

# ANALYSIS OF RISKS IN RESIDENTIAL BUILDING CONSTRUCTION PROJECTS

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**Abstract.** Risk management in terms of time, cost, quality and scope becomes crucial task in the construction industry. The risk management plays a vital role in residential building construction projects, so that the time and cost given to the client is duly met. In this study, an implementation of project risk management has been done on regional construction projects from Mumbai region to identify the major risk factors affecting the time and cost of the projects. Based on expert interview and suggestions taken from construction industry experts, the Work breakdown structure of a residential project is developed. Also, Microsoft project is used to develop the critical path for identification of the most important activities i.e. critical activities which affect the duration of a project. After successful study of literature survey and evaluation of expert opinions, a questionnaire form was prepared which include 50 major risks headed under 7 major risk factors and personal opinions were also invited. The Qualitative risk analysis is carried out to define the level of significance of risks parameters by using Relative Importance Index (R.I.I.) method. According to R.I.I. method, the most five important parameters are; Delay in approval of passing Occupancy certificate (OC) and Commencement certificate (CC), Local Calamity, substandard quality of material, Shortage of skilled labors, poor safety management. This study contributes to the risk management and provide a general idea about the important risk parameters in residential building construction project.

**Keywords:** Risk management, work breakdown structure, RII, Microsoft Project.

## 1 Introduction

The construction industry has complex and dynamic unpredictable nature creating a climate of uncertainty and risk. Infrastructure development has been a key sector in every Indian State even in the recent past. These projects have always been riddled with questions of time and cost overruns with the aim to find the reasons for such uncertainties and hence risk management in project management has become an important technique for successful project completion. Risk is defined as the uncertainty of the result

or threat of negative actions and events. Risk must be assessed in relation to the combination of the probability of something happening and the impact that occurs when this happens.

Some of the risks in the construction process can be easily predicted or easily identifiable; However, some may be completely unexpected. Many construction projects get delayed because of the environmental management issues and problems related to land acquisition. In addition, there are problems in the tender process, which affects the viability of the projects, thus delaying the implementation phase of construction is facing cost overruns and disputes and, finally; provider skills are low throughout the value chain. The present report seeks to identify relevant issues and uncertainties delaying the project completion of residential construction industries

### **1.1 Risk management**

Risk management contains properly prepared management policies, processes and procedures to the tasks of establishing context, identify, analyses, evaluate, treat, monitor and report on risks. The process of risk management is a fundamental principle of understanding and managing risk in the project.

Risk factors: looking at the risk, you need to determine:

- The likelihood of it happening (that)
- The range of possible outcomes (or money)
- Waiting time (when) in the life cycle of the planned project,
- The frequency of risk events from this source (how many times)

## **2 Literature study**

Uher and Toakley introduced the application of risk management in the conceptual phase of the construction project in the Australian construction industry through a survey. It was found that while most respondents were aware with risk management; its application in the conceptual period was relatively low, even though individuals were ready to embrace change. Abu Mousa identified important risk factors that influence the building projects in Gaza Strip. During the risk analysis, they observed that the most important risk factors are the design to unqualified designer, Defective design, Occurrence of accidents, Difficulty to access the site, inaccurate quantities. Mahendra et al., observed that the construction projects which are multifaceted in nature, hesitation and risks in the same can progress from diverse sources. The impact of risk was un-controllable in the past as per record. This study proposes to apply the risk management technique which includes well - documented procedures for the one stop solution all types of hazards most likely to occur during any construction project Lifecycle. Wand and Dulami in their study outlined twenty-eight risks connected to construction projects in developing countries. Three levels of risk were categorized; country, market and projects. Twenty-two risks were deemed as critical or very critical based on a seven-degree rating scale. Critical risks identified are (in no order); termination of joint venture, influence of government on disputes, policies of government. Kansal and Manoj Sharma

says that current risks are very common in construction sector. Risk is the possibility of suffering losses and the impact on the involved parties. Risk affect construction sector negatively and focusing on risk reduction measure and its significant. The purpose of their study was to assess the use and method of risk identification techniques in the construction industry. They are classified industrial construction, infrastructure and heavy construction. They conducted a survey research by applying a questionnaire among in the construction industry. The risk identification techniques more frequently applied in construction are flowchart, checklist, Brain storming, Delphi method etc

### **3 Methodology**

The thorough literature study and brainstorming lead the path in deciding the scope of the research project and methodology to be followed. The basic objective this study is to identify the most critical risk factors and its level of significance.

A case study of construction projects of Mumbai and its near-by region were taken to investigate potential risk factors which in turn leads to delay in project completion. The research aimed at identifying the key risk factors affecting the project time and cost in residential projects in Mumbai and Vasai-Virar.

Work Breakdown Structure of a residential project and critical path of the same was beforehand done for clearly understanding the major risks and uncertainties delaying any project. WBS of the project and scheduled time for each factor was collected from expert interviews. Risk identification is the first and perhaps the most important step in the risk management process, as it attempts to identify the source and type of risks. It includes the recognition of potential risk event conditions in the construction project and the clarification of risk responsibilities. Risk identification develops the basis for the next steps: analysis and control of risk management.

According to literature study about 50 critical risks were identified and were classified into 7 major groups as given below:

1. Design risks
2. Financial risks
3. Environmental risks
4. Management risks
5. Technical risks
6. Logistic and safety risks
7. Socio political risks

#### **3.1 Field survey: -**

A questionnaire was prepared which included all the risk factors categorized into above given groups and interviews were taken at 50 residential project sites. Moreover, the expertise were taken from every agency involved in construction projects and the risks were categorised and analysed by keeping the consideration of agent based risk identification for more precise results. The agencies involved were:

- 1) *Consultant*
- 2) *Clients*
- 3) *Contractors*
- 4) *Project managers*
- 5) *Designers*
- 6) *Labours*

### 3.2 Risk analysis

It is the systematic use of available information to characterize the risks, determine how often the specified events could occur, and judge the magnitude of their likely sequence. On the other hand, risk evaluation is the process to decide risk management priorities by evaluating and comparing the level of risk against predetermined standards, target risk levels, or other criteria.

Qualitative risk analysis is done using Relative Importance Index (R.I.I) Technique. The Relative Importance Index (RII) method is used to determine the relative importance of the various causes and effects of delays. The same method is adopted in this study within various groups (i.e. clients, consultants or contractors). The scale ranged from '1' being the 'LEAST IMPORTANT' and the 'Nth' number of delay occurring in the construction project being the 'MOST IMPORTANT'. RII will be calculated using the following formula:

$$RII = W / (A * N) \text{ where } (0 \leq RII \leq 1) \quad (1)$$

where:

'W' is the weight assigned to each factor by the respondents and ranges from 1 to 5, (where "1" is "strongly disagree" and "5" is "strongly agree");

'A' is the highest weight (i.e. 5 in this case) and;

'N' is the total number of respondents.

In this study, Relative Important index (RII) have been employed and calculated for ranking of causes of cost overrun in the construction project. The RII is used to rank the different delay factors. These rankings make it possible to cross-compare the relative importance of the factors as perceived by the groups of respondents. 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 delays of construction and cost overrun in construction industry. The calculated numerical scores of each of the identified factors were then converted to relative importance indices to determine the relative ranking of the factors. Higher the value of RII, more important is the delay for cost overrun.

An ordinal scale was used for deciding the severity of the delays and thereby classifying it. The ordinal scale used is shown by Table 1.

**Table 1.** Interpretation of RII

Relative Importance Index	Scale of Importance
0-0.20	Least Important
0.20-0.40	Less Important
0.40-0.60	Important
0.60-0.80	More Important
0.80-1	Most Important

The Likert scale of 1 to 5 was used for ranking the impact of the risk factors. Here 1 impact score has the least important rank and 5 being the highest. The experienced agencies were asked to give probability and impact scores for all the risk factors. The importance and level of the significance of various risk factors which are calculated based on RII along with respective ranking is shown by Table 2.

**Table 2.** Risk factors associated with RII and Rank

Sr. No.	Risk Factors	R.I.I.	Rank
1.	Delay in approval of passing OC and CC	0.82	1
2.	Local calamity	0.592	2
3.	Shortage of skilled labors.	0.512	3
4.	Substandard quality of material	0.512	3
5.	Poor safety management	0.48	4
6.	Delay in approval of plans	0.51	4
7.	Implementation of new laws	0.48	4
8.	Water quality issue	0.47	5

## 4 Conclusion

Majority of contractors and construction managers in construction projects of developing areas such as chosen in our scope are unaware of formal risk management techniques. Considering this finding, it is imperative to educate these professionals about risk management, and thus a formal and informal system of risk management training needs to be developed. The main point which was considered this research is to explore the key risk factors and identify these factors that could be faced in residential construction projects. The data findings and results provide five most important risk factors are important parameters are; Delay in approval of passing Occupancy certificate (OC) and Commencement certificate (CC), Local Calamity, substandard quality of material, Shortage of skilled labours, poor safety management. The risk related with the Management type of risks are found to be critical, hence proper care should be taken. This study plays vital role in the construction management and is also useful in decision making.

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