

Contractor Performance Evaluation in Construction Industry

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Abstract- Contractors are a significant part of any of the Construction development business. Contractor's performance evaluation is basically identifying and assessing the quality of work performed. The idea behind the performance evaluation is to improve the efficiency of the contractor performance incorporating the endeavour to build contractor performance assessment in development projects and the evaluation is incorporated with the survey with various managers and trades working on site with a questionnaire survey differentiating various activities in construction. The research report aims to improve contractor's performance. The questionnaire survey is prepared by collecting data using literature survey, check list, etc., and then they are categorized upon their occurrences at different stages of construction work. It is important to rank the activity performance to give us the priority in evaluation process and work on it to enhance the efficiency. Ranking is done logically by methods such as various indices, analytical hierarchy processes, fuzzy logics, etc., and a questionnaire survey is prepared and then the collected data is analyzed giving the end result depicting 6 main factors affecting the performance like "knowledge, Quality, Timely Performance, Effectiveness of Management, Compliance with safety standards, Accuracy of billing". In this paper questionnaire survey is prepared and key performance indicators are identified and measures to increase the efficiency of contractor's performance are given.

Keywords- Performance Evaluation, Contractor's performance, Relative Importance Index, Construction Performance.

I. INTRODUCTION

Construction activities play a vital role in the economic growth of a country in terms of contribution to the gross domestic product (GDP), employment and market for material produced by other sectors of industries [1,5]. Performance Evaluation topic in construction industry is of utmost importance which is often discussed but rarely defined. Performance evaluation is basically defined as a measurement of quantification of efficiency and effectiveness of action. The process and action on it leads to a better performance and

hence a excellent end result product [6]. This is a very broad definition for performance evaluation. Traditionally performance evaluation was used to control the businesses. On the later stages new factors were considered in performance as quality, time, cost, flexibility, safety of project sites, site disputes, environmental impact, client satisfaction [5,6].

However, considering the construction projects it is always found that the projects are rarely completed without any rework on them also, neither of them are completed in time and in the budgeted cost and the construction activities are considered as one of the most unsafe activities of any industry. The construction industry always aims of achieving the 5 objectives of effectiveness, efficiency, relevance, impact, and sustainability. Performance evaluation also helps in avoiding poor quality construction hence mitigate the increased costs and delays in project. Traditionally the performance evaluation was only to achieve economic objectives but now in construction it is closely related with the performance of the contactors working on site. If we get the best performance from the contractors working on site it will always lead to achieve the economic objectives.

Now, here in this study we will be doing the performance evaluation with the accepted facts that businesses perform better if managed through formalized, balanced and integrated measures. The concepts of performance measurements are developed to improve the performance of businesses [29]. This study includes the attempt to develop the contractors performance evaluation in construction projects and the measurement is incorporated with a questionnaire prepared depending on the literature reviews and then rank this depending on their relative importance and analyzing them on different projects and hence formulating a recommendation to solve the future challenges related to performance of contractors in construction industry [5].

II. OBJECTIVES

1. To identify major critical barriers in performance of contractors in construction and provide remedial measures

to maintain the efficiency of contractors in construction work through literature survey.

- To design Questionnaire based on findings of literature survey.

III. DATA COLLECTION

Contractor performance evaluation were done on the basis of literature review and questionnaires were distributed amongst field experts. A criterion for respondents was of minimum 10 years of experience. In all the questionnaires were distributed to 120 field experts, out of which 90 questionnaires were received.

1. EXPERT OPINION

While distributing the questionnaires, stakeholders were projected. All the stakeholders from contractor, site engineer, project manager and owner were taken into consideration. Questionnaire was formulated on 5-point Likert scale from 1 to 5 ratings representing as Very Low, Low, Moderate, High and Very High respectively.

2. TYPES OF RESPONDENTS

From the total experts 30% of respondents were owners, 50% project managers, 20% senior site engineers.

3. EXPERIENCE OF FIELD EXPERTS

Among the total respondents 40% of the respondents have 10 to 20 years of experience, 30% of respondents have 7 to 10 years of experience and 30 % of respondents have 5 to 7 years of experience.

IV. DATA ANALYSIS

For the performance rankings two methods are used like Relative Importance Index and Geometric mean Method (AHP). The details of these methods are as follows:

A. RELATIVE IMPORTANCE INDEX

Also, for Comparison Relative Importance Index (RII) by following formula, was also adopted.

$$RII = \frac{\sum_{i=1}^5 w \times x}{A \times N}$$

Where,

w: Weighting given to each factor by respondents and its ranges from 1-5

x: Frequency of it response given for each factor

A: Highest weight (i.e. 5 here)

N: Total no. of respondents

Suppose impact value given by 3 respondents were 5, 5 respondents gave value of 2 and 2 respondents gave value of 4 on a 1-5 point likert scale. The RII will be

$$RII = \frac{(3 \times 5 + 5 \times 2 + 2 \times 4)}{(5 \times 10)}$$

$$RII = 0.66$$

4.2 GEOMETRIC MEAN-AHP

The geometric mean of a data set {a1, a2... an} is given by:

$$GM = \sqrt[n]{a_1 \cdot a_2 \cdot \dots \cdot a_n} \text{ or } (a_1 \cdot a_2 \cdot \dots \cdot a_n)^{1/n}$$

For example, in a set of four numbers {1, 2, 3, 4}, the product of 1 X 2 X 3 X 4 is 24, and the geometric mean is the fourth root of 24, or 2.213. The exponent on the left side is equivalent to the taking nth root.

The geometric mean of a data set is less than the data set's arithmetic mean unless all members of the data set are equal, in which case the geometric and arithmetic means are equal.

From the calculation Ranking of the risks was given on the basis of Geometric Mean and RII. It was observed that both the method showed the similar ranking. This confirmed that Ranking is done accurately. Next step is to determine the weight of each factor. Weights are determined by applying AHP technique. First a pair wise comparison matrix is design. A pair wise comparison matrix, square matrix, compares the important of one alternative over that.

$$Weight1 = \frac{R01}{R01}$$

$$Weight2 = \frac{R02}{R01}$$

After calculating all the weights ranking was given as per the smallest value of sum of weights.

Table 1 Sample Calculations of AHP

Section 1: Knowledge		
Evaluation	1.1	1.2
1.1	1.00	1.07
1.2	0.93	1.00
Σ	1.93	2.07
Rank:	1	2

As you can see the major difference between RII and AHP is that in RII greater the value greater is the Impact whereas in case of AHP smaller the value greater is the impact. As per the comparison results from both method is same. Hence we can go for mitigation measures for the most important evaluation factors making higher impact.

V. RESULT AND DISCUSSION

Table 2 Comparison of AHP & RII

	RII	AHP
Section 1: Knowledge		
Knowledge of work/specification/IS standards	0.93	1.93
Knowledge of Work Performed	0.88	2.07
Section 2: Quality		
Workmanship	0.80	4.60
Quality of Contractor's Record Keeping	0.76	4.82
Use of Specified Materials and Ratio of mixes	0.72	4.83
Control on Wastage	0.74	5.32
Project Cleanliness/ Housekeeping	0.70	5.34
Section 3: Timely Performance		
Adherence to Project Schedule	0.82	4.84
Response to instructions/requirements	0.74	5.03
Submission of progress reports (DPR, MPR etc.)	0.64	3.93
Required material availability	0.72	4.89
Completion of Snag list Items	0.72	4.94
Section 4: Effectiveness of Management		
Cooperation/Communication with site incharge	0.86	6.62
Coordination and Control of labour by contractor	0.80	6.77
Attendance at Project Meetings	0.88	6.43
Project Workforce Experience	0.78	6.74
Adequate Equipment to Perform Work	0.80	6.96
Storage of Materials/ Equipment	0.90	7.46
Availability of required labour	0.72	8.34
Section 5: Compliance With Safety Standards		
Adequacy of Safety Measures	0.86	2.01
Corrective actions taken on instructions	0.80	1.99
Section 6: Accuracy of billing		
Accuracy of Contractor's Billing	0.86	2.00
Manner in Which Contractor Determined Price for extra item	0.92	1.85

All the factors in the respective evaluation of contractor's performance in construction are ranked as per the weights and further used for providing mitigation measures. According to analysis factors in each stage of evaluation which should be given priority are:

Table 3 Most Important factors at evaluation of contractor's performance

Factors	Description
Section 1: Knowledge	Lack of Clarity about framework and restriction under which Project is to be implemented.
Section 2: Quality	Contractors weak performance directly affects on quality of work.
Section 3: Timely Performance	Delay due to budget approvals from concerned authority
Section 4: Effectiveness of Management	Various permissions to be obtained from Authorities are not clearly identified
Section 5: Compliance With Safety Standards	Lack of safety precautions resulting into serious accidents
Section 6: Accuracy of billing	Delay in payment.

VI. MITIGATION MEASURES

Table 4 Performance Mitigation Measures

Factors	Description	Recommendations as Mitigation Measures
Section 1: Knowledge	Lack of Clarity about framework and restriction under which Project is to be implemented.	Knowledge incorporation for fruitful ventures, associations, and cycle bunches has additionally been expressed as the central component of venture mix the board and project the executive's execution. Contractor's performance is mainly based on his knowledge of work Specification and Work Standards.
Section 2: Quality	Contractors weak performance directly affects on quality of work.	Quality control in construction typically involves insuring compliance with minimum standards of material and workmanship in order to insure the performance of the facility according to the design.
Section 3: Timely Performance	Delay due to budget approvals from concerned authority	Disorganization at the site can badly hamper the quality and performance of the work and progress of the project. Timely organization of every activity in the project such as well documented plan, orderly worker's deployment, timely monitoring the project progress and hence can be used in evaluation of the performance of the contractors.
Section 4: Effectiveness of Management	Various permissions to be obtained from Authorities are not clearly identified	Knowledge sharing is one of the basic techniques that can help well-being in the construction business. There has been tracked down a huge gap between the management personnel and the contractors. The absence of correspondence happens because of lack of communication between senior management and representatives, lack of sharing data about the losses and the reasons for deaths with the workers, keeping them clueless about the insurance policies, and not informing about the new techniques in the field that can help laborers in performing without any problem.
Section 5: Compliance with Safety Standards	Lack of safety precautions resulting into serious accidents	The goal of the appraisal of safety execution is to gauge the organizations' readiness in controlling the number of rates of mishaps and fatalities coming about because of dangers by laying out safety targets and objectives.
Section 6: Accuracy of billing	Delay in payment.	The expense of construction is essentially the expense of cash, the expense of material, the expense of work, and the expense of management. The main three elements distinguished by the overview results for example Change in costs of crude materials, Unstable expense of fabricated materials, High expense of apparatus are markets related issues.

Contractors and Managers can determine where the dangers may happen. This gained knowledge spreads from one construction project to another. Contractor's agreement with the goal that the individual who starts the work are the one to complete it. Experts are used for undertakings where execution or results incredibly impact security. Therefore, experience of one's own or others' mishaps expand the measures of safety.

Contractors working on site are mostly illiterate and work only in practical sense without any documented form.

They mostly work on the daily wages so have less knowledge regarding the contract documents. Hence, make it difficult to adhere to the compliance with the contract document. If the contractors are given a proper knowledge regarding the contract prior to the work would improve the performance of the work and avoid delays in the project. Many contractors do not read the contract documents what they are supposed to do in a particular project and do the work as per regular way therefore creating confusion while working on site and affecting the performance.

While evaluating for the performance of contractor with respect to contract it was also noticed that in some contracts the work scope is not mentioned clearly by the builder or the client which also creates disputes among the contractor and builder and at the later stage it is either the contractor or the builder who suffers in terms of money and the purchaser suffers in terms of delay in the project due to lack in performance and the blame usually comes on the contractor.

It is always necessary to have a well-planned and descriptive work scope in the contract to avoid any delays due to contract. To have a well-planned contract both the parties should be equally responsible and make the terms on practical basis.

VII. CONCLUSION

The research paper includes the performance evaluation of the contractor in the building construction project in different the types of activities performed in construction. All the activities in the construction progress were given points by the specialized personnel in that specific field and construction managers and hence critical factors were determined. This helps in focusing on the critical factors on the specific stage of construction. Then appropriate measures were given to enhance that factor and hence increase the efficiency and quality of work.

Considering the findings and inferences above in the research report, further analysis and evaluation can be carried out using qualitative and quantitative assessment. With the help of qualitative assessment, the preventive measures can be adopted to increase the efficiency of specific performance factor in the construction industry.

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