

Smart Decision Making Technique in Construction Supply Chain Management for Infrastructure Engineering Projects

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Abstract— In this competitive era, the infrastructure sector has shown its promising side and has reached new heights. Companies execute multiple projects at various locations. In this fierce competition, the Indian infrastructure industry is facing tough competition from its counterparts. Also, in this everchanging demanding era of globalization, the project manager needs to equip himself with latest trends and technologies in infrastructure sector. Thus, to thrive in this era the companies need to enhance its criteria's and management methodology, also strive for customer satisfaction and delight. To improve this scenario, the decision making process for the infrastructure sector has to be revamped. First it is important to know the factors (parameters) affecting the decision making in infrastructure projects. This paper explains the various decision criteria's in construction supply chain process and factors affecting each decision criteria. The study is carried out using questionnaire survey conducted across different companies in Pune and Nasik and also using face to face interview with managers and engineers and then subsequent analysis of the response from companies. The analysis of the study is the application of AHP to construction supply chain process and its utilization as an effective means for the formalization of knowledge possessed by competent, experienced practitioners. On the practical side, it guides them in making logical, consistent decisions, and provides a facility for all necessary calculations.

Index Terms - Analytical Hierarchy Process (AHP)

I. INTRODUCTION

In today's aggressive sourcing environment, organisations must select suppliers based on their value-added capabilities and not purely on competitive process of quality and price. Therefore, in order to select supplier who continually outperform the competition, suppliers must be carefully analysed and evaluated. When making these critical material and service decisions, the key issues that a supply manager faces can be classified as either mistakes or success factors. Infrastructure engineering companies know that it is important to improve the decision-making process in supply chain process. However, they do not know exactly how to improve the decision making in supply chain process in relation to the needs of the organization. One reason is that a lot of companies do not have knowledge of factors and performance measure, which can support decisions in this area. To improve the decision making in supply chain

process, first it is important to know the factors (parameters) affecting the decision making in construction supply chain process. Studies show that the poor material management is due to the inaccurate decision making during material management process. Hence for the effective material management system, it is vital to have accurate decision making during the process.

II. LITERATURE REVIEW

Review of literature on the material management process in the construction industry is discussed in these research papers. The investigation considered the entire range of activities necessary for procuring the needed material, starting with the estimating process and ending with site delivery, distribution and storage logistics. To improve the material management process on fast track projects, there needs to be an integrated material handling process from the design stage to the

usage of materials. The materials management of manufacturing can assist in formalizing that of construction and some of the developed detailed techniques can be adapted or readily applied.

S. Vignesh and S. Shanmugapriyain their paper explained the need of the improved technique in decision making in the construction industry. Construction lacks the proper assessment while decision making, so by using AHP various parameters have been studied and evaluation has been done and proper ranking and weightage has been calculated for various parameters.

Syama Krishnakumar and Linu T. Kuriakose in their paper explained various parameters which play an important role in decision making have been enlisted. Along, with the parameters various methods for decision making like Analytical Hierarchy Process, Analytical Network Process, TOPSIS method have been explained.

Akshay Patil and Prof. Madhav Kumthekar in their paper explained that there is no best way to evaluate or select a supplier. Thus, this paper, supplier evaluation system is explored, this paper studies various supplier selection methods. The methods enlisted are AHP, Linear Programming, Multi Objective Programming. AHP process is selected for evaluation and supplier selection.

Linda F. McHenry and W.C. Benton in their paper explained mistakes made by the organizations while making decisions have been pointed out and how these mistakes can be rectified are stated. It also suggests, realistic assessment of capabilities, expertise of the suppliers and the alternative strategies have been proposed.

Sangeetha S and Anila PV in their paper explained 39 criteria's which affect the supplier selection process were identified and the effects and relative importance of these criteria's on the supplier selection process were studied by interviewing the organizations with the help of a predefined questionnaire. Thus, it was found AHP integrated with TOPSIS method was the best method to select the supplier.

III.METHODOLOGY OF WORK

The research is intended to improve the decision-making process for the supply chain management in the construction industry. After the research was conducted various criteria's were deduced. These criteria's were then enlisted to form a questionnaire. Preparing a questionnaire containing all the aspects that play vital role in decision making. Interviews were conducted in various companies to evaluate their ideology of decision making. The preferences for projects at different stages i.e. Initial stage, middle stage and finishing stage were categorized with the help of a mathematical analytical method. Analytical Hierarchy Process (AHP) was found out to be the best mathematical analytical method. Thus AHP was used as the mathematical analytical method. The parameters were evaluated by their weightages and ranking by using AHP. Suggestion of modifications in the preferences will be provided to the participating companies. The entire research data was gathered through questionnaire survey carried out across different construction companies in Pune and Nasik. The questionnaire was sent to nearly 12 different construction firms out of which 5 people replied their responses, meaning that success ratio of survey was 41.6%. Face to face interview of 2 people were carried out keeping in view the main objectives of the study. Also, there were some limitations to the collection of data like availability of people for interview due to their busy schedule and work load they bear.

IV.GENERALFACTORS USED FOR SUPPLIER SELECTION, CONTRACT ALLOCATION

4.1 Cost:

The basic and one of the most important criteria for selecting a supplier or allocation of the contract. Companies often give order to the vendor who supplies material and services at the cheapest rate.

4.2 Quality:

This factor which is at the top most priority irrespective of the cost. The durability and customer satisfaction is decided by the quality of the raw material and make of the product.

4.3 Availability:

The stage of the project affects the priority for availability of the material. Ex. If the project is in initial stage then the availability of the product which is required at later stage is not a concern/priority.

4.4 Financial Position:

This parameter affects the majority of the project. Project delivery is totally dependent on this parameter. Also, the quality and grade of the project is dependent on this.

4.5 Availability of the labours / Work force:

The contract allocation depends on the work force that the contractor has. This allocation also depends on the delivery time and stage of the project.

V .DATA PRESENTATION AND ANALYSIS

The data collected is analysed and presented in this section. This section is intended to represent graphically the decision making process. Using AHP rankings and weightages of various parameters for different stages of infrastructure project of multiple companies were mathematically evaluated. For this evaluation, AHP excel sheet developed by Prof. Goepel is used. Thus bar graphs are made to enhance the data analysis for proper and easy understanding.

QUESTIONNAIRE

Project:
Developer:
Stage of the project:

Please rate the preferences according to the company policy and project stage.

Serial No.	Decision Node	Scale (1-10)
1.Selection of Supplier	Location of Supplier	
	Availability of Material	
	Business relations with supplier	
	Credit capacity	
2.Contract Allocation	Experience	
	Cost Effectiveness	
	Grade of Equipment	
	Work force	
	Reputation	
	Credit capacity	
3. When to order material	Availability of funds	
	Ordering material in advance	
	Availability of material at best cost	
4. How much to order	Availability of funds	
	Availability of material at best cost	
5. Material Selection	Ordering as per the requirement of the current stage of work	
	Cost	
	Quality	
	Availability	

*Scale of 10 being most important and 1 being the least important.

Fig 1: Sample Questionnaire

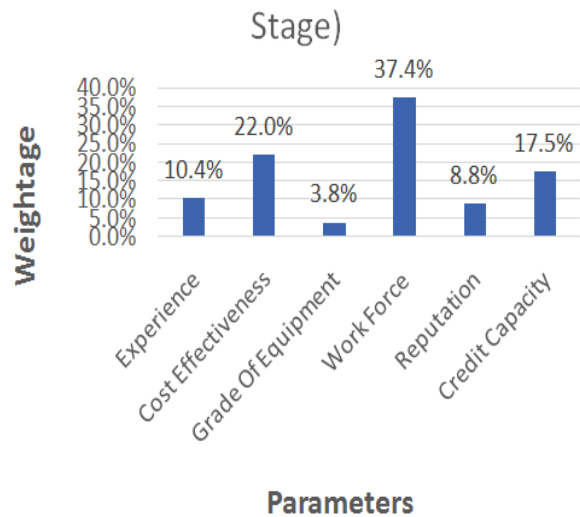


Fig 2: Graph for Initial Stage of Construction Project

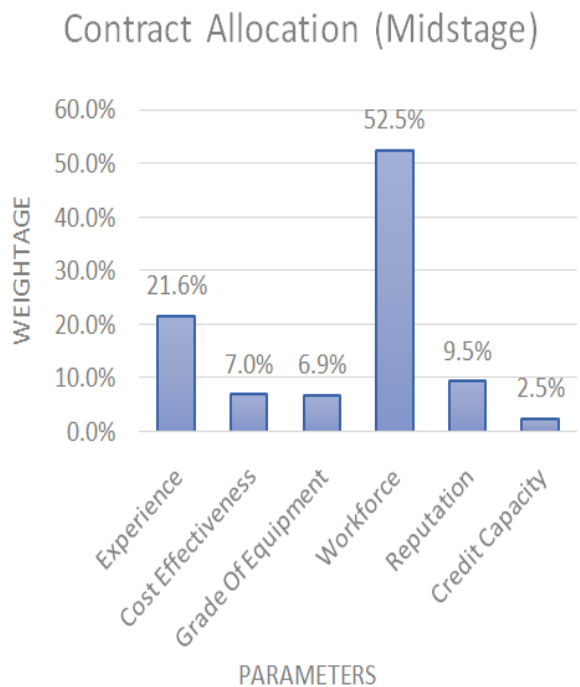


Fig 3: Graph for Middle Stage of Construction Project

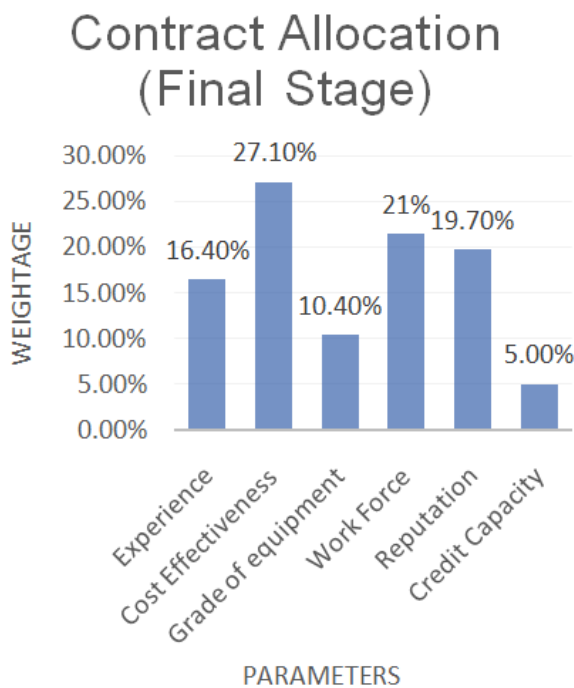


Fig 4: Graph for Final Stage of Construction Project

From the above graphs it can be seen the preferences of the companies for the projects differ according to the stages of projects. From Fig2, it can be seen that for the initial stage project, weightage is given to 'Work Force' by the infrastructure companies. From Fig 3, it can be seen that for projects in mid-stage, weightage is given to 'Work Force' and from Fig 4, it can be seen that for the project in completion stage the weightage is given to 'Cost Effectiveness' while allocating the contract for infrastructure project.

The various other parameters and its evaluation is being currently done and its output will presented soon.

CONCLUSION

The results found can give a practical approach to developers to optimise and reschedule a total inventory control and management on infrastructure projects. The research paper gives summary of various parameters and their method to prioritise and vary the decisions. This innovative concept of streamlining decisions can lead to effective and precise execution of a project. This

research is an attempt to highlight total quality management required for large scale infrastructure companies. The method suggested can be effectively implemented on multinational large scale projects.

REFERENCES

- [1] Krishnakumar S. and Kuriakose L, "Supply Chain Management in Construction Industry", 'IJSER Volume 4 Issue 3, March 2016'.
- [2] Erande S and Pimplikar S, "Total Quality Management in Indian Construction Industry", 'IRJET Volume 3 Issue 6, June 2016'.
- [3] Vignesh S and Shanmugapriya S, "Improvement in decision making process in construction supply chain management using analytical hierarchy process", 'IJETA Volume 6 Issue 4, April 2016'.
- [4] Tyagi N and Shrivastava P "Effectiveness of Quality in Supply chain management", 'Novelty Journals Volume 2 Issue 2, May 2015'.
- [5] Anila PV and Sangeeta S, "Supplier Selection in Construction Industry using AHP integrated with TOPSIS method: A case study", 'IJRSET Volume 5 Issue 8 August 2016'.
- [6] Wani D, Master's Candidate in Operational Excellence at University of Applied Sciences, Hof Germany
- [7] Vrijhoef R and Koskela L.
- [8] Prof. Goepel KD, BPMG, Singapore
- [9] Anderson J and Wemner T, "Strategic Decision – Making Model for supply chain.
- [10] Gorener A, "Comparing AHP and ANP: An application of Strategic Decisions making in a manufacturing company", 'International Journal of Business and social science Volume 3 Issue 11 June 2012'.