dev} at F.A., is the total no. of quantity accepted under variation (inspection and line); N_{conc} is the total no. of quantity accepted under concession (inspection and line); N_{rej} at F.A., is the total no. of quantity rejected at Final Assembly; N_{Total} is the total no. of quantity received; and $N_{\text{rej } 951}$ is the total Quantity rejected on movement 951 for scrap at our end.

Example: A supplier ships 100,000 parts to a plant, of those 7 are found to be non-conforming.

The scorecard calculation will be $(7/100,000) \times 1,000,000 = 70$ RPPM'S.

The Supplier's score for this example has 12 points.

Table 1 shows parts per million ranges and their respective scores.

From table it clear that, maximum score has been assigned to minimum rejected part per million and so on. Following are the minimum requirements from the suppliers end during the inspection of their submitted lot for acceptance to the OEMs.

Minimum expectations: it is expected that the minimum score should be 85%, (combined total of 51 points out of 60 possible).

Corrective actions: those suppliers who cannot meet the minimum expectation should be applied following corrective actions.

1. **First month:** announcement letters has been sent to Suppliers for giving justification regarding not meeting minimum score, reason for the same and what corrective action will be taken in future.
2. **Second consecutive month:** a second announcement letter has been sent stating that failing to meet minimum score and why. A corrective action plan is required.
3. **Third consecutive month:** if the problem is not solved in first and second notice then purchase manager either visited or called meeting with supplier to discuss performance. Within this period, suppliers may be on probation.
 - **Rejection:** any parts that not meeting customer specifications has rejected.
 - **Rework:** if doing any minor correction on part, it becomes fit for use then it comes under rework.
 - **Deviation:** any supplied part whose critical dimensions or material specifications cannot be reworked/repared is termed as deviation.
 - **Concession:** when approval of product development has not taken for the minor repair that are not specified in the drawing and which does not affect the product quality, it is termed as concession.
 - **Segregation:** division of accepted/rejected parts, done with permission of QA personnel of that area, is known as segregation.

- **Rejection at final assembly:** due to supplier part if final assembly gets rejected, then it comes under rejection at final assembly.

To simplify communication and wherever technically practical and feasible, only one target value should be agreed for each product family delivered by suppliers or if possible for all products delivered.

General rules to declare Non-conforming parts:

1. **Rejection:** a part has been rejected if it falls out of the engineering specification. After proper inspection a part has been rejected. For example, in case of incorrect dimension, if the supplier has not produced a part as per specified dimensions, rejection will be done otherwise part will be accepted if it falls within specified specification.
2. **Rework:** parts shall be declared as rework if they are non-conforming only if the supplier is responsible. An analysis agreed by the supplier shall define the accountability for the rework (supplier); the supplier can take part in the investigation process. All records related to Deviation, Concession and Segregation, rework quantities are kept.
3. **Deviation:** the variation for the use of non-conforming part has been agreed by the Product development and respective plant quality head.
4. **Concession:** the dispensation has rose by the Manufacturing Quality and approved by the respective plant quality head.
5. **Segregation:** the quantities accepted after separation of the supplier parts has been taken into account in the calculation of PPM_{eq}. This has not been interpreted as the total quantity which is separated.
6. **Quantity of non-conforming parts:** it has been declared with the conformity of the supplier and customer. Sample has not used to declare the non-conformance.
7. **Re-acceptance:** after correcting the parts it has been reaccepted within same month of rejection of that part so as to have correct performance of that supplier on monthly basis.

RPPM rating	Score	RPPM rating	Score
0–25	30	61–65	14
26–30	28	66–70	12
31–35	26	71–75	10
36–40	24	76–80	8
41–45	22	81–85	6
46–50	20	86–90	4
51–55	18	91–95	2
56–60	16	96–100	0

Table 1.
PPM ranges and their scores.

2.2 Scorecard

The purpose of the Scorecard is to communicate key supplier performance metrics that align with business objectives. The program rewards suppliers based on data, serves as a foundation for continuous improvement, and assists with future sourcing decisions.

Supplier rating system based on:

- **Delivery:** to meet expected dates as per delivery date.
- **Lead time:** time required in between placing order and receiving material.
- **Quality:** it is calculated in parts per million defective (PPM)
- **Productivity savings:** suppliers' assistance in helping to meet our productivity goals
- **Payment terms:** after delivery it may be within 3 to 6 month

Span:

To select a group of critical suppliers.

Benefits:

It benefits purchaser and supplier to achieve the benefits, sharing information by establishing open communication.

Supplier reimbursement:

- Visibly stated performance opportunity
- Enhance communication
- Business association get improved
- Data is available to measure performance
- Superior in general competitiveness in the market

Organization's reimbursement:

- Visibly communicated performance opportunity to supplier network
- Quicker associations with our suppliers
- Better accepting of overall performance

Supplier scorecard point system:

Every month suppliers receive performance score based on following areas as shown in **Table 2**.

Supplier performance levels:

Supplier is ranked depending upon their ongoing performance:

Level 1: supplier having 71 points or above is referred as world class and will be rewarded by new business opportunities.

Level 2: supplier having ongoing score 51–70 points performing acceptable level but at the same time assurance team should work to lift them to level 1 performance by developing them.

Level 3: a supplier having score 31–50 points kept on conditional level of performance. Assurance team must work to lift them to achieve level 2 or level 1 status.

Level 4: a supplier having score 30 points or below is a restricted supplier, any time they exist and another alternative source has to be find out.

2.3 Collaborate with suppliers

Enterprises that shared performance data with suppliers were able to generate 62% greater improvements in supplier performance than enterprises that only used this information internally (see **Figure 2**).

Based on a data purchaser can find out the opportunities to improve and develop the supplier performance by sharing business information. Many organizations can collaborate with their supplier in exchange of design and process data.

2.4 Process audit

Process audit for the manufacturing is quality tool to assess the continuous improvement of the organization in process/product performance. Doe to process audit, it become easy to analyze, maintain and improve quality system. So process audit become essential for the organization to sustain into competitive environment. Based on ISO 9001 certification requirement internal audit has to be conducted.

Sr. Nos.	Focus area	Allocated score
1.	Delivery	(0–20 points)
2.	Lead time	(0–20 points)
3.	Quality	(0–20 points)
4.	Productivity savings	(0–20 points)
5.	Payment terms	(0–20 points)

The maximum possible score for the Month or Year-to-Date is 100 points.

Table 2.
Performance score based on the focus area.

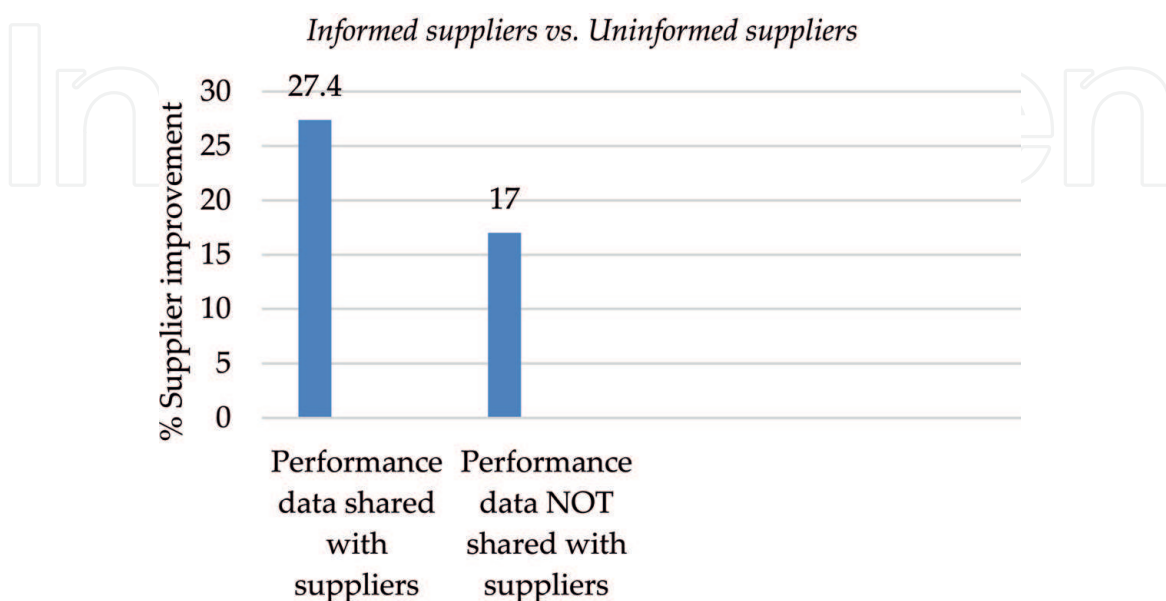


Figure 2.
Supplier performance improvements.

Due to customer awareness and global competition there is tremendous pressure on manufacturing firms to improve quality and reduce cost of the product. Each organization is struggling to meet customer varied demands as well as meet environmental regulation applied by government so that process/product should be ecological feasible. Audit is one of them to assess current state of nature and future plan of action to improve quality of the product and process. Audit can be used throughout the business area of quality, production, safety, human resource, purchasing, accounting, etc. [6]. Many organizations not only manufacturing but also service industry, have conducted the audit or been audited in order to comply with certain standard requirements [7].

2.5 ISO 9000 and ISO 14000 standards

The International Organization for Standardization (ISO) is a set of standards that “makes the development, manufacturing, and supply of products and services more efficient, safer and cleaner” [8]. The ISO has created several standards, but the best-known ones are ISO 9000 and ISO 14000. ISO 9000 is used for assessing quality requirements, while ISO 14000 is a standard for environmental quality management. ISO 9000 and ISO 14000 are known as “generic management system standards” because they can be applied to any product, material or service [8]. An ISO certificate can be given to any organization after it prepares its documents containing a description of its business practices in line with the guidelines provided by ISO. According to [9], having ISO 9000 has the following benefits:

1. **Way in to markets:** having ISO 9000 certification helps organizations to maintain and increase number of customers. Due to globalization, it is essential to certify and enter into global market.
2. **Customer requirement:** customers buy the product from certify supplier only. So now it become need that supplier should have ISO certification.
3. **Quality system improvement:** due to certification, quality system of the organization gets improved and also organization prepares itself for quality auditing.
4. **Other benefits:** the certificate is recognized around the world, and can develop quality through recovering an organization’s overall competitiveness.

2.6 Normalize supplier measurement procedures across the enterprise

Organization should have formal measurement process which improves the supply base of the vendors than those vendors without having such type of formal measurement process.

On the other hand, firms should have standardized supplier performance metrics to reach better results at least 25% performance improvement can be seen in this process.

However, supplier performance metrics changes from organization to organization depending upon their needs and capabilities of the supplier supplying part or components to them. But agreeing on standard metrics for evaluating vendor performance is easy than on firm basis where different firm units have varied goals, requirements, and suppliers.

3. Results and discussion

A critical area to focus purchasing attention continues to be supplier quality management. Although supplier performance has likely improved in real terms over the last several years, supplier quality still does not fully satisfy continuously changing performance expectations. Measuring continuous supplier performance is not the only time when firms should evaluate suppliers. For most firms, supplier evaluation is central to their philosophy of quality at the source. Almost 70% of purchasing managers say that, the organizations use quantitative-based supplier evaluation process to check the capability and control techniques in there continuous quality improvement commitment. Around 80% firms assess supplier capabilities directly by cross-functional team site visits. Any kind of material or components either in semifinished, finished or raw material supplied by supplier has to be consider for calculating PPMeq and deciding which supplier has to be selected for doing business. If supplier having high PPM score consistently should be deleted from business list, PPM > 500 supplier has to be called or reviewed. Although most quality standards have been fulfilled till there are quality issues in manufacturing industry. According to ACMA reports 170 firms have already received ISO 9000 certification and 23 firms have received QS 9000 certification but still they are struggling to achieve excellence in quality.

In this work evaluation of the supplier has been done through Part per Million equivalents which help the OEMs to track the rejection rate at Plant level, Supplier level and Process level. Having high PPMeq the OEM can take a prompt decision regarding doing the business in future or to give time for improvement or to develop for excellence. Process-wise PPMeq can also help to find out the weak supplier for the particular process like Machining or Casting.

4. Conclusions

An organization should measure supplier's performance because without measurement improvement cannot become possible, also supplier cannot improve and remove wastages as well as cost drivers so vendors should be measured to facilitate performance improvement and enhance competitiveness. Thus an informed business decision has been possible that impact the enterprise.

Supplier quality cost should be incorporated into a buyer's supplier rating system. Supplier rating should be involved not only traditional indicators like cost, quality, on time delivery but also supplier quality costs. When problems that effect on customers occur, the speed with which problems has identified solved and the solution implemented has a direct impact on customer satisfaction. To reduce cost of quality there should be supplier involvement so that the quality related problems can be resolved and analyze the occurrence of the problems and failure that take place due to the faulty method or processes for that suppliers must be actively participated to solve the shop floor problems.

Use of part per million equivalent technique help to the purchasing organization to take a decision related to supplier selection and evaluation in critical conditions. It helps purchase manager in decision-making process at the time of selecting single supplier from the available number of suppliers.

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Conflict of interest

I confirm there is no “conflict of interest.”

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