

A Study on Inventory Management in Manufacturing Company

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ABSTRACT - Vendor Evaluation (VE) may be defined as the evaluation of a prospective vendor or supplier to determine if he can effectively meet the obligations and needs of the business regarding a product or service for the company. Vendor evaluation and selection is not only a process to choose the one offering the lowest price, but it is a process to select the best vendor or supplier that can submit the best deal on all required criteria amongst a host of competing vendors. Evaluation and selecting a vendor is a complex problem involving qualitative and quantitative multi-criteria. Evaluating and selecting a vendor is now considered as important a process as developing new products. However, there is no one best way or ideal to evaluate and select vendors or suppliers; organizations use a variety of different approaches that suits the best for their business needs. This project report examines and analyses the Vendor Evaluation and Management processes for a typical manufacturing company. To reduce the time and effort in selecting a vendor, generally a multi-criteria decision model is used for evaluation and selection of vendors. Choosing the right vendor could give the right quantity at the right cost on the right time.

Key words: Vendor Evaluation, Purchase order, Manufacturing, Supplier, Organization, New products.

I. INTRODUCTION

In this project study two broad areas are covered which are indicated by the title of the project, viz., Vendor Evaluation (& Selection) and Vendor Performance Assessment and Management. While Vendor Evaluation is a pre qualification stage activity, Vendor Performance Assessment and Management is a post issue of purchase order activity. Both are very important from the point of achieving strategic advantage from sourcing. Further, vendor performance assessment needs to be undertaken periodically and feedback provided to the vendors in order to generate continuous improvement plans at the vendor organisation. Manufacturing companies now increasingly rely on outsourcing from their supply chain network as a necessary tool of competitive advantage and cost optimisation. Companies have increasingly downsized and they are now more focused on their core competences while leveraging their vendors' capabilities and technologies.

In this context, the role of purchasing and sourcing in a manufacturing company is crucial and assumes a strategic significance. Professional sourcing of materials, goods and services can be a great enabler in a situation of aggressive competition and in a varying business environment. With companies now more dependent on vendors for meeting their end customer requirements, poor decision making can have serious consequences.

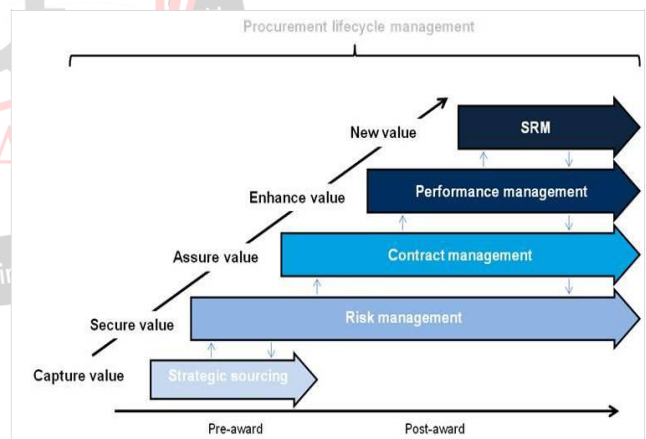


Figure 1. Procurement Lifecycle Management

An inappropriate vendor evaluation and selection can result in cost and time overruns and delay in project completion or delivery of finished/assembled goods to their end customers and in extreme cases knock them out of business. Some other considerations affecting source decisions are the buyer's expectations, the seller's experience with the product or service, the stage of economic development of the vendor, and preferences for geographical location. Bulky or heavy items can be costly to transport long distances". Selecting the right vendors is a key task in an organisation because it has a direct effect on cost reduction, profitability, and the flexibility of a company. The simplification of processes will create operational

efficiency. A part of this strategy implementation is to improve strategic sourcing processes to gain flexibility in demanding market situations and to achieve cost savings. In recent years companies have shown more interest in sustainable practices that include risk mitigation. The vendor selection strategies have shifted from pricing inquiries to fulfilling qualitative, quantitative and other criteria designed to meet the overall objectives of the company. The vendor evaluation and selection process according to Monczka et al. (2011) is simple and easy to scale according to the needs and requirements of each instance of vendor selection. It is an upper level process but it nevertheless brings together all necessary elements of the vendor evaluation and selection steps.

OBJECTIVES OF THE STUDY

Primary Objective

The primary objective of the study is to understand and analyse the current Vendor Evaluation and Management processes in a typical manufacturing company.

Secondary Objective

To study the effectiveness of vendor evaluation processes based on gathered data, analyses and inferences.

II. REVIEW OF LITERATURE

According to Dickson (1966) was the first researcher who performed an extensive study on criteria. His study was to determine, identify, and analyze what criteria were used in the selection of a firm as a vendor. Dickson's study (1966) was dependent on a questionnaire, sent to 273 purchasing agents and managers selected from the membership list of the National Association of Purchasing Managers. The list included purchasing agents and managers from the United States and Canada, which was a total of 170 regarding the importance of 23 criteria for vendor selection. Dickson asked them to order the importance of each criterion on a five point scale: extreme, considerable, average, slight, and of no importance. He came up with "quality" is the most important criterion.

Price, Delivery, Quality, and Production capacity and location were the criteria most often treated in the literature. The important criteria dependent on the study were "delivery" and "performance history" (Tahriri, Osman, Yusuff and Esfandiary, 2008). "

According to Weber, Current and Benton (1991), the review of the articles about vendor selection between 1966 and 1991 were investigated. In a related study, Zhang, Lei, Cao and Ng (2003) collected 49 articles between 1991 and 2003, which was a comprehensive classification of vendor selections published.

The study of Zhang, Lei, Cao and Ng (2003) was done based on the Weber, Current and Benton (1991) study, and the 23 criteria of Dickson's (1966) study. The study

concluded that net price, quality, and delivery were the most important vendor selection criteria. As concluded from three different studies, price is the number one selection factor, replacing Dickson's (1966) number one ranked quality criterion (Tahriri, Osman, Yusuff and Esfandiary, 2008).

In addition to Dickson (1966), Weber, Current, and Benton (1991) and Zhang, Lei, Cao, and Ng (2003), other researchers have also recently begun discussing new important criteria to select vendors. The definition of Dickson's (1966) 23 criteria has been expanded, and some new criteria were developed with the growth of new business needs. The review performed by the Bross & Zhao study concluded that the most valuable supplier selection criteria were cost, quality, service, relationship, and organization (Bross & Zhao, 2004).

After Weber's work, most researchers focused on vendor-selection criteria in either specific industries or specific countries. Since Internet-based businesses have grown rapidly since 1995, vendor criteria have changed a great deal, thus corresponding to the business environmental changes. While a number of vendor selection criteria studies have been conducted over the years, Dickson (1966), Weber, Current, and Benton (1991) and Zhang, Lei, Cao, and Ng (2003) are still recognized as the most common, and cited as the most comprehensive studies done on selection criteria. Table 3.1 summarizes some of these criteria, which have appeared in literature since 1966

Ha and Krishnan, (2008), One of the most important processes performed in organisations today is the evaluation, selection, and continuous measurement of vendors. Selecting a vendor is now as important a process as developing new products. Vendor selection process is a multi-criteria problem, which includes both qualitative and quantitative factors. Purchasing commands a significant position in most organisations since purchased parts, components, and supplies typically represent 40 to 60 percent of the sales of its end products. Thus relatively small cost reductions gained in the acquisition of materials can have a greater impact on profits. Vendors have a large and direct impact on the cost, quality, technology, and time-to-market of new products (Chen, Lin & Huang, 2006).

III. RESEARCH METHODOLOGY

Research in common parlance refers to a search for knowledge. One can also define research as a scientific and systematic search for pertinent information on a specific topic. In fact, research is an art of scientific investigation. The Advanced Learner's Dictionary of Current English lays down the meaning of research as "a careful investigation or inquiry specially through search for new facts in any branch of knowledge." Redman and Mory define research as a "systematised effort to gain new knowledge." Some people consider research as a movement, a movement from the known to the unknown. It

is actually a voyage of discovery. (Kothari C.R. 1990 , 1). Research methodology is a way to systematically solve the research problems. It is the scientific steps that are generally adopted by the research in studying the problem along with the logic behind them.

Data Collection

The data collection was based on a combination of primary data and secondary data. The primary data focused on the Vendor Evaluation and Selection Processes (pre-qualification stage), whereas the secondary data focused on the Vendor Performance Management aspects (post purchase order materialisation and closure activities)

Primary Data

There are several methods of collecting primary data. In this case primary data was collected through a combination of Questionnaire, Interview method and content analysis. These were primarily related to Vendor Evaluation and Selection Processes (pre-qualification stage). The Questionnaire designed for this purpose is attached as Annexure I

Secondary Data

The secondary data was collected from the company’s Oracle EBS (E Business Suite) with regard to Vendor Performance Assessment. Three sets of half yearly data, for periods 2016-17 (H1), 2016-17 (H2) and 2017-18(H1) was collected from the database of the company. The vendors name was replace with serial nos to ensure confidentiality as per company rules. These are placed as Annexure II, III and IV

STATISTICAL TOOLS USED

The collected data was subjected to analysis by using appropriate tools, viz., SPSS and MS Excel Data Analysis tools.

IV. DATA ANALYSIS AND INTERPRETATION

Vendor Evaluation and Selection

Questionnaire was employed to gather information and inputs for further examination and content analysis and perusal of documents and records. A total of six employees were interviewed from the procurement department including senior manager. From the responses received it was apparent that the process of evaluation, its awareness and implementation is of very high order and everyone is contended with the current processes. Further content analysis was carried out based on questionnaire responses.

It is also evident that documented procedure is meticulously adhered to.

Vendor Performance Management

Data Analysis

The data on vendor performance was collected from the company database, for the periods 2016-17 and 2017-18.

The Purchase Order data of both domestic vendors and foreign vendors (import) were collected in order to enable comparative study at a later stage. The names of the vendors as been replaced with serial numbers, as per the requirement of confidentiality of information stipulated by company rules.

The data was grouped for the periods 2016-17 (H1), 2016-17 (H2) and 2017-18 (H1) since the company also does analysis once in every six months.

The total number of vendors and Purchase Order Lines (PO Lines) taken into consideration is tabulated below:-

	No of Vendors		Total PO Lines	
	Domestic	Import	Domestic	Import
2016-17 (H1)	88	37	4345	1555
2016-17 (H2)	100	35	5250	1435
2017-18 (H1)	97	40	4973	2191
Grand Total	285	112	14568	5181

Table 1: Secondary Data Collection Summary

The vendor performance evaluation is based on three critical parameters. These are:- On-Time -Delivery (OTD)

- a) Quality
- b) Response
- a) OTD- 45%
- b) Quality-45%
- c) Response- 10%

The results of performance evaluation against each vendor for the H period is tabulated and attached Annexure II, III and IV. Each row represents a Vendor and Purchase Order Lines placed with it for the concerned period is included in the data. This could be a single PO or multiple PO against the same vendor

Statistical Analysis of the data was carried out with respect to OTD for domestic vendors and the results are appended below:

On Time Delivery (OTD) Rating

Domestic Vendors

OTD Rating	2016-17 (H1)	2016-17(H2)	2017-18(H1)
Mean	28.24205672	31.33981705	32.24051506
Standard Error	1.98124414	1.746574343	1.613648692
Median	36.35011442	43.12821612	41.25
Mode	45	45	45

Standard Deviation	18.58571748	17.46574343	15.89259651
Sample Variance	345.4288943	305.0521935	252.5746238
Kurtosis	-1.422903587	-0.935881428	-0.56972441
Skewness	-0.552436362	-0.85377418	-0.92993106
Range	45	45	45
Minimum	0	0	0
Maximum	45	45	45
Sum	2485.300991	3133.981705	3127.329961
Count	88	100	97

Table 2 Descriptive Statistics – OTD Rating –Domestic Vendors

Bin	2016-17(H1)		2016-17(H2)		2017-18(H1)	
	Frequency	Cumulative %	Frequency	Cumulative %	Frequency	Cumulative %
5	21	23.86%	16	16.00%	11	11.34%
10	3	27.27%	4	20.00%	2	13.40%
15	2	29.55%	4	24.00%	6	19.59%
20	4	34.09%	5	29.00%	4	23.71%
25	4	38.64%	2	31.00%	7	30.93%
30	2	40.91%	6	37.00%	5	36.08%
35	7	48.86%	4	41.00%	6	42.27%
40	4	53.41%	4	45.00%	5	47.42%
45	41	100.00%	55	100.00%	51	100.00%

Table .3 Frequency Distribution and Histogram – OTD Rating-Domestic Vendors

Foreign Vendors (Import)

OTD Rating	2016-17 (H1)	2016-17(H2)	2017-18(H1)
Mean	32.451	36.76103386	39.26348744
Standard Error	2.6217	2.246466527	1.870357857
Median	40.099	45	45
Mode	45	45	45
Standard Deviation	15.947	13.2902752	11.82918173
Sample Variance	254.31	176.631415	139.9295405
Kurtosis	-0.095	2.471898537	6.100456584
Skewness	-1.108	-1.807019514	-2.59091758
Range	45	45	45
Minimum	0	0	0
Maximum	45	45	45
Sum	1200.7	1286.636185	1570.539497
Count	37	35	40

Table .4 Descriptive Statistics-OTD Rating-Foreign Vendors

Bin	2016-17(H1)		2016-17(H2)		2017-18(H1)	
	Frequency	Cumulative %	Frequency	Cumulative %	Frequency	Cumulative %
5	5	13.51%	3	8.57%	2	5.00%
10	0	13.51%	0	8.57%	1	7.50%
15	2	18.92%	0	8.57%	0	7.50%
20	1	21.62%	1	11.43%	0	7.50%
25	2	27.03%	2	17.14%	0	7.50%
30	2	32.43%	2	22.86%	2	12.50%
35	4	43.24%	1	25.71%	1	15.00%
40	2	48.65%	5	40.00%	6	30.00%
45	19	100.00%	21	100.00%	28	100.00%
Count	37		35		40	

Table 5 Frequency Distribution- OTD Rating –Foreign Vendor

Quality Rating Domestic Vendors

Quality Rating	2016-17(H1)	2016-17(H2)	2017-18(H1)
Mean	43.37462229	44.19904131	32.24051506
Standard Error	0.707389235	0.475029002	1.613648692
Median	45	45	41.25
Mode	45	45	45
Standard Deviation	6.635899235	4.750290024	15.89259651
Sample Variance	44.03515865	22.56525531	252.5746238
Kurtosis	25.46612011	77.79155191	0.56972441
Skewness	4.862819213	-8.499190424	0.92993106
Range	45	45	45
Minimum	0	0	0
Maximum	45	45	45
Sum	3816.966761	4419.904131	3127.329961
Count	88	100	97

Table 6 Descriptive Statistics- Quality Rating-Domestic Vendors

Bin	2016-17(H1)		2016-17(H2)		2017-18(H1)	
	Frequency	Cumulative %	Frequency	Cumulative %	Frequency	Cumulative %
5	1	1.14%	1	1.00%	0	0.00%
10	0	1.14%	0	1.00%	0	0.00%
15	1	2.27%	0	1.00%	0	0.00%
20	0	2.27%	0	1.00%	0	0.00%
25	1	3.41%	0	1.00%	0	0.00%
30	2	5.68%	0	1.00%	0	0.00%
35	0	5.68%	1	2.00%	1	1.03%
40	1	6.82%	2	4.00%	0	1.03%
45	82	100.00%	96	100.00%	96	100.00%
Count	88		100		97	

Table .7 Frequency Distribution-Quality Rating-Domestic Vendor

V. INFERENCES

From the descriptive statistics, central tendencies value, histogram and normal curves of OTD Rating of Domestic Vendors it is apparent that most of the vendors have met the expectations from the company by ensuring On-Time – Deliveries. The Mode for all the three half yearly periods is 45 (maximum possible) thereby indicating maximum compliance to on time delivery by vendors. However, the minimum value is also 0 in some cases indicating that there are some exceptions, which the company needs to ascertain the reasons for poor performance.

From the descriptive statistics, central tendencies value, histogram and normal curves of OTD Rating of Foreign Vendors it is apparent that most of the vendors have met the expectations from the company by ensuring On-Time – Deliveries. The Mode for all the three half yearly periods is 45 (maximum possible) thereby indicating maximum compliance to on time delivery by vendors. However, the minimum value is also 0 or low in some cases indicating that there are some exceptions even among Foreign Vendors, which the company needs to ascertain the reasons for poor performance.

From the descriptive statistics, central tendencies value and histogram of Quality Rating of Domestic Vendors it is apparent that most of the vendors have met the expectations from the company by ensuring quality requirements. The Mode for all the three half yearly periods is 45 (maximum possible) thereby indicating maximum compliance to

quality by vendors. However, the minimum value is also 0 in one case, indicating that there are some exceptions, which the company needs to ascertain the reasons for poor performance.

From the descriptive statistics, central tendencies value, histogram and normal curves of Quality Rating of Foreign Vendors it is apparent that most of the vendors have met the expectations from the company by ensuring quality requirements. The Mode and Median for all the three half yearly periods is 45 (maximum possible) thereby indicating maximum compliance to quality by vendors. Even the mean is very close to 45 thereby indicating greater compliance to quality by Foreign Vendors as compared to Domestic Vendors

From the descriptive statistics, central tendencies value, histogram of Response Rating of Domestic Vendors it is apparent that most of the vendors have met the expectations from the company by ensuring prompt response within the laid out time frames. The Mean, Median and Mode for all the three half yearly periods varies between 7.7 to 9 thereby indicating maximum compliance to response expectations. However, the minimum value is also 0 in some cases, indicating that there are some exceptions, which the company needs to ascertain the reasons for poor performance.

From the descriptive statistics, central tendencies value, histogram of Response Rating of Foreign Vendors it is apparent that most of the vendors have met the expectations from the company by ensuring prompt response within the laid out time frames. The Mean, Median and Mode for all the three half yearly periods varies between 8 to 9 thereby indicating maximum compliance to response expectations.

From the descriptive statistics, central tendencies value, histogram of Overall Rating of Domestic Vendors it is apparent that most of the vendors have met the expectations from the company. The Mean for all the three half yearly periods varies between 87 to 95 whereas the mode varies between 98 to 99. The minimum rating recorded is 23. The company needs to investigate the cases of very poor performers and institute remedial measures.

From the descriptive statistics, central tendencies value, histogram of Overall Rating of Foreign Vendors it is apparent that most of the vendors have met the expectations from the company. The Mean for all the three half yearly periods varies between 85 to 93 whereas the mode varies between 98 to 99. The minimum rating recorded is 53. The company needs to investigate the cases of poor performers and institute remedial measures.

VI. FINDINGS

The Vendor Evaluation and Management processes of an manufacturing company was examined and analysed in detail. The process documents relating vendor evaluation

and management were perused. Data relating to vendor performance assessment for the periods 2016-17 and 2017-18 (H1 only) were collected.

The company employs E-Business Suite (EBS) developed by M/s Oracle for handling its business processes including that of procurement department. EBS includes supplier lifecycle management module which is also used for vendor evaluation, selection and registration processes and other procurement related activities. Vendor Response assessment is based on the timing of response to notifications on concerns to the vendor initiated by the company and the time taken to complete containment actions on the concerns raised by the company. This category also includes the vendor's professional behaviour after receipt of purchase order. A maximum weightage of 10% is assigned to this category Overall Rating of performance is arrived at by adding the three ratings and expressed as a percentage.

It can be observed from the data analysis and interpretation that the Mode of OTD Rating and Quality Rating is 45 (maximum possible) for all three periods of half yearly analysis, both in the case of domestic as well as foreign vendors. This clearly indicates that maximum number of vendors have met the On-Time-Delivery and Quality expectations of the company. Similarly the Mode of Overall Rating, both in the case of domestic and foreign vendors varies between 98 to 99 thereby indicating that maximum number of vendors are meeting the overall objectives set forth by the company. This in turn validates the vendor evaluation process of the company, because most of the vendors, if not all of them, have met the company's key objectives.

However, there are couple of instances wherein the vendors, particularly domestic vendors, have been assessed as 0 (zero) in respect of OTD rating and that should be a cause of concern for Toshiba. The defaulting vendors needs to be dropped or re-evaluated to ascertain why they failed to deliver on time, despite have passed the grade during the vendor evaluation process during the pre qualification stage.

VII. SUGGESTIONS

The company has very robust vendor evaluation and vendor performance assessment and management processes and has yielded the desired higher objectives towards achievement of sourcing strategy

However, vendor performance rating with respect to certain vendors, especially domestic vendors were found to be below expectations. It is felt such approach will ensure better selection of vendors and lead to better performance.

Further, only three parameters are utilised to assess the overall performance of vendors. It is suggested to broad base performance assessment by including more parameters

appropriate to their business needs. These two proposals could be part of the company's continuous improvement plan of internal processes.

VIII. CONCLUSION

Study of Vendor Evaluation and Management of M/s Toshiba JSW Power Systems Pvt. Ltd, Chennai, which represents a typical manufacturing firm of international repute, was carried out and data collected was analysed using statistical tools. Literature review was carried out to learn about the latest trends in vendor evaluation and performance assessment. Based on the analysis of data it is observed that the vendor performance is of very high order indicating that their processes are indeed robust and meeting the objectives set forth by the company. Their processes of vendor evaluation and vendor performance assessment and management were compared through review of literature. The processes followed by the company are well documented and E- Business Suite is used to initiate and record the results of various processes for vendor evaluation, selection and performance assessment.

Based on the analysis of data on vendor performance assessments and review of literature it was suggested to consider more effective vendor evaluation tools like AHP and broad base the number of parameters considered for **overall** performance assessment in addition to the three parameters that are currently in use.

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