INVESTIGATION OF DELAY FACTORS IN CONSTRUCTION PROJECT BY RII METHOD

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Abstract

A construction project is commonly acknowledged as successful, when it is completed on time, within budget, in accordance with the specifications and to stakeholder's satisfaction. In construction industry, contractors tend to maximize their profit for market growth. To achieve this aim, it is crucial for contractors to carefully identify the factors that affect the success of project and estimate their impacts before the bidding stage. Delay means non-completion of the project within the specified duration agreed on contract. Total 61 causes were identified under 9 major groups. Total 60 respondents comprises of 16 owners, 17 contractors and 13 architects & 14 Consultant who participated in this field survey. This paper suggests an approach to carry out ranking of causes of delay by techniques Relative importance index. We distributed a total of 100 questionnaires and received 60 responses, the analysis of which resulted in determining top 5 factors causing maximum delays in project completion. The top five results have been tabulated in the paper and their subsequent conclusions and recommendations have been provided here as well. It is hoped that the findings of the paper will help the stakeholders to act on critical causes and try to reduce delay of their projects.

Keywords-Construction Project; Stakeholders; Relative Importance Index; Delay Factors; project completion

I. INTRODUCTION

The Real Estate industry is the backbone of any nation's economy, but the industry suffers humungous losses due to delays in project completion. Due to these delays the overhead costs for the projects keep on increasing and keep piling up. Economics is a very important part of Real Estate industry and it greatly influences many aspects of construction ranging from the cost of materials to purchase and scrapping of equipment, bonus and/or penalty clauses and so on. Thus minimizing the overhead costs by timely completion of the project is a big challenge faced by the industry. A construction project is commonly acknowledged as successful, when it is completed on time, within budget, in accordance with the specifications and to stakeholder's satisfaction. In construction industry, contractors tend to maximize their profit for market growth. To achieve this aim, it is crucial for contractors to carefully identify the factors that affect the success of project and estimate their impacts before the bidding stage. Construction projects may differ in size, duration, objectives, uncertainty, complexity, pace and some other dimensions. Delay means non-completion of the project within the specified duration agreed on contract. It is widely accepted that construction project schedule plays a key role in project management due to its influence on project success. Delays are common in various construction projects and cause considerable losses to project parties. The common results of delays are: Late completion of project, increased cost, and disruption of work, loss of productivity, third party claims, disputes and abandonment or termination of contracts. The Relative Importance index (RII) is a structured technique for organizing and analyzing complex decisions, based on mathematics and psychology. The RII method helps decision makers categorize the major delay factors through detailed literature review and interview with experts in construction industry. An interview Questionnaire is prepared or developed to assess the perception of the construction industry on relative causes of delays. Then, the questionnaire is filled by experts from the industry. The losses due to delays and mismanagement , costs the Real Estate Industry in India potentially crores and crores of rupees so it is of utmost importance to find a solution for these problems.

II. OBJECTIVES

➢ To Interview Experts of the Field to Answer the Questionnaire.
➢ To Categorize and Identify the Delay Factors in Construction Project and give rank by RII (Relative Importance Index)
➢ To Study for Minimizing the Delays in Construction Project.

III. DELAYS IN CONSTRUCTION

Unplanned deferment of a scheduled activity because of something or occurrence that impedes its commencement or continuation. Delay usually has time-associated cost effects on a contract which may be measured in terms of time, money, or a combination thereof. Delay could be defined as the time over run either beyond completion date specified in a contract or beyond the date that the parties agree upon for delivery of a project. It is a project slipping over its planned schedule and is considered as a common problem in construction projects. A delay in an activity may not result in the same amount of project delay. A delay caused by a party may or may not affect the project completion date and may or may not cause damage to another party. A delay may occur concurrently with other delays and all of them may impact the project completion date. Delays caused by the client such as late submission of drawings and specifications, frequent change orders, and inadequate site information generates claims from both the main contractors and subcontractors which many times

entail lengthy court battles with huge financial repercussions. Delays caused by contractors can generally be attributes to poor managerial skills. Lack of planning and a poor understanding of accounting and financial principles have led to many a contractor's downfall.

3.1. Reasons/Causes for Delays

In construction projects, as well in other projects where a schedule is being used to plan work, delays happen all the time. It is what is being delayed that determines if a project, or some other deadline such as a milestone, will be completed late. There are many reasons for delay in completion of a project, here are some which have been identified and categorized by various researchers such as Consultant Related Factors category, Contractor Related Factors, etc.

Previous studies mentioned above were generally focused on finding causes of delays. Some of these studies identified very limited (lacking) factors or ignored some important groups. This may be misleading, or may result in wrong analysis.

3.2. RII Method.

This definition considers only the relative contribution of a variable to total predictable variance and makes no assumptions about either the statistical significance or practical significance associated with a particular predictor. Information regarding a variable's contribution to predictable variance is helpful when considering the practical utility of a variable, but aspects of the particular situation must also be considered to fully gauge practical importance.

RII"s are calculated for each factor as in equation:

RII= ΣW / (A*N)

The symbols in this formula stand for the following concepts:

RII: Relative importance index.

W: Weighting given to each factor by the respondents (ranging from 1 to 4).

A: Highest weight (i.e. 4 in this case).

N: Total number of respondents.

The RII value had a range from 0 to 1 (0 not inclusive), higher the value of RII, more important was the cause of delays.

Multiple regressions is perhaps the most frequently used statistical tool for the analysis of data in the organizational sciences. The information provided by such analyses is particularly useful for addressing issues related to prediction such as identifying a set of predictors that will maximize the amount of variance explained in the criterion.

IV. ANALYSIS OF QUESTIONNAIRE

The score assigned to each factor by the respondents represents the extent to which the factor contributes to overall delays on a typical project. This suggests that the factors can be prioritized. However, using the Relative Importance Index (RII) Method, the data were subjected to statistical analysis for further insight.

A. DATA COLLECTION

The target population included civil engineering and buildings construction firms of central Gujarat region of India. The architects, contractors and developers of various Vadodara and of various cities of Gujarat who work in Vadodara were targeted for survey. The details of various stakeholders and total numbers of were collected through internet. These details were considered as size of population to decide sample size of study.

We distributed over a 100 Questionnaires, out of which we received 60 questionnaires. The analysis of these questionnaires helped us calculate the Relative Importance of each clause. We received responses from a pretty diverse group of professionals ie owners, contractors, builders, architects, consultants, etc.

B. Relative Importance Index technique:

We used the Relative Importance Index method to determine the relative importance of the various causes and effects of delays. The same method is going too adopted in this study within various groups (i.e. clients, consultants or contractors). The four-point scale ranged from 1 (less important) to 4 (extremely important) is adopted and transformed to relative importance indices (RII) for each factor as follows:

$$RII = \Sigma W / (A*N)$$

Where, W is the weighting given to each factor by the respondents (ranging from 1 to 4), A is the highest weight (i.e. 4 in this case), and N is the total number of respondents. The RII value had a range from 0 to 4 (0 not inclusive), higher the value of RII, more important was the cause of delays. The RII was used to rank (R) the different causes. These rankings made it possible to cross-compare the relative importance of the factors as perceived by the three groups of respondents (i.e. developer, consultants and contractors). Each individual cause's RII perceived by all respondents should be used to assess the general and overall rankings in order to give an overall picture of the causes of construction delays in Indian construction industry.

4.1. Example of Calculation.

For Example: The analysis & calculations for the CONTRACTOR Respondents reveals that the primary cause of delay is caused by the OWNER GROUP and the factor "delays in payment progress from the owner's side" is the leading factor. The calculations were done as follows, Firstly the factors were ranked according to their importance so from very important to not important and assigned numerical value from 4 to 1 respectively. Then all the data was collected and tabulated, which revealed how many respondents selected this particular factor and their responses were added to conclude the Net Weightage for each factor then the RII formula was applied and the final Relative Importance was found. So for this particular OWNER FACTOR in CONTRACTOR's Responses the individual weightage of that clause were added as shown below:

Weightage

=2+2+4+4+4+4+2+4+4+4+4+4+4+4+4+4

=62

Then RII Formula was applied as shown below:

RII

=62/(4*17)

=0.91

,Where
62 = Total Weightage for that Particular Clause
4 = An (The highest Weightage)
17 = No. Of Responses (for Contractors only)

V.   RESULT BY RII METHOD

Sr.No	Group	Causes of delay	$\sum Wn$	RII Result
1	Equipment	Shortage of equipment	190.00	0.81
2	External	Accident during construction	190.00	0.81
3	Contractor	Poor site management and supervision by contractor	188.00	0.80
4	External	Delay in obtaining permits from municipality	187.00	0.79
5	External	Effects of subsurface conditions (e.g., soil, high water table, etc.)	185.00	0.78

Table 5.1:   TOP 5 FACTORS AFFECTING DELAYS IN CONSTRUCTION

VI.   CONCLUSION & RECOMMENDATION

Delays can be avoided or minimized when their causes are clearly identified. The aim of this report was to identify the delay factors in construction projects, since delays are considered to be a serious problem in the construction industry. The paper addressed the most significant factors and groups to cause delays. The most and the least important factors and groups were achieved through ranking results.Top five ranks are given by RII Technique which are most responsible for delay of construction project. These causes are:

(1) **Shortage of equipment**
(2) **Accident during construction**
(3) **Poor site management and supervision by contractor**
(4) **Delay in obtaining permits from municipality**
(5) **Effects of subsurface conditions**

According to the findings above, following points can be recommended in order to minimize and control delays in construction projects:

1) Advance arrangement of equipment's should be made or equipment should purchase on rent.
2) The quality and experience of labor supply can have major impact on the projects. Unexperienced labor may lead to inefficient work and may cause accidents during construction.
3) Site management and supervision should be made in a correct manner. Administrative staff should be assigned to make necessary arrangements to complete the project within specified time while satisfying required quality and estimated cost.
4) Approval of design documents should not be late, since it could delay the progress of work. Progress payments should be made on time to contractor to finance the work.
5) Finding out G.L. water pipe connection leakage and quickly take appropriate action consulting with structural engineer like (Pile foundation, providing impervious layer etc.)

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