

# RISK ANALYSIS IN CONSTRUCTION PROJECTS

Babita Yadav

*Gurgaon College of Engineering Department of Civil Engineering*

**Abstract**—Construction projects are initiated in complex and dynamic environment resulting in circumstances of high uncertainty and risk, which are compounded by demanding time constraints. Thus, the need of risk analysis is mandatory. Risk analysis is done to identify these risks in a project and manage it accordingly. In this study, risk analysis is defined as technique that aims to identify and estimate risks to personnel and property impacted upon by the project. The methodology of this study relies largely on the survey questionnaire, which has been collected from the local building contractors by mail or by personal meeting. A thorough literature review has initially been done to identify the risk factors that affect the performance of construction industry as a whole. Out of all the factors studied in literature, eight factors have been chosen for further studies. The survey questionnaire is designed to probe the probability of occurrence of these risk factors and their respective impact on construction projects.

## I. INTRODUCTION

Project management is the application of knowledge, skills, tools and techniques to project activities in order to meet or exceed stakeholder's needs and expectations from a project. Project risk management includes the processes concerned with identifying, analyzing, and responding to project risk. It includes maximizing the results of positive events and minimizing the consequences of adverse events. (PMI, 1996)

**Risks In Construction Projects :-** Construction Projects are vulnerable to the numerous business risks that often represent greater exposures than those that are traditionally insurable. For example, there are regulatory and legislative risks, professional, contractual, competitive and human resource/cultural risks, reputational, strategic, customer and operational, political, legal, financial and technological risks. (Wong & C.M. Hui, 2006)

**Risk Concept:-** The types of exposure to risk that an organization faces are wide-ranging and vary from one organization to another. These exposures could be the risk of business failure, the risk of project financial losses, the occurrences of major construction accidents, default of business associates and dispute and organization risks.

**Risk Analysis:-** Traditional risk assessment for construction has been synonymous with probabilistic analysis. Such approaches require events to be mutually exclusive, exhaustive and conditionally independent. However, construction involves many variables, and it is often difficult to determine causality, dependence and correlations. As a result, statistical analysis that rely on historical information and the experiences of individuals and companies have been used to assess the impact of construction risk and uncertainty.

**Objective of Study:-** The aim of this study is to do a critical literature review of past studies on risk assessment followed by risk analysis of construction projects to find out the key risk factors which have high probability of occurrence and their level of impact if occurs which enable us to calculate risk index score of selected survey sites.

**Limitations of Study:-** This study is done on High Rise Residential Buildings. It is restricted within NCR region (including Gurgaon region construction project sites). This study involves risk analysis which is based on mitigating key risk factors & ranking them as per their chances of occurrence. This study deals with only analysis of risk factors by having survey at certain construction project sites.

## II. LITERATURE REVIEW

An extensive review of international project risk assessment and management was conducted during the initial phase of the research effort. Previous research suggests that construction activity is particularly subject to more risks than other business

activities because of its complexity; a construction project usually requires a multitude of people with different skills and interests and the coordination of a wide range of disparate, yet interrelated, activities.

The aim is to find research gap in field of risk analysis & management that needs more attention or improvement for further studies. The relevant information necessary for this study was collected through a detailed literature review from relevant works like journals, the Internet, published books related to risk analysis & management.

**Kangari (1995)** discussed the attitude of large U.S construction firms toward risk and determined how the contractors conduct construction risk management through a survey of the top 100 contractors. The study showed that in the recent years contractors are more willing to assume risks that accompany contractual and legal problem in the form of risk sharing with the owner.

**E Uher and Toakley (1999)** studied the use of risk management in the conceptual phase of the construction project development cycle in the Australian construction industry through a survey. It was found that while most respondents were familiar with risk management; its application in the conceptual phase was relatively low, even though individuals were willing to embrace change.

**Jannadi and Almishari (2003)** developed and computerized a risk assessor model – RAM, to determine the risk associated with a particular activity and the justification factor.

**Yng Ling and Hoi (2006)** studied the risks that Singapore-based architecture, engineering and construction (AEC) firms face when working in India and investigated the risk response techniques adopted by them.

**Rezakhani (2012)** classified the risk factors under three heads: External, Legal and internal. External risk was sub divided into two subsets: unpredictable/uncontrollable, predictable/uncontrollable and Internal risk was sub divided into two subsets: Non-technical / controllable, Technical/controllable. Further he suggested a hierarchy based risk break down structure and identified the key risk factors.

**Hwang et al. (2014)** reported that risk management implementation is relatively low in small construction projects and this is due to lack of time and budget, low profit margin and not economical. The results indicated a positive correlation between RM implementation and improvement in project quality, cost and schedule performance of small projects.

### III. METHODOLOGY

The information gathered formed the basis for understanding risk management process. The methodology adopted in this project starts with study of literature related to risk analysis followed by preparation of questionnaire after which site visits to major construction project sites have been done where questionnaire survey and personnel interviews with in-charges and managers and collection of data from site have been done. Totally, questionnaire has been sent to twenty companies out of which responses from twelve has been recorded and processed further. Then analysis of the questionnaire has been done after which qualitative analysis of data obtained from site has been done to identify the root cause. Based on analysis, remedial measures has been suggested and the present data has been recorded for future reference. Lastly, conclusions, recommendations and scope for future study has been given.

**Analysis of survey results:-** To assess the relative significance among risks, this study suggests establishing a risk significance index by calculating a significance score for each risk. For calculating the significance score, it is to multiply the probability of occurrence by the degree of impact. Thus, the significance score for each risk assessed by each respondent can be obtained through the formula:

$$S = \alpha \times \beta$$

where S= significance score assessed by respondent for risk;  $\alpha$ = probability of occurrence of risk assessed

by respondent; and  $\beta$ = degree of impact of risk assessed by respondent. By averaging scores

from all the responses, it is possible to get an average significance score for each risk, and this average score is called the risk index score and is used to rank among all risks. The formula for the calculation of risk index score can be written as:

$$RS = \frac{\sum S}{T}$$

T

Where RS= index score for risk; S= significance score assessed by respondent for risk and T = Total number of responses. To calculate S, the five point scales for  $\alpha$  and  $\beta$  is adopted, this will be converted into numerical (Likert scale) scale.

#### IV. RESULTS

The table below provides the overall ranking of all the sub-risk factors as per the calculated Risk factor based on responses from twelve companies regarding each risk probability & its impact which covers the major eight risk factors chosen for the study i.e. Financial risk, Technical Risk, Legal Risk, Market Risk, Political Risk, Management Risk, Social Risk, Environmental Risk. As per the survey at selected construction projects sites “Shortage of Skillful Workers” is ranked first and the most prevalent risk factor in construction projects.

S.No.	Sub Risks	Mean
1.	Shortage of Skillful Workers	19.3
2.	Time Constraint	15.16
3.	Project delay	14.75
4.	Low credibility of stakeholders and lenders	11.83
5.	Site distance from urban area	11.41
6.	Sub-contractor related problems	10.58
7.	Team work	9.5
8.	Competition from other companies	9.5
9.	Materials Shortage	9.25
10.	Internal management Problem	8.25
11.	Loss due to Fluctuation of inflation Rate	8.25
12.	Poor communication Between clients	7.91
13.	Improper Verification of contract documents	7
14.	Poor Quality of procured materials	6.58
15.	Increase of materials price	6.41
16.	Design Changes	6
17.	Improper project organization structure	6
18.	Improper project planning budgeting	6
19.	No past experience in similar	5.75
20.	Improper project feasibility study	5.66
21.	Unknown Site physical condition	5.58
22.	Breach of contract by project partner	5.58
23.	Wastage of materials by workers	5.33
24.	Error and design drawing	5.25
25.	Equipment failure	5.16
26.	Changes in bank formalities and regulations	5.16
27.	Any adverse impact on project due to Climatic conditions	5.16
28.	Bankruptcy of project partner	5
29.	Loss due to Fluctuation of interest rate	4.75
30.	Increase of labour costs	4.75
31.	Loss Incurred due political changes	4.5
32.	Lack of knowledge of arbitration	4.5
33.	High degree of difficulty in construction	4.33
34.	Surplus Materials handling	4
35.	Loss due to rise in fuel prices	3.75
36.	Lack of enforcement of legal judgment	3.75
37.	Poor relation and disputes with partner	3.75
38.	Architect Vs. Structural Engineer disputes	3.75
39.	Cost increase due changes govt. Policies	3.41
40.	Loss due to fluctuation of exchange rate	3.33
41.	Shortage in supply fuel	3.33
42.	Change of top management	3.08
43.	Incompetence of transportation facilities	3.08
44.	Obsolescence of building equipment	3.08
45.	Inadequate forecast about market demand	2.91
46.	Inadequate choice of project partner	2.75
47.	Insurance risk	2.66
48.	Poor relation with govt. departments	2.66
49.	Increase of accessory facilities price	2.66
50.	Accidents on sites	2.66
51.	Stiff environmental regulations	2.66

52.	Loss due to Bureaucracy for late approvals	2.66
53.	Shortage in supply of water	2..66
54.	Increase of resettlement costs	2.66
55.	Unfairness in tendering	2.16
56.	Healthy working environment for the worker	2.16
57.	Resettlement and rehabilitation of people	1.91
58.	Short tendering time	1.91
59.	Local people support for the project	1.25
60.	Local protectionism	1
61.	Loss incurred due to corruption and bribery	1
62.	Problems due to adjacent or nearby project	1
63.	Other risk	0.66
64.	Any impact on the environment due to the project	0.66
65.	Theft of materials at site	0.41

## V. CONCLUSIONS & RECOMMENDATIONS

Thus the interest in risk assessment is growing. With an increasingly complex and rapidly changing business environment, owners and their contractors are being challenged to manage risk while maintaining control and improving performance. However, some owners are not familiar with the concepts of risk assessment. Therefore, the onus must fall on the construction industry to market the concepts of risk assessment so that all owners recognize that the analysis of risk is not just a cost but rather an investment, in terms of actual money saved, when resources are used more efficiently and the consequence of a delay to the project can be avoided. This study has created a list of risks and its impact on the construction industry using survey.

### Recommendations:-

- This study should assist management in identifying activities where there is a risk of injury or loss and hence enables management to take objective decisions on the reduction of risk to an agreed level.
- Risk management workshops should be organized, introduces vocational training on risk management. The attitude of accepting the lowest bid should be reviewed in order to facilitate quality works. Some criteria should be used to select because most of the times the lowest bids are not the best especially in relation to Risk management.

## SCOPE FOR FUTURE WORK

- 1. Further studies can be done in order to explore the extent of impact of certain risk factors and a research on benefits of risk management to construction industry will be of great importance.
- 2. Further researches in this area are welcome and can be done to develop a generic risk management model for construction industry at both global and national level. Such model can help contractors in correct identification and classification of risk as either controllable or uncontrollable. It can also help them in the correct measurement of impacts of risks and probabilities of risk occurrence.

## REFERENCES

- [1] Roozbeh kangari "Risk management perceptions and trends of U.S construction", Journal of Construction Engineering and Management, Vol. 121, No. 4, December, 1995, 422-429.
- [2] Thomas E Uher and A Ray Toakley "Risk management in the conceptual phase of a project" International Journal of Project Management Vol. 17, No. 3, 161-169, 1999
- [3] Joe Wong and Eddie C. M. Hui, "Construction project risks: further considerations for constructors pricing in Hong Kong", Construction Management and Economics, April 2006, 425-438
- [4] Choudhary & Iqbal, Journal on Evaluating Risk Mgmt. Practices by School of Civil Construction, Chile, 2014
- [5] Journal of civil engineering research 2014
- [6] WWW.Wikipedia.com