Modifications for Methods of Vendor Evaluation in Construction Industry

Criteria and Factors Involved in Vendor Evaluation

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Abstract:With the use of technology the world is growing faster, so as construction industry. When we are talking about Construction management we mainly focus on Execution of work and that too based on parameters like Time, Cost & Quality. But we all knew that Execution is not only the segment to focus on; Construction materials comprises of about 60-70% of cost. Selecting a proper vendor has become integral part of construction management. This study has been undertaken to investigate thechange in trends and methods of evaluation for selection of a vendor in construction industry. Rather studying what are the factors affecting selection of vendor, this study focuses on how to evaluate the vendor with the use of weightage point method which revolves around main parameters of construction management – Time, Cost & Quality. This study had been done through a case study of a project on which suppliers of crucial materials such as cement and steel has been evaluated. Also, with the modification of weightage method another parameter included in study was Credit limit in terms of time & cost as being market affected by economy this parameter has gained importance and it plays a vital role in selection of vendor. The data analysis shows modification of formula and entire composite rating system. Any firm who is into purchasing of the construction materials have to constantly analyze the data of the vendors and also have to modify the method of evaluation.

***IndexTerms*–Vendor Evaluation, Supplier Evaluation, Supplier Selection, Purchase Management.**

I. INTRODUCTION

1.1 Introduction

With the use of technology, the world is growing faster, so as construction industry. When we are talking about Construction management we mainly focus on Execution of work and that too based on parameters like Time, Cost & Quality. But we all knew that Execution is not only the segment to focus on; Construction materials comprises of about 60-70% of cost. Selecting a proper vendor has become integral part of construction management. Supplier evaluation is assessment of new or existing supplier on basis of their delivery,price, production capabilities, qualities of management, technical capabilities and services [1]. In many typical cases, people tends to procure the material with the aspect of availability of quantity with the supplier, nearness to the site, relation with the supplier etc., no one really tends to get the right supplier who can full fill the principle of purchases such as Right Place, Right Quality, Right Price, Right time, Right Quantity [2]. Vendor evaluation is a term used in business and refers to the process of evaluating and approving potential Vendors by quantitative assessment [2].The purpose of Vendor evaluation is to ensure a portfolio of best in class Vendors is available for use. Vendor evaluation is also a process applied to current Vendors in order to measure and monitor their performance for the purposes of reducing costs, mitigating risk and driving continuous improvement .For many items, these three performance areas would be enough, however for critical items needing an in-depth analysis of the supplier's capabilities, a more detailed supplier evaluation study is required [1]. Supplier Management is a strong and major concept in manufacturing industry but it is also becoming integral part of construction material without a doubt.

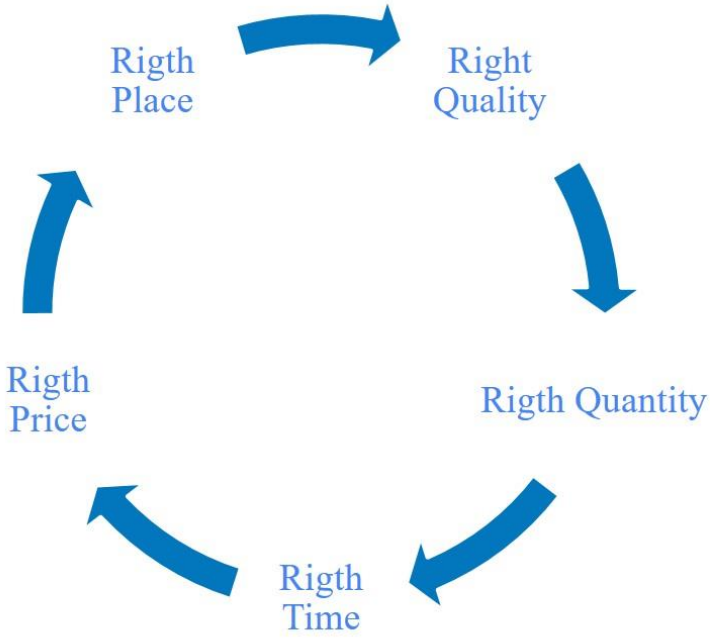

Figure 1.1 – Principles of Purchase

Few are the purchase parameters which are universally followed while doing procurement of major construction materials.

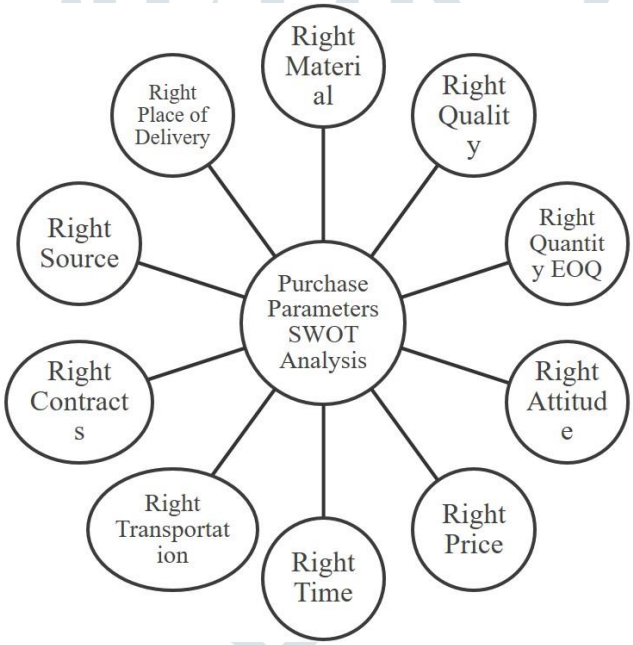

Figure 1.2 – Parameters of Purchasing

This study has been undertaken with the few of removing the favoring or to become subjective about one particular factor. On the scale of 1-10 many of us selects a vendor who is good at price; but what if my project demands of Quality. Many of us selects a vendor who is excellent at Quality; but what if the arrival schedule of material. So, there are lots questions, if-buts in the case when we only emphasize on one particular parameter.

II. LITERATURE REVIEW

[1] Akshay Patil mentions vendor evaluation is of foremost important concept for better purchase management. Also, a sometimes criterion for a vendor selection or its performance evaluation is beyond Time, Cost & Quality parameter. The data has been collected by the means of questionnaire survey. Author has used Analytical Hierarchal Process (AHP) for the analysis of collected data which aims at quantifying the relative priorities for the given set of the alternatives on the ratio scale, based on judgment of decision makers and stresses the importance of initiative judgment of decision maker as well as consistency of the comparison of alternative decision making process.

[3]William Ho says that Supplier evaluation and selection problem has been studied extensively. Various decision making approaches have been proposed to tackle the problem. In contemporary supply chain management, the performance of potential suppliers was evaluated against multiple criteria rather than considering a single factor-cost. The author reviews the literature of the multi-criteria decision making approaches for supplier evaluation and selection. Related articles appearing in the international journals from 2000 to 2008 are gathered and analyzed so that the following three questions can be answered: (i) Which approaches were prevalently applied? (ii) Which evaluating criteria were paid more attention to? (iii) Is there any inadequacy of the approaches? Based on the inadequacy, if any, some improvements and possible future work are recommended. This research

not only provides evidence that the multi-criteria decision making approaches are better than the traditional cost-based approach, but also aids the researchers and decision makers in applying the approaches effectively.

[4] Mohammed Saada The author examines the early progress towards the adoption of supply chain management (SCM) relationships in construction. It was based on a literature reviewand survey of the views of construction practitioners. He contends that SCM has many of the features associated with 'fifth generation innovation'. The author suggests that although construction practitioners have some knowledge of SCM they need a better conceptual understanding of it and new and more systematic approaches to its implementation.

[5] Chengter Ho mentions in the study that supplier chain management is required to maintain the quality in construction industry. In this paper, asset of supplier selection and assessment criteria was adapted from Kannanand Tan (2002), to design the questionnaire for practical survey in Taiwan and Vietnam. The questionnaire for this survey was designed to find out how companies in the construction industry of Taiwan and Vietnam manage the relationships with suppliers and the actual range and importance of each criterion. Four hundred questionnaires were mailed to Taiwanand Vietnam construction companies, 200 in each area. Data from the survey were analyzed by using SPSS software version. Descriptive data analysis was conducted to investigate the actual rank of supplier evaluation and selection criteria. Hypothesis testing for equality of means was also used to discover the differences between Taiwan and Vietnam in rating the criteria. The results confirmed that non-quantifiable criteria play a very important role in the selection process and that the construction companies of Taiwan and Vietnam have come to an agreement in most of the criteria.

DATA COLLECTION

3.1 Method of Data Collection

Data collection has been done through approaching to a construction company who purchases all the materials for different works. Data has been collected in a tabular format as the requirement of weightage point method which focuses on Quality, Time & Price of supplier.

3.2 Data and Sources of Data

For this study primary data regarding supplier's Quality, Time & Price has been collected. The Data collection is done for the crucial material of the project such as cement& steel for any three vendors. Most commonly known parameters are quality, delivery, price and services. Each factor is assigned a weight which varies from vendor to vendor, depending upon the buyer's judgement about the importance of the factor.

The vendors which are selected for the cement are as follows:

1. S1- Gandhi Traders – Birla cement.
2. S2-Hiren Bhai - J. K Laxmi cement.
3. S3-Firdosh Cement Depo -Ultratech cement.

The three factors of quality, price and delivery are assigned individual weights of 40%, 35%, and 25% respectively for cement.All the data is listed in the flowing table.

Table 3.1: Data Collection in tabular format

Supplier	***Inspection Analysis***		***Price Analysis***			***Price Analysis***
	Lots Received	***Lots Accepted***	***Basic Price (Rs. Per Bag***	***Discount (%)***	***Transport***	***Deliveries missed (%)***
S1	1000.00	1000.00	295.00	-	-	-
S2	1000.00	980.00	285.00	-	-	30.00
S3	1000.00	975.00	300.00	-	-	50.00
Quality factor (%) =				30		
Price Factor (%) =				50		
Delivery factor (%) =				20		

3.3 Modified Data

As the weightage method implies on the Time, Cost & Quality parameter of a certain material, this study becomes lesser effective if we do not include the current trends of the market such as credit limit of time & cost for the materials, the selection of vendor becomes ineffective. In the interaction with the company representative for the data collection purpose, this study took turn around having credit analysis as a 4th parameter of the study. Importance of this parameter can be judged by knowing "Even if your supplier is giving you 10% discount but it is essential to know his payment terms." Hence, the original data was modified and included Credit as 4thparameter of the study which can be termed as sub-parameter of Time & Cost.

The four factors of quality, price and delivery are assigned individual weights of 25%, 45%, and 10% & 20% respectively for cement. All the modified data is listed in the flowing table.

Table 3.2: Modified Data Collection in tabular format

Supplier	Inspection Analysis		Price Analysis			Price Analysis	Credit Analysis	
	Lots Received	Lots Accepted	Basic Price (Rs. Per Bag)	Discount (%)	Transport	Deliveries missed (%)	Credit Time	Credit Limit in Cost
S1	1,000.00	1,000.00	295.00	-	-	-	30.00	10,00,000.00
S2	1,000.00	980.00	285.00	-	-	30.00	60.00	2,00,000.00
S3	1,000.00	975.00	300.00	-	-	50.00	90.00	15,00,000.00
Quality factor (%) =				25				
Price Factor (%) =				45				
Delivery factor (%) =				10				
Credit factor (%) =				20				

IV. RESULTS AND DISCUSSION

4.1 Method of Analyzing the data

For the purpose of the data analysis is weighted point method is used.

4.1.1Weighted Point Method

A vendor performance under the weighted point system is assessed on the basis of certain carefully selected factors. Most commonly known factors are quality, delivery, price and services. Each factor is assigned a weight which varies from company to company, depending upon the buyer's judgment about the relative importance of the factor. A typical evaluation criterion may be assign may be assign 30 points for quality, 20 for delivery, 50 for price s.it varies with needs of client.

The frequently used method is to determine each vendor's performance against each factor. The performance is expressed in terms of individual ratings called quality rating, delivery rating, price rating. The individual ratings are summed up to obtain the supplier's composite rating.

4.1.1.1 Quality Rating

Quality rating is measured in terms of percentage of lots accepted. Quality rating can be obtained by flowing formula.

$$\text{Quality rating} = \text{Proportion} \frac{\text{of lots accepted}}{100} \times \text{Quality factor weight in percentage.}$$

Table 4.1: Quality Rating for original data

QUALITY RATING					
Supplier	No. of lots received	Lots accepted	Proportion % of lots accepted	Factor Weight	Quality Rating
C1	C2	C3	C4	C5	C6 = (C4*C5)/100
S1	1,000.00	1,000.00	100.00	30.00	30.00
S2	1,000.00	980.00	98.00	30.00	29.40
S3	1,000.00	975.00	97.50	30.00	29.25

4.1.1.2 Price Rating

Price performance is measured in terms of percentage of lowest price to the price paid and calculated based on following formula.

$$\text{Price rating} = \frac{\text{Lowest price}}{\text{Price paid}} \times \text{Price factor weight in percentage}$$

Table 4.2: Price Rating for original data

PRICE RATING					
Supplier	Unit Price (Rs.)	Lowest price	C3 AS % OF C2	Factor Weight	Price rating
C1	C2	C3	C4=(C3/C2)*100	C5	C6=C5*C4/100
S1	295.00	285.00	96.61	50.00	48.31
S2	285.00	285.00	100.00	50.00	50.00
S3	300.00	285.00	95.00	50.00	47.50

4.1.1.3 Delivery Rating

Delivery performance is measured in terms of proportion of the performance promises fulfilled. Delivery rating equals the proportion of promises kept up, multiplied by the service factor weight in percentage.

Delivery rating= Proportion of commitments kept up x Services factor weight percentage

Table 4.3: Delivery Rating for original data

DELIVERY RATING				
Supplier	**% Deliveries missed**	**Proportion of promises kept**	**Factor Weight**	**Delivery Rating**
C1	***C2***	***C3***	***C4***	***C5=(C3*C4)/100***
S1	-	100.00	20.00	20.00
S2	30.00	70.00	20.00	14.00
S3	50.00	50.00	20.00	10.00

4.1.1.4 Composite Rating

Composite rating is the aggregate of quality rating, price rating and delivery rating.

Table 4.4: Composite Rating for original data

COMPOSITE RATING				
Supplier	***Individual Rating***			***Composite rating***
	Quality rating	***Price rating***	***Delivery rating***	
S1	30	48.31	20	98.31
S2	29.40	50.00	14	93.40
S3	29.25	47.50	10	86.75

Acceptance and the non-acceptance norms are then fixed which are applied to the composite rating. The acceptance norms generally vary from vendor to vendor, depending upon their needs.

Table 4.5 Category

Category	***Range***
A	96-100
B	91-95
C	86-90
D	81-85
E	76-80

Thus the supplier S1 is preferred because it has a highest rating.

4.2Modification of Weighted Point Method

As Discussed in section 3.3, The data has been modified with the inclusion of Credit Factor to the study. Now, the data was re-analyzed with assigning 25 points for quality, 10 for delivery, 45 for price& 20 for credit factor.

4.2.1 Quality Rating

Quality rating is measured in terms of percentage of lots accepted. Quality rating can be obtained by flowing formula.

Quality rating= Proportion of lots accepted x Quality factor weight in percentage.
100

Table 4.6: Quality Rating for Modified data

QUALITY RATING					
Supplier	***No. of lots received***	***Lots accepted***	***Proportion % of lots accepted***	***Factor Weight***	***Quality Rating***
C1	***C2***	***C3***	***C4***	***C5***	***C6 = (C4*C5)/100***
S1	1,000.00	1,000.00	100.00	25.00	25.00
S2	1,000.00	980.00	98.00	25.00	24.50
S3	1,000.00	975.00	97.50	25.00	24.38

4.2.2 Price Rating

Price performance is measured in terms of percentage of lowest price to the price paid and calculated based on following formula.

Price rating= Lowest price x Price factor weight in percentage

Price paid

Table 4.7: Price Rating for Modified data

PRICE RATING					
Supplier	***Unit Price (Rs.)***	***Lowest price***	***C3 AS % OF C2***	***Factor Weight***	***Price rating***
C1	***C2***	***C3***	***C4=(C3/C2)*100***	***C5***	***C6=C5*C4/100***
S1	295.00	285.00	96.61	45.00	43.47
S2	285.00	285.00	100.00	45.00	45.00
S3	300.00	285.00	95.00	45.00	42.75

4.2.3 Delivery Rating

Delivery performance is measured in terms of proportion of the performance promises fulfilled. Delivery rating equals the proportion of promises kept up, multiplied by the service factor weight in percentage.

Delivery rating= Proportion of commitments kept up x Services factor weight percentage

Table 4.8: Delivery Rating for Modified data

DELIVERY RATING				
Supplier	**% Deliveries missed**	**Proportion of promises kept**	**Factor Weight**	**Delivery Rating**
C1	***C2***	***C3***	***C4***	***C5=(C3*C4)/100***
S1	-	100.00	10.00	10.00
S2	30.00	70.00	10.00	7.00
S3	50.00	50.00	10.00	5.00

4.2.4 Credit Rating

Credit Rating can be measured in terms of Time & Cost both. It can be evaluated by Addition of Credit Time Rating & Credit cost rating

Credit Time rating= Highest time given among the suppliers' x Credit time factor in percentage

Individual time given by the supplier

Credit Cost rating= Highest Credit given among the suppliers' x Credit time factor in percentage

Individual Credit given by the supplier

Credit Rating = Credit Cost rating + Credit Time Rating

Table 4.9: Credit Rating for Modified data

CREDIT RATING											
Supplier	***Credit Limit***	***Time Limit (in Days)***	***Highest Credit Limit in Cost***	***Highest Credit Limit in Time***	***Factor for Cost***	***Factor for time***	***C4 AS % OF C2***	***C5 AS % OF C3***	***Credit Rating***	***Price rating***	***Final Rating***
C1	***C2***	***C3***	***C4***	***C5***	***C6***	***C7***	***C8=C2/c4***	***C9=C3/C5***	***C10=C8*C6***	***C11=C7*C9***	***C12=C10+C11***
S1	1,000,000.00	30.00	1,000,000.00	90.00	5.00	15.00	1.00	0.33	5.00	5.00	10.00
S2	200,000.00	60.00	1,000,000.00	90.00	5.00	15.00	0.20	0.67	1.00	10.00	11.00
S3	500,000.00	90.00	1,000,000.00	90.00	5.00	15.00	0.50	1.00	2.50	15.00	17.50

4.2.5 Composite Rating

Composite rating is the aggregate of quality rating, price rating and delivery rating.

Table 4.9: Composite Rating for Modified data

COMPOSITE RATING					
Supplier	***Individual Rating***				***Composite rating***
	Quality rating	***Price rating***	***Delivery rating***	***Credit Rating***	
S1	25.00	43.47	10.00	10.00	88.47
S2	24.50	45.00	7.00	11.00	87.50
S3	24.38	42.75	5.00	17.50	89.63

Acceptance and the non-acceptance norms are then fixed which are applied to the composite rating. The acceptance norms generally vary from vendor to vendor, depending upon their needs.

Table 4.9: Composite Rating for Modified data

Category	***Range***
A	96-100
B	91-95
C	86-90
D	81-85
E	76-80

Thus the supplier S3 is preferred because it has a highest rating.

4.3Conclusion

Here, As the comparison of Evaluation of supplier in section 4.2.5 & 4.1.1.4, it is known that with accurate allocation of factors of Time, Cost & Quality, one can select the appropriate vendor & also with the changes and modification in weighted point method we can have effective selection of vendor. With the use of such methods mentioned in this study, it prevents the selector or evaluator to become subjective about one particular criteria for selection.

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