



# Risk Management in Building Construction

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**ABSTRACT:** In any country, infrastructure development will increase the growth of countries economy and generates the large amount of job opportunities. Hence those projects involve a large amount of investment to carry out. In view of that, if any sort of wastage (either time, resources etc) occurs that would lead to the huge monetary losses. These losses occur due to various risks associated with such mega projects. Consequently, these risks play a crucial role for the completion of project within the time schedule and planned budget. In this connection, this study mainly discusses the critical risk factors and its assessment techniques through comparative study of various international construction projects. About 50 relevant articles published over the last 25 years have been reviewed. The review resulted that a simple analytical tool will be developed for each project task to assess the risk easily and quickly, which will encourage the practitioners to do the risk analysis in their project. This review concluded that the earlier risk identification in the project and assessment during the bidding stage of the construction project will lead to the better estimation of the escalation on cost and time overrun.

**KEYWORDS:** Risk Factors, Risk Assessment Techniques, 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 needs and expectations from a project. Project risk management includes the processes concerned with identifying, analyzing, and responding to project risk. [1]

### a. Background

The word "risk" was known in the English language in the 17th century. It is believed that the word was originally a sailor's term that came from

the Spanish and meant "to run into danger or to go against a rock." The money spent to fund shipments overseas was the first example of risk business in the early days of travel.[2] Each and every activity we do involve risk, only the amount of risk varies. Prof. Kent Miller of Purdue University defines risk as "Unpredictability in corporations/businesses outcome variables".[3] About Uncertainty he defines as "Unpredictability of environmental and organization al variables that impact the corporations/businesses performance."Consequences of uncertainty and its exposure in a project, is risk. In a project context, it is the chance of something happening that will have an impact upon objectives. [4] It includes the possibility of loss or gain, or variation from a desired or planned outcome,as a consequence of the uncertainty associated with following a particular course of action. Risk thus has two elements: the likelihood or probability of something happening, and the consequences or impacts if it does. [6] Managing risk is an integral part of good management, and fundamental to achieving good business and project outcomes and the effective procurement of goods and services.[9].

### b. Motivation

The real estate and construction industry has changed significantly over the past several years. It is an industry driven primarily by private investors; the presence of securitized real estate has increased considerably. [6]Not unexpectedly, the influence of institutional investors on the real estate industry is formidable. They are beginning to experience a higher degree of scrutiny by investors, consultants and analysts, and are expected to deliver "best in class" service in all areas - from property management to risk management.[6]To be successful in this environment, where our collective "performance bar" is being raised significantly, the real estate industry will have to dedicate more resources and develop a higher degree of operational sophisticationReal estate is vulnerable to the numerous other business risks that often represent greater exposures than those that are traditionally insurable.[8] For example, there are regulatory and legislative risks, professional, contractual, competitive and human resource/cultural risks, reputational, strategic, customer, operational, political, legal, financial, and technological risks.[9]



## II. OBJECTIVES OF THE STUDY

The Development of infrastructure is one of the most important activities that can boost up the business of the various Industries, thereby increasing the Gross Domestic Product (GDP). Due to this fact countries stress on infrastructure development and provide finances for the same in their yearly budget.

1. The construction industry, perhaps more than most, is overwhelmed by risk.
2. Too often this risk is not dealt with satisfactorily and the industry has suffered poor performance as a result.
3. Infrastructure projects being huge in nature and involving a large amount of money, any sort of wastage (either time, resources etc) would lead to huge monetary losses. The losses are due to various risks associated with such mega projects
4. These risks are to be identified and mitigated to avoid the losses. This entire process of risk identification and mitigation is termed as risk management.
5. Research on risk assessment and management has been done by various people, mostly on developed countries. In India, only few research works have been done in this area. Thus this study focuses risk assessment and management in India in field of construction. [7]

## III. LITERATURE REVIEW

**Roozbehkangari (1995)** discussed the attitude of large U.S construction firmstoward 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. The survey also found that contactors assume the risk associated with actual quantities toward the practice of defensive engineering is determined.

**Akintola S Akintoye and Malcolm J MacLeod (1997)** studied the constructionindustry's perception of risk associated with its activities and the extent to which the industry uses risk analysis and management techniques with the help of a questionnaire survey of general contractors and project managers. The authors concluded that risk management is essential to construction activities in minimizing losses and enhancing profitability. Construction risk is generally perceived as events that influence project objectives of cost, time and quality.techniques for construction industry activities.

**Shen L Y (1997)** identified the most serious project delay risks and the effectiveactions for managing these risks. Practitioners' risk management actions and their effectiveness have been investigated through a questionnaire survey. It revealed that methods where practitioners' experience and subjective judgement are used are the most effective and important risk management action, and that methods using quantitative analytical techniques have been rarely used due to limited understanding and experience.

**Thomas E Uher and A Ray Toakley (1999)** studied the use of risk managementin 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.

**Li Bing and Robert L. K. Tiong (1999)** based on their study categorised the riskfactors and their mitigating measures, the most effective risk mitigating measures were categorized into eight groups. Those are partner selection, agreement, employment, control, subcontracting, engineering contract, good relationship, and renegotiation. They proposed a risk management model incorporating measures. Three cases of international construction JVs were analyzed from the perspectives of the execution of these measures.

### 1. QUESTIONNAIRE STRUCTURE

The structured interview questionnaire is shown in Appendix A. The questionnaire was tested with a pilot survey for clarity, ease of use, and value of the information that could be gathered. The questionnaire survey is divided into two parts. The first part consists of general information like type of company, experience, value of their project e.t.c. and the second part consists of the construction risk factors for evaluation.Risk factors for this study are classified into eight categories, namely:

1. Financial risk
2. Legal risk



3. Management risk
4. Market risk
5. Policy and political risk
6. Technical risk
7. Environmental risk
8. Social risk

## 2. QUESTIONNAIRE DESIGN

The survey questionnaire is designed to probe the cross-sectional behavioural pattern of construction risks construction industry. [4]The questionnaire was prepared for the pilot survey was formulated by seeing the relevant literatures in the area of construction risk. The interviewer was free to ask additional questions that focused on issues arising during the course of the interview. The freedom to follow the interviewee, to ask for clarifications, and to focus on specific projects, risk practices and knowledge, made the interviews insightful.

## 3. RISK RATING

Likert scale of 1-5 was used in the questionnaire. A Likert scale is a type of psychometric response scale often used in questionnaires, and is the most widely used scale in survey research. When responding to a Likert questionnaire item, respondents specify their level of agreement to a statement. The scale is named after Rensis Likert, who published a report describing its use (Likert, 1932). The respondents were required to indicate the relative criticality/ effectiveness of each of the probability of risk factors and their impact to the management.

## 4. DESIGN OF SURVEY

The respondents were requested to judge the significance or “expected loss” of each risk. There are many criteria that respondents may need to consider. One alternative approach adopted by previous researchers (Shen et.al 1998) is to consider two attributes for each risk: the probability level of the risk occurrence, denoted by  $\alpha$ ; and the degree of impact or the level of loss if the risk occurs, denoted by  $\beta$ . The same type of evaluation is followed in this study also. Therefore, risk significance, denoted as RS, can be described as the function of the two attributes  $RS = f(\alpha, \beta)$ . By applying this approach, the respondents were asked to respond to the two attributes for each risk. For considering  $\alpha$ , the respondents were required to judge the probability level of risk occurrence by selecting one from among five levels, namely, Very small, Small, Normal, Large and Very large. For considering  $\beta$ , the respondents were required to judge the degree of impact if the risk concerned occurs, by selecting one from among five grades, namely, Very low, Low, Medium, High, and Very high.[6]

## IV. SYSTEM ANALYSIS

Risk assessment consists of an objective evaluation of risk in which assumptions and uncertainties are clearly considered and presented. Part of the difficulty in risk management is that both the quantities by which risk assessment is concerned – potential loss and probability of occurrence – can be very difficult to measure. To assess the relative significance among risks, previous literatures study suggests establishing a risk significance index by calculating a significance score for each risk. For calculating the significance score 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 model.

$$1. S_j^i = \alpha_j^i \beta_j^i \dots\dots\dots(1)$$

$$2. RS = \frac{\sum_{j=1}^T S_j^i}{T} \dots\dots\dots(2)$$

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

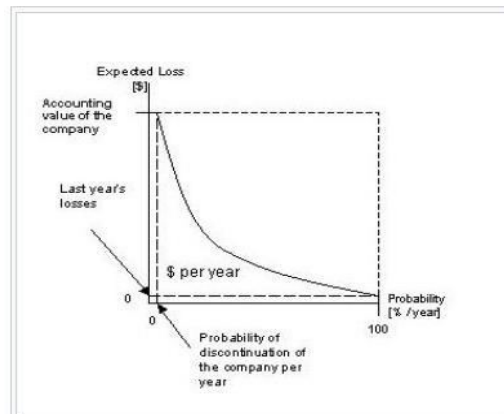


Fig No 01 Risk Analysis Flow

If the risk estimate takes into account information on the number of individuals exposed, it is termed a "population risk" and is in units of expected increased cases per a time period.

#### V. EXPERIMENTAL SET UP

Totally for seventy five companies the questionnaires were given, out of which forty five had an effective reply and two were rejected due to improper answering. Thus the response rate is 60% which is considered a good response in this type of survey. In those forty five companies surveyed, twenty one are contractors and 24 are owners. Sub-contractor related problems, time constraint, and increase in inflation were the major problems concerned with both the contractor and owner.

##### 1. Qualitative Risk Analysis

Qualitative Risk Analysis at its simplest involves only a description of the obvious project risks; in some circumstances risk identification may be all the risk analysis that is required, in other cases more in-depth analysis will be warranted.

Table No 01. Aggregating criticality scores

Risk Identification	Cost Impact	Schedule Impact	Performance Impact	Criticality Score
Risk 1	L	L	L	L
Risk 2	H	H	H	H
Risk 3	H	L	L	M
Risk 4	VL	VL	H	H

##### 2. Quantitative Risk Evaluation

Quantitative Risk Analysis generally follows on from the qualitative risk analysis. The quantitative risk analysis process aims to numerically analyze the probability of each risk and its consequences on the project objectives as well as the extent of overall project risk.

#### VI. CONCLUSION

As far as India is concerned risk management is still a new word in the construction sector and this should be changed as soon as possible. Currently the Government of India has proposed a risk rating system will help the developers to develop projects at a faster pace by taking quick decisions. Each rating agency will have its own methodology to rate projects. The system will help government to develop a strategy to mitigating risk. This will encourage more response from developers and investors for public-private partnerships projects. It could make the bidding projects more competitive. The system will enable bankers to take quick decisions for lending finances, which could lead to the financial closure of the project at a faster pace.



## REFERENCES

- [1] SEBRAE (2016) Apenas 13% das Empresas Têm Gestão de Risco Eficaz. Auditoria Interna do Sistema SEBRAE.
- [2] Buzzi, D.C. (2015) Diretrizes para o Gerenciamento de Risco em Incorporadoras da Construção Civil: Uma Abordagem Utilizando Lógica Difusa, in Programa de Pós-Graduação em Engenharia Civil. UFSC, Florianópolis.
- [3] Wang, J. and Yuan, H. (2016) Factors Affecting Contractors' Risk Attitudes in Construction Projects: Case Study from China. *International Journal of Project Management*, 29, 209-219. 2016
- [4] Correa, P.S. (2010) O Papel das Incorporadoras e das Construtoras na Construção Civil Brasileira. Palestra-FGVUNICOC-Fundação Getúlio Vargas, Ribeirão Preto.
- [5] Hsueh, S.L., et al. (2016) On-Line Multi-Criterion Risk Assessment Model for Construction Joint Ventures in China. *Automation in Construction*, 16, 607-619. 2016
- [6] Akintola S Akintoye and Malcolm J MacLeod "Risk analysis and management in construction" *International Journal of Project Management* Vol. 15, No. 1, pp. 31-38, 1997
- [7] Alfredo del Can, and M. Pilar de la Cruz, "Integrated Methodology for Project Risk Management" , *Journal of Construction Engineering and Management*, ASCE, December 2002, 473-485
- [8] Artem Aleshin "Risk management of international projects in Russia", *International Journal of Project Management* Vol. 19, 2001, PP. 207-222
- [9] Bing, L., Tiong, R. L. K., Wong, W. F., and Chow, D, "Risk management of international construction joint ventures." *Journal of Construction Engineering and Management*, 1999, ASCE, 125(4), 277-284.
- [10] Darrin and Mervyn K Lewis "Evaluating the risks of public private partnerships for infrastructure projects", *International Journal of Project Management* 2002 , 107-118
- [11] Daud Nasir, Brenda McCabe and Loesie Hartono "Evaluating Risk in Construction-Schedule Model (ERIC-S) Construction Schedule Risk Model" *Journal of Construction Engineering and Management*, ASCE, Vol. 129, No. 5, October, 2003, 518-527