

Identification and Qualitative Risk Strategy Development of Construction Projects

Divya Negi¹, Masoom Reza² and Dr. Mutnuru Srinivasa Rao³

¹Lecturer, Department of B.Voc (Construction Technology), Aryabhata Institute of Technology

²Assistant Professor, Department of Civil Engineering, Al-Falah University Faridabad

³Lecturer (SG) and Nodal Officer (B.Voc), Department of Civil Engineering/B.Voc (Construction Technology), Aryabhata Institute of Technology, DTTE, Government of NCT of Delhi

E-mail:¹dsngi2826@gmail.com, ²masoomreza085@gmail.com, ³visitmsrao@gmail.com

Abstract—In India, as the construction industry is gaining momentum every project is becoming quite challenging in terms of nature, scope and complexity. In order to make a project viable and profitable all the knowledge areas of management are need to be dealt with effectively. So far, the various functions of construction management such as planning and scheduling have been addressed in detail but now a strong need is being felt for studying and implementing various risk management techniques and strategies so that adverse situations and unnecessary delays in construction projects may be avoided. A good risk management removes potential risks from the project qualitatively as well as quantitatively.

The aim of this study is to propose a simple but effective approach of identifying the risks which are associated with various construction projects in India and then qualitatively analyzing them using Risk Index Score Method (RISM). This has been done through deliberate study of various literatures, observing and brainstorming with professionals of construction field. Based on these, around fifty major and minor risk factors have been established referring to different sources. These risks are categorized based on their technical, financial, environmental and social impacts on success rate of the projects. Once the approach is applicable to the system it shall assist in earning greater benefits and reduced losses from the projects.

Keywords: Risk Management, Risk Analysis, and Risk Index Score Method (RISM).

Introduction

Risk management in construction sector is still considered as a fresh and unfamiliar term, with progress and changes going on day after day. Different agencies propose their own risk rating systems as risk is generally seen as 'uncertainty of occurrence of an event'. Although proper implementation of project management techniques may also lead to reduced possibility of occurrence of an undesired event upto a certain level but refined engineering of identification, analysis and implementation of risk management strategies results in producing better regulated outcomes while executing projects.

There is always a great deal of activities, critical points and expectations involved in construction projects, therefore many developers, investors and all other stakeholders run an equal chance of success and failure. Thus it is necessary to assess the exact source and effect of risks involved and their elimination.

1. RESEARCH OBJECTIVE

The purpose of this study is to focus on identifying risk causing factors usually encountered by various professionals while working on domestic construction projects. The scale of these projects may vary from small, medium and large besides the functioning and the amount of time spend on finalizing the project. Based on various literatures and conducting brainstorming and interview sessions, the objective is formulated as;

1. Identifying and categorizing risk governing factors which results in adverse impacts on projects.
2. Proposing a qualitative strategy for risk analysis by using Risk Index Score Method (RISM).
3. Spreading awareness at managerial level about quick and easy usage of the technique.

2. LIMITATION OF SCOPE OF RESEARCH

Since every construction project is bound to have risks therefore it is not always possible to remove all the risk factors that may or may not affect a project. This research also limited to random and independent factors and does not show interdependency on each other. Further, there cannot be a single way to analyze all the risks listed in a project as there may be contradictory statements and assumptions however I have tried my best to make this research appropriate.

3. RISK MANAGEMENT PROCESS

The process of risk management is quite complex and in this study we have considered four broader phases; viz. Risk Identification, Risk Assessment, Risk Response, and Risk Mitigation & Control. Accordingly forms of risks may also be classified in a number of different ways and notions. The Enterprise Risk management tool elaborates more on types of risks as:

1. **Financial Risks:** This includes risks related to capital market, cash flows, debtors/creditors, foreign exchange, fraud (internal or external), investments, bankruptcy, pension & benefits, stock price, price escalation and taxes.
2. **Operational Risks:** This includes risks related to business interruption and disputes, interdependency, supply chain disruption, transportation, product liability, non-availability or breakdown of machinery, data security/cyber risk, business resiliency plan, organizational structures, and terrorism/sabotage.
3. **Strategic Risks:** This includes risks related to shareholder value, joint ventures/subsidiaries, product development (technical and design risks), intellectual property, legal and compliance, mergers and acquisitions, Political risk, succession planning, reputation/corporate culture, and emerging risks.
4. **Market Risks:** This includes risks related to market shares/competitors, geographical spread, contractual and trade barriers, distribution channels, and patent infringement.
5. **Environmental Risks:** This includes risks related to weather implications, environmental policies and laws, earthquake, storm, fire/explosion, safety hazard, and flood.
6. **Social Risks:** This includes risks related to corporate governance, employee health and welfare, knowledge management, recruiting and retention, labour and key employees.

Some of the impacts of risks that have been frequently observed in construction industry are; Time and cost overruns, Poor quality of material and work, Mis-management and Vulnerability.

4. IDENTIFICATION OF RISK FACTORS

The following major risk factors have been considered in this study for identification as per construction projects:

Table 1: Classification of Risk factors

S. No.	Classification	Risk Factors
1.	Financial	<ul style="list-style-type: none"> ➤ Delay in payments by client/owner ➤ Investment risks ➤ Cash flow problems ➤ Inflation of prices ➤ Excessive site overheads ➤ Taxes and penalties of being defaulter ➤ Increase in labour cost ➤ Increase in supply and transportation cost ➤ Economic crisis ➤ Improper planning and budgeting
2.	Operational	<ul style="list-style-type: none"> ➤ Interference of local bodies ➤ Excessive changes of regulatory and govt. policies and laws ➤ Frequent internal and external disputes ➤ Absence or delays in dispute redressal mechanism ➤ Frequent breakdown of important machines ➤ Non-availability of specific equipments/ parts ➤ Complex organizational structures ➤ Communication gap between management levels ➤ Reluctance in use of new/ advance technologies ➤ Transfer of project to another contractor ➤ Shortage of skilled labour, material or supply of water, oil, gas, electricity etc. ➤ Poor maintenance and site infrastructures
3.	Strategic	<ul style="list-style-type: none"> ➤ Excessive changes in drawings and plans ➤ Errors in design and drawings ➤ Delay in timelines and planning ➤ Inaccurate testing results ➤ Limited or no inspection of work at site ➤ Late approvals of drawings and NSR items ➤ Lack of enforcement of legal judgments ➤ Poor quality control and monitoring ➤ Non-conformance with management and quality standards ➤ Litigation and Land acquisitions ➤ Demand of project completion before estimated time ➤ Procurement and handling issues ➤ Theft and security issues on site
4.	Market	<ul style="list-style-type: none"> ➤ Competition among similar projects

		<ul style="list-style-type: none"> ➤ Inappropriate site location ➤ Faulty contracts or untimely termination of contracts
5.	Environment	<ul style="list-style-type: none"> ➤ Air, water, and soil pollution ➤ Difficulty in obtaining clearances ➤ Extreme weather conditions – floods, earthquake, cyclone etc. ➤ Improper handling and disposal of construction waste ➤ Recycle, reuse or treatment of sewage/ sludge
6.	Social	<ul style="list-style-type: none"> ➤ Unfair Tendering process ➤ Non productivity/ unavailability of labours ➤ Injuries and accidents on site ➤ Irregularities in payment of wages ➤ Loss due to poor site safety and occupational health hazards ➤ Extensive working hours, shifts of employees and labours ➤ Labour Strikes
	Total	50

5. QUALITATIVE RISK ASSESSMENT

It is one of the simplistic techniques describing risks in linguistic variables and making quicker assessments. A Risk scoring matrix is a tool commonly used in qualitative analysis. However risks factors can also be assessed and ranked using Risk Index Score method. The model for calculation of risk index score (IS_r) is mathematically stated as:

$$IS_r = \sum_{i=1}^n (SI_r) / n \quad \dots Eq (1)$$

Where,

n = Number of times/ cases *i* risk is assessed

SI_r = Risk significance index

The order of risk ranking is given as per higher IS_r values to lower IS_r values. It will clearly demonstrate the intensity of a particular risk's impact on the project. Also,

$$(SI_r)_{ij} = (\alpha)_{ij} * (\beta)_{ij} \quad \dots Eq (2)$$

Where,

(α)_{ij} = Probability of occurrence of a risk *i* assessed *j* times in risk scoring matrix

(β)_{ij} = Probability of degree of impact of a risk *i* assessed *j* times in risk scoring matrix

The proposed risk modeling shows risk prioritization by assigning probability of occurrence to that event and also its impact. Therefore, the obtained strategy for risk analysis from above is shown below;

Step 1: Identification of risks/ risk factors using literature reviews, interviews, checklists, brainstorming sessions, surveys, Delphi technique, expert opinion etc.

Step 2: Categorization of risks factors identified based on parameters as observed in construction industry.

Step 3: Assigning probabilities of occurrence (α) and its degree of severity/ impact (β) on projects to each particular event. (Only those risks affecting negatively to the progress of project is considered).

Step 4: Applying Equation (2) to every factor to determine risk significance index value and generation of risk scoring matrix based on calculations.

Step 5: Applying Equation (1) to determine risk index score of the given sample size *n* and determining risk index scores for each factor.

Step 6: Estimating mean of risk index scores for every risk factor and ranking them in sequence from highest mean value till lowest mean value obtained.

6. CONCLUSION

The proposed paper presents risk identification and a qualitative approach and strategy of understanding risks in a better form so that appropriate response and mitigation plans can be made to counter these even before their origin. This system will encourage developers, existing beneficiaries and parties in making quicker decisions and adopting relevant solutions to the problematic situations generally arising due to direct or indirect influence of risks. The method suggested here will navigate the users as to how prioritize all the risks associated with construction projects by ranking them systematically using Risk Index Score Method (RISM).

REFERENCES

[1] Uher, T., "Programming and Scheduling Techniques", UNSW Press, Sydney, 2003

[2] Akintoye, A. S. & MacLeod, M. J., "Risk Analysis and management in construction". International Journal of Project Management, 1996, pp. 31-38

[3] Kráľová, M., "Comparison of Methods of Analysis of Security Risks", University of Žilina, master's thesis. [online], [cit. 2017-03-13]. (Czech Republic), 2003

[4] Vladimíra Osadská, "Stochastic Methods in Risk Analysis", Safety Engineering Series, ISSN 1805-3238, Transactions of the VSB - Technical university of Ostrava, Vol. XII, No. 1, 2017, pp. 61-67.

[5]. Chen, H., Hao, G., Poon, S.W. and Ng, F.F., "Cost Risk Management in West Rail Project of Hong Kong", 2004, AACE International Transactions.

[7] Tam, C.M., Zeng, S.X. and Deng, Z.M., "Identifying Elements of Poor Construction Safety Management in China", Safety Science, 42, 2004, pp. 569-586.

[8] Dinesh Kumar R., "Causes and Effects of Delays in Indian Construction Projects", International Research Journal of Engineering and Technology, Vol. 3, issue 4, 2016, pages 1831-1837.

- [9] Roopdarshan Walke, Vinay Topkar, Sajal Kabiraj, "Risk Quantification Using EMV Analysis – A Strategic Case of Ready Mix Concrete Plants", *International Journal of Computer Science Issues*, Vol. 7, Issue 5, September 2010, pp. 399-408.
- [10] Md Sarwar Ali; Masoom Reza, "Risk Identification And Management In Construction Projects", *International Journal of Research in Engineering and Technology*, Vol. 6, Issue 5, 2016, pp. 52-62.
- [11] Danish Ali and Alvin Harison, "Risk Management Strategies in Construction Companies in India", *International Journal for Innovative Research in Science & Technology*, Vol. 2, Issue 10, 2016, pp. 6-8.