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An Approach for Supplier Selection for Construction Companies Through Analytical Hierarchy Process

Engineering

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ABSTRACT

In this highly competitive environment, construction companies which design and manage their supply chains best will be more profitable and hence stronger. 'Supplier' is one of the most important components of a supply chain. A construction company which develops good relationships with its suppliers gain cost advantages through on-time and desired quality deliveries. Therefore supplier evaluation has a strategic importance for the construction companies. At present most of the construction companies are randomly selecting suppliers for the purchase of materials. The present approach of supplier selection does not consider all types of criteria. It also lacks on part of considering the relative importance of criteria while making a selection of the best supplier. This paper presents a supplier evaluation approach through the Analytic Hierarchy Process. Such approach may support supplier selection in the most scientific manner which considers the relative importance of various criteria for decision making.

INTRODUCTION

Suppliers have been acknowledged as the best intangible assets of any business organization However, selecting the right suppliers for a long term relationship is a relevant procurement issue that demands judicious attention.

The supplier selection problem has become one of the most important issues for establishing an effective supply chain system. Indeed, supplier selection and evaluation represents one of the significant roles of purchasing and supply management functions. One of the key elements essential to supply chain success is an effective purchasing function.

The purchasing function of a construction firm is central to materials management and especially includes the commitment of project funds for construction materials. Purchasing within an organization typically involves all activities associated with the buying process.

These activities include: determining the need, selecting the supplier, arriving at a proper price, specifying terms and conditions, issuing the contract or order, and ensuring proper delivery.

The step involving supplier selection is one of the most significant steps in the building construction process. Past literature and anecdotal evidence suggest that the main issue with materials purchasing is with supplier selection in the building materials industry, which depends on careful examination of supplier economics.

LITERATURE REVIEW

The objective of supplier selection is to identify suppliers with the highest potential for meeting a firm's needs consistently. In the past, several methodologies have been proposed for supplier selection problem. Weber and Ellram (1993) developed the use of a multi-objective programming approach as a method for supplier selection in just in time (JIT) setting. Weber and Current (1993) used multi-objective linear programming for supplier selection to systematically analyze the trade-off between conflicting criteria. In this model, aggregate price, quality and late delivery are considered as goals. Chaudhry et al. (1991) have used integer goal programming to solve the problem of allocating order quantities among suppliers. Liu et al. (2000) used data envelopment analysis (DEA) to compare the performance evaluation of different supplier for best selection. Kumar et al. (2002) have used fuzzy mixed integer goal programming for supplier selection problem. Wang et al. (2004) used the advantages of AHP and preemptive goal programming to incorporate both quantitative and qualitative factors in the supplier selection problem. Wadhwa and Ravindran (2007) proposed a supplier selection methodology that consists of 3 objectives, such as price, lead time and rejects. All of these objective functions are minimised. Vahdani et al. (2008) also presented a three step methodology based on balancing and ranking methods in supplier evaluation.

NEED OF INNOVATIVE SUPPLIER SELECTION MODEL:

To understand current practice of supplier selection, a survey was carried out on selected construction companies in the Gujarat state of India. Purpose of the survey was to study the methodology adopted by the middle level construction companies. Figure 1 given below shows the present approach used by construction companies in selection of best supplier.

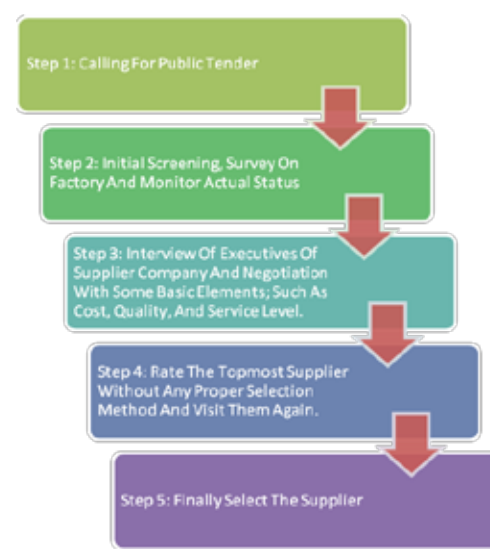

Figure 1 The present approach used by construction companies in selection of best supplier

From the study of current supplier selection approach, it is felt that stakeholders require support of scientific and mathematical technique. The present approach of supplier selection has following shortcomings:

- It does not consider a comprehensive set of criteria. Only a few criteria are observed and based on these criteria, the decision is

made which may prove wrong in the long run.
- At present relative importance of criteria is not considered in supplier selection.
- It does not collect sufficient data to evaluate a supplier. Very few data are collected instead of a thorough investigation and so the accuracy of the result is very poor.
- There is no subdivision of the criteria and so mutual comparisons among the subdivisions are absent here which may help the evaluation process to become more precise.
- It does not perform any quantitative analysis to assess the value of the supplier in most of the cases. For this reason it is extremely difficult to know the difference between the selected one and the others.

OF THE STUDY

This paper has an objective to develop criteria framework which contributes to supplier selection for construction companies. Secondly, it suggests the technique for supplier selection in Indian context.

CRITERIA FRAMEWORK FOR SUPPLIER SELECTION

Supplier selection depends upon many factors. Literature study and interview with construction professionals were carried out to prepare the hierarchical framework for supplier selection. Criteria which contribute towards supplier selection are divided in 8 major groups as: Quality, Cost, Delivery, Trust, Technical capability, Financial capability, Commercial capability and Managerial capability. These criteria are further subdivided into sub criteria. A final framework for supplier selection criteria is given in Figure 2.

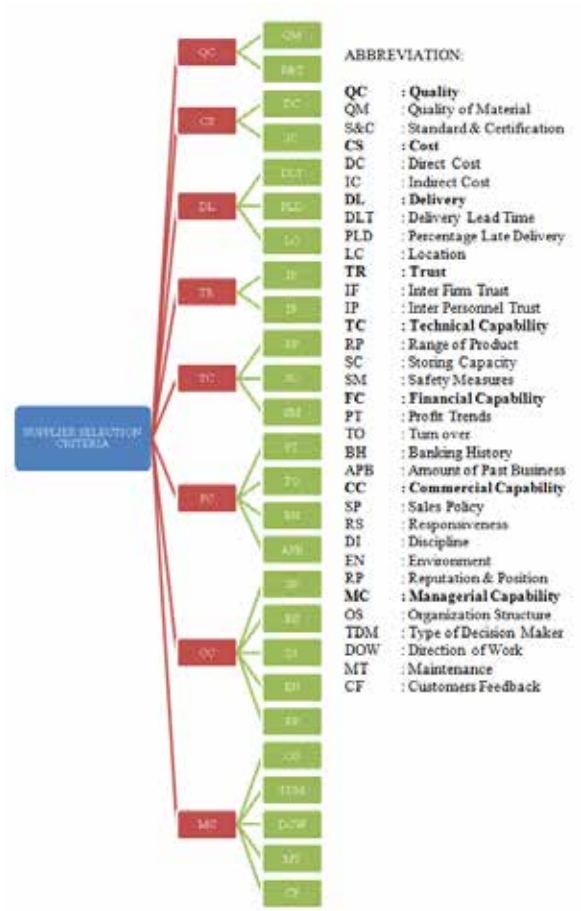

Figure 2. Framework for supplier selection criteria

ANALYTICAL HIERARCHY PROCESS:

The analytic hierarchy process (AHP) is a structured technique for organizing and analyzing complex decisions. Based on mathematics and psychology, it was developed by Thomas L. Saaty in the 1970s and has been extensively studied and refined since then. It has particular application in group decision making, and is used around the world in a wide variety of decision situations, in fields such as government, business, industry, healthcare, and education.

Rather than prescribing a "correct" decision, the AHP helps decision makers find one that best suits their goal and their understanding of the problem. It provides a comprehensive and rational framework for structuring a decision problem, for representing and quantifying its elements, for relating those elements to overall goals, and for evaluating alternative solutions.

APPLICATION OF ANALYTICAL HIERARCHY PROCESS:

It is widely used for decision making. AHP technique is widely applied to various fields as given below:

- Choice - The selection of one alternative from a given set of alternatives, usually where there are multiple decision criteria involved.
- Ranking - Putting a set of alternatives in order from most to least desirable
- Prioritization - Determining the relative merit of members of a set of alternatives, as opposed to selecting a single one or merely ranking them
- Resource allocation - Apportioning resources among a set of alternatives
- Benchmarking - Comparing the processes in one's own organization with those of other best-of-breed organizations
- Quality management - Dealing with the multidimensional aspects of quality and quality improvement
- Conflict resolution - Settling disputes between parties with apparently incompatible goals or positions

ADVANTAGES OF ANALYTICAL HIERARCHY PROCESS:

- It illustrates how possible changes in priority at the upper levels have an effect on the priority of criteria at lower levels.
- The method is able to rank criteria according to the needs of the buyer which also leads to more precise decisions concerning supplier selection.
- It provides the buyer with an overview of criteria, their function at the lower levels and goals at the higher levels.

PROCESS OF ANALYTICAL HIERARCHY PROCESS:

The procedure for using the AHP can be summarized as:

- Model the problem as a hierarchy containing the decision goal, the alternatives for reaching it, and the criteria for evaluating the alternatives.
- Establish priorities among the elements of the hierarchy by making a series of judgments based on pair wise comparisons of the elements. For example, when comparing potential real-estate purchases, the investors might say they prefer a location over price and price over time.
- Synthesize these judgments to yield a set of overall priorities for the hierarchy.
- Check the consistency of the judgments.
- Come to a final decision based on the results of this process

PROPOSED SUPPLIER SELECTION PROCESS:

Supplier selection is a multi-criteria decision making problem and hence AHP fits to it. It is suggested to use AHP technique for supplier selection. So, a survey questionnaire can be prepared based on AHP technique. It will require the experts to compare various criteria and sub-criteria on 1 to 9 scale. While doing this comparison they have to use their past knowledge and information of criteria as well as available suppliers. Following Figure 3 explains proposed AHP based supplier selection process.

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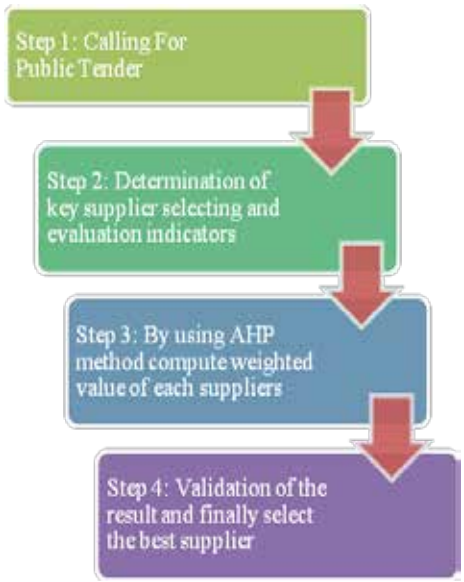

Figure 3 Proposed AHP based supplier selection process

CONCLUSION

The present trend of supplier selection by construction companies has certain shortcomings. It requires certain support of scientific technique in decision making. The present study has developed a framework of criteria which contributes for supplier selection. As supplier selection is a multi-criteria decision making problem, Analytic Hierarchy Process is suggested for the solution. AHP based supplier selection approach is suggested in this study. Such approach will be more comprehensive and will include the relative importance of criteria in the final decision making. Stakeholders are encouraged to use such innovative and simple tool like AHP to support their decisions which will finally help the project success achievement.

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