

# IMPACT OF UNCERTAINTY FACTORS IN CONSTRUCTION PROJECTS

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## **ABSTRACT**

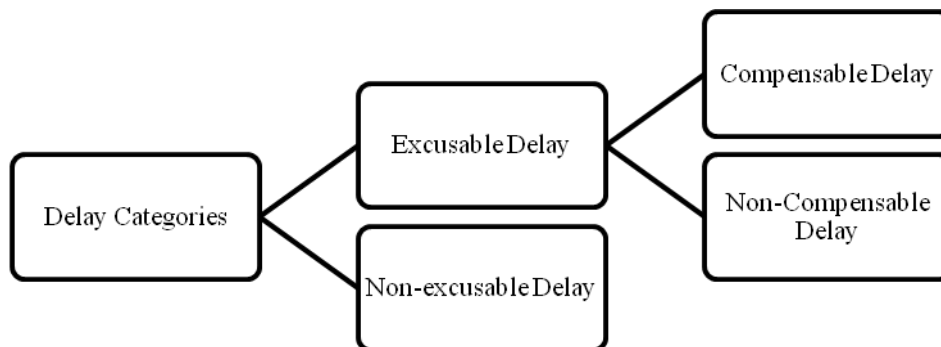
*Research on uncertainty in construction has emphasized the importance of incorporating uncertainty factors in project cost and time forecasts. Delays are always measured as expensive to all parties concerned in the projects and very often it will effect in clash, claims, total desertion and much difficult for the feasibility and it slows the growth of construction sector. For analyzing the causes of delay, an evaluation on construction project's time performance was conducted. The main intention of this study is the identification of factors of delay and their effects on the successful completion of project. However, little attention has been paid to identification and quantification of the specific factors. The present paper focuses on an assessment of the effect of uncertainty on the outcomes of planning. The factors influencing the planning of the construction projects which then ultimately causes delays in the projects. This paper mainly focuses the important uncertainty factors that cause delays in construction projects. Literature reviews and interviews are used as a tool for identifying the uncertainty factors. Totally 18 uncertainty factors were identified and the root causes for the top factors will be found and recommendation and suggestion will be provided to the companies.*

**Keywords :** *Construction Industry; Delays; Planning; Relative Importance Index; Root Causes; Uncertainty.*

## **I. INTRODUCTION**

Planning is a bridge between the experiences of the past projects and the proposed actions that produces favorable results in the near future. It can also be said that it is a preliminary precaution by which we can reduce undesirable effects or unexpected happenings and thereby eliminating confusion, waste of resources, and loss of efficiency. Planning includes prior determination of activity, specification of uncertainty factors, forces, effects and relationships necessary to reach the desired goals. Planning should be done logically, effectively, thoroughly and honestly to have a chance to succeed. The previous experiences of projects provide basic planning logic. Then difference between previously completed projects and current projects shall be known to make any exceptional features in the basic planning logic. These differences can be undesired client requirement, out of the way location, possible external or internal delaying factors. The construction delay is a universal evident reality not only in India however all the countries faced this global fact. Construction delay can be defined as execute later than intended planned, or particular period, or letter than specific time that all the concerned parties agreed for construction project. Delay in project is counted as a common problem in construction projects. On large level there is no suspicion that the development of country depends upon its achievement of its advance

plain with elevated construction contents. There is a Famous dictum “when the construction industry prospers everything prospers”. Terry Williams (2003) discovered that there are units 3 basic ways that classify delays.



**Fig 1-types of delays**

The project’s success depends on meeting objectives within time and budget limits. Tools and techniques play important role in project management. The major factor of construction problems is project’s delay. Delay means loss of income according to and for the owner or client. In case of contractor, delay leads to the higher costs due to longer working time, labor cost increase and higher fabrication costs. On time completion of project is an indicator of efficiency. But there are many uncertainty factors and variables resulting from various sources affecting construction projects. Delays are one of the biggest problems which construction firms face. The problem of delay in the construction industry is a global phenomenon. Keeping construction projects within estimated costs and schedules requires sound strategies, good practices, and careful judgment. However, to the have an aversion to of owners, contractors and consultants, many projects experience extensive delays and thereby exceeds initial time and cost estimates.

## **II. OBJECTIVES OF STUDY**

The focal objectives of this study include the following:

1. To identify the uncertainty factors that influences the planning and causes delays in construction projects in Indian scenario.
2. To rank uncertainty factors that causes delays by RII (relative importance Index) method and to find out the root causes for these factors.
3. Mitigation for the top 5 uncertainty factors and implementing the solution in construction projects.

## **III. LITERATURE REVIEW**

A numerous of studies have been carried out to determine the causes of delays in construction projects.

Ali S. Alnuaimi and Mohammed A. Al Mohsin(2013)<sup>[1]</sup> a field study was conducted on a number of construction projects in muscat area to identify problems resulting from delays in completion of construction projects. The data collected was classified into two groups of the project, the first group includes the project constructed during the period 2007-2008 and the second group comprised projects constructed during the period 2009-2010. Percentage of delays have been calculated for each project constructed in these periods and both the period where compared. It was founded that 40 percent projects in both groups have experienced delay in completion.

Alwi and Keith (2003)<sup>[2]</sup> have identified the important causes of delays in building Construction projects in Indonesia. A detailed questionnaire survey was carried out targeting 89 respondents from large contractors and 23 respondents from small contractors. The respondents were asked to predict the level of effect the 31 potential delay causes on their projects. Major critical delay factors were grouped into six major groups. The results showed that the large and small contractors generally agree on the importance ranking of the individual delay factors. In relation to the groups of the delay variable, however, result showed that there is no agreement between the two groups of contractors. The results of this study is professional management group was ranked the highest and the external groups were ranked the lowest by large contractors. Whereas, the small contractors ranked the design and documentation group as the highest and the execution group as the lowest.

Enas Fathi Taher and R.K.Pandey (2013)<sup>[3]</sup> they have identified and ranked delay causes in the planning and design phases. A well structured questionnaire was sent to engineers at the Architect/Engineering companies for public construction projects in India. This study has identified the delay causes and analyzed the importance and the frequency of delays using the relative importance index. Analytical results shows that changes in client's requirement are the main cause of delays in both planning and design phases. The factors that were affecting have been categorized into contractor related delay, client related delays and material related delays and labour related delays. This literature has suggested good management and management of these causes can minimize the delays of the projects.

Hitendra R. Gavhale (2013)<sup>[4]</sup> they have evaluated specific schedule impact scenario on a single project Mumbai Metro Rail Project (MMRP) is taken as case study. The source of delay cost of delay and methods to mitigate delays were studied. The questionnaire survey covering delays and disputes was developed and presented to construction professionals. Questionnaire covers various factors influencing delays attributed to client, contractor, consultant, material related, labour related, equipment and other external factors. The responses to questionnaire were analyzed by Rank Index(I). The survey results implies the effect of delays in time overrun of the project, cost overruns, disputes, arbitration, Litigation and total abandonment and have recommended some suggestions for minimizing the effect of delays in projects.

Kasimu A. M (2013)<sup>[5]</sup> the study focuses on specific causes of delay like insufficient coordination and inefficient communication between involved parties in construction projects. Questionnaire survey has been used as a tool to carry out this study. The results of factors are analyzed based on mean value criterion and standard deviation (SD). Some factors are improper planning of activities, lack of effective communication, design errors, shortage of material supply like steel, concrete etc, slow decision making, financial issues, shortage of materials, cash-flow problems during construction, site accidents, quality assurance and control and political influence and economic condition. This study implies in adequate planning, coordination and effective monitoring of the construction projects by an experienced and qualify professional will reduce the impact of delays.

Megha Desai (2013)<sup>[6]</sup> they have worked on identification and ranking of causes of delay in residential construction projects in Indian context. Totally 59 causes were identified under 9 major group. A questionnaire survey was conducted and the causes of delays are ranked by two different techniques Relative importance index and important index based on degree of severity and degree of frequency. Results shows us that out of top 10 factors totally 5 factors are common in ranking by both methods. The result shows some factors are original

contract duration is too short for completing, shortage of labours, delay in material delivery, low productivity level of labours, delay in progress payments by owner. Labour related factors were the ranked first and external factors are ranked last.

Remon Fayek Aziz (2013)<sup>[7]</sup> this research works attempts to identify, investigate and rank factors perceived to affect delays in the construction projects with respect to their relative importance to proffer possible ways to coping with this phenomenon. Totally, ninety-nine (99) factors were short-listed to be part of the questionnaire survey and were identified and categorized into nine (9) major categories and they were consultant related factors, contractor related factors, design related factors, equipment related factors, external related factors, labour related factors, material related factors, owner related factors and project related factors. The data were analyzed using Relative Importance Index (RII), ranking and simple percentages.

S.M.Renuga and Balasubramanian Malathi (2013)<sup>[8]</sup> they have identified the critical factors influencing delay and their impact on project completion. In this study they have concentrated in Resource (Manpower, Material and Equipment) related delay in construction projects. For this research, a questionnaire survey method was adopted to find the impact of critical factors that leads to resource related delays in construction projects. The survey results in this literature they have identified top ten critical factors using Relative Importance Index (RII) in each of the categories (Manpower, Material and Equipment) and provided some recommendations to reduce the impact of the resource related delays in construction projects.

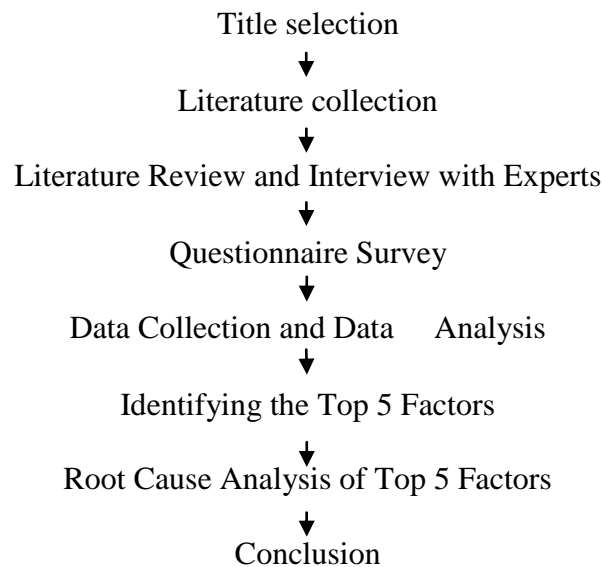
Towhid Pourroostam and Amiruddin Ismail (2012)<sup>[9]</sup> they have identified the causes and effect of delays in Iranian construction projects. Projects investigated in this study include residential, office and administration buildings and roads. A questionnaire survey was conducted to solicit the causes and effect of delay from consultant and contractors viewpoint. This survey has identified 10 most important cause of delay from a list of 28 different cause of delay and 6 different effect of delay. This survey have identified some factors are delay in progress payment by client, change orders by client during construction, poor site management, slowness in decision making process by client, financial difficulties by contractors, late in reviewing and approving the design documents by client, problem with subcontractors, ineffective planning and scheduling of project by contractor, Mistakes during construction and weather condition the survey also implies the effect of delays in time overrun, cost overrun, disputes, arbitration, Litigation and total abandonment. Relative Importance Index (RII) has been used for ranking the causes and spearman rank correlation coefficient is used for studying the strength of relationship between two sets of ranking. This literature has highlighted factors and the need to reduce delays by client, consultant and contractors.

#### **IV. RESEARCH METHODOLOGY**

The research methodology contains two phases. The first phase included a literature reviews and interviews. The literature review was conducted through books and international management journals. As the outcome of this phase, 18 uncertainty factors causes of delays for construction projects were identified. These causes are :Approval, Materials related, Labours related , Equipment related, Financial issues & Cash flow, Mistakes during construction, Government policies, Client related, Contractor related, Prefeasibility studies, Deviation in drawings/Design related, Weather condition & Environmental factors, accidents, quality control/assurance,

economic condition, Agreement issues, Adaption of advanced technology and Activity path depending the frequency of occurrence there are importance scale.

The second phase includes the ranking of the uncertainty factors which are causes of delays in construction projects. These factors are ranked by Relative Importance Index (RII) and the top 5 uncertainty factors are identified and their root causes for delays will be founded out and suggestion and recommendation will be given accordingly to factors.



**Fig 4.1 - Working Methodology**

#### 4.1 Data Analysis

The data analysis will be done by relative importance index technique Relative Importance Index technique: S.M.Renuga and Balasubramanian Malathi[1] used the Relative Importance Index method to determine the relative importance of the various cause of delays. The same method is going to be adopted in this study. The five-point scale ranged from 1(not much) to 5 (very important) will be adopted and will be transformed to relative importance indices (RII) for each factors as follows:

$$RII = \sum W/A * N \quad (1)$$

Where, W is the weighting given to each factor by the respondents (ranging from 1 to 5), A is the highest weight (i.e. 5 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 the RII, more important was the causes of delays.

The RII was used to rank the different uncertainty factors that cause delay. These ranking made it possible to cross-compare the relative importance of the uncertainty factors as perceived by the respondents.

#### 4.2 Questionnaire Survey

Questionnaire were completed at the meeting with the project manager, planning engineer this method had the added benefit of making clarification to respondent about the uncertainty factors and gives chances to surveyor

to explore possible uncertainty factors influencing the construction projects. Totally 44 surveys were completed and the consolidated results of these uncertainty factors in means of importance scale are carried out by relative importance index method (RII).The uncertainty factors are ranked according to the RII values and the top 5 uncertainty factors are identified and they are listed in Table 2.

**Table 1 Survey Results According to RII**

Uncertainty Factor	Importance scale					Total	RII	Rank
	5	4	3	2	1			
Approval	13	13	12	4	2	44	0.74	2
Material related	6	6	14	8	10	44	0.554	10
Labour related	7	5	10	11	11	44	0.536	11
Equipment related	3	5	19	8	9	44	0.531	12
Financial issue & Cash Flow	17	10	11	3	3	44	0.759	1
Mistakes during construction	0	4	16	12	12	44	0.454	14
Government policies	3	8	11	13	9	44	0.522	13
Client related	11	14	9	6	4	44	0.7	4
Contractor related	2	9	12	14	7	44	0.531	12
Pre-feasibility studies	6	8	18	10	2	44	0.627	7
Deviations in Drawings/Design related	11	14	12	3	4	44	0.713	3
Weather condition & Environmental factors	3	4	12	13	12	44	0.477	15
Accidents	2	4	9	17	11	44	0.445	16
Quality assurance/control	8	10	15	8	3	44	0.654	6
Economic condition	5	10	14	12	3	44	0.609	8
Agreement issues	6	2	14	16	6	44	0.536	11
Adaption of advanced technology	8	7	9	8	12	44	0.559	9
Activity Path/CPM	9	15	7	6	7	44	0.659	5

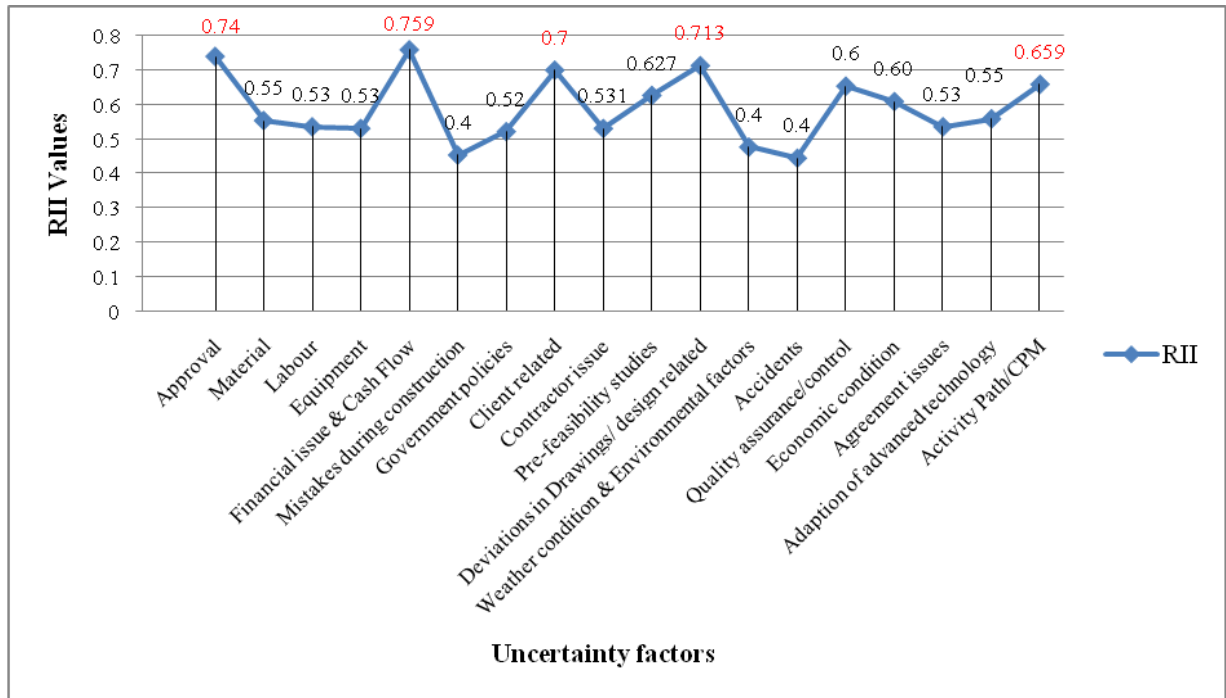


Fig 4.2.1 relative importance index value for uncertainty factors

Table 2 Top 5 uncertainty factors according to RII

Delay Factors	RII
Financial issue & Cash Flow	0.759
Approval	0.74
Deviations in Drawings/ Design Related	0.713
Client Related	0.7
Activity Path/CPM	0.659



Fig.4.2.2 relative importance index value for top 5 factors

## V. SUMMARY

Present study outlines the major uncertainty factors which represent the causes of delay in construction projects in India. Based on the literature study and from the interview of experts, 18 uncertainty factors were identified are Approval, Materials related, Labours related, Equipment related, Financial issues & Cash flow, Mistakes during construction, Government policies, Client related, Contractor related, Prefeasibility studies, Deviation in drawings/Design related, Weather condition & Environmental factors, accidents, quality control/assurance, Economic condition, Agreement issues, Adaption of advanced technology and Activity path/ CPM. With the help of questionnaire survey the top 5 uncertainty factors were identified and the top factors are Financial issue & cash flow, Approvals, Deviations in drawing/Design related, Client related and Activity path/ CPM. Further methodology is suggested to work out root causes for these uncertainty factors and the ways to mitigate the delays in the next phase.

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