Risk Management in High Rise Construction Projects: A Review

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Abstract: This paper gives information about identification of risk factors and perceptions of Indian construction practitioners i.e., contractors, owners, project managers and Engineers on the importance of different construction risks and how the risks should be assigned between the different parties of the contract. As the very common project styles, construction projects have so many characteristics likewise time limitation, specific items, financial restrictions and requirements, extraordinary structural and legal situations, complexity features. For this situation every construction project has own complex method. Risks constantly happen at construction projects and frequently cause time overrun or cost overrun. If you don't contemplate these risk factors, or neglect the main factors, these risk factors will affect the damage because of the managerial errors. Risk management is the process which covers to identify the risks, for assessment with the help of qualitatively and quantitatively, to response with appropriate technique for management and controlling. The concept has gain popularity in various industries. Various companies frequently found the method in their projects for upgrading their performance, reducing their losses and increasing their profits. Questionnaire survey among clients, contractors, engineers and architects is analyzed using, Relative Importance Index (RII) and Importance Index (IMP.I) methods. The focus of this study is to understand what Risk Management is, understand the process of risk management at construction project and have depth knowledge on the use of risk management in high-rise construction projects.

Keywords: Risk, Risk Management (RM), Risk Assessment (RA), Construction, High-Rise Construction.

I. INTRODUCTION

High Rise construction projects are very major part of construction industry which has an important role for growth of the nation. The risk factors in construction projects are very high. Hence risk involved in high-rise structures also plays a major role in construction industry. Construction project objectives are always unique and built once. Risks are arising from different sources. Risk all the time occurs at construction projects and frequently leads to time overruns or cost overruns. Indian cities perceive huge demographic growth due to migration from surrounding villages. Many citizens all over India migrate to the cities for better jobs and education. In India, a building greater between 35 to 100 meters, generally 12 to 39 stories, is considered as high-rise. **(24)** Most of the high-rise buildings in India are in the Mumbai. More than 2500 high-rise buildings are previously constructed. Delhi and its nearby area perceive vast construction events with 1500 already constructed high-rises.

RM planning is the procedure of determining how to approach and organize the risk events for respective projects. RM should apply at the initial phase for project development; RM will be very useful in developing an understanding of project uncertainty.

II. CRITICAL LITERATURE REVIEW

The following are the earlier research paper review based on Risk management in High-Rise construction industry.

II.I Literature Review on Risk Management in High-Rise Construction

Edmundas et al. (2013) defined that the RA is based on multi-factors assessment methods which contains uncertain info. RA factors are designed as macro level, mezzo level and micro level of construction project. **(6)**

Shakil et al. (2013) noted that RM eventually reduces project damages and increase the possibility so the project will finish on time and in the given budget. RM is practical management method for primary reflectivity of possible problematic areas. RM contains the total project, containing the design part, engineering related part, business related part, contracts, and finance related part, purchasing department and estimation, project management. **(21)**

Patel et al. (2013) identifies that risks are classified as technical related risks, construction related risks, physical risks, organization related risks, finance related risks, socio-political risk factors, and environment related risks. RM method hardly used by the applicants at construction projects. The applicants easily handle the risks. This method isn't working because of less knowledge and awareness between the constructions industries. The RM method should be useful for several construction projects at early phase of the project for maximum profit of the method. **(19)**

Kavilkar et al. (2014) carried survey of Pune city. The survey was based on housing need, demand, market, and type of structure. It reveals that high constructions of 11 floors are being established on the city's urban area. From investigation it reveals that high rise structures are not desired due to fire safety as customer point of view and higher cost of the building. (**22)**

Bhandari et al. (2014) described construction industry is highly risk contains. Risk is divided into technical related risks, logistics related risks, management related risks, environment related risks, and finance related risks, socio-political risk factors. **(2)**

Patel et al. (2014) carried a survey which includes 47 risk factors which occurs at construction projects. Outcomes found from literature review, organized interview with relevant experts and current scenario of construction industry. Total 47 risk factors categories as design risks, physical risks, logistics risks, legal risks, environmental risks, management risks, cultural risks, financial risks, construction risks and political risks. **(20)**

Mostafa et al. (2015) identified that investigating risk analysis techniques used to analyze risks in construction projects in Gaza strip. The findings indicate that the most important risk analysis techniques that contractors use to analyze risk factors to better manage risks of construction projects at the bidding cost estimate stage are as in ascending order as Comparative analysis, Direct judgment using experience, Action plan analysis with project details, Probability analysis using historical data, Descriptive analysis, Sensitivity analysis, Simulation analysis using software programs. It recommend contractors to select and use which of the previous risk analysis techniques as the optimal and proper technique, to analyze and estimate risks properly and to determine the convenient preventive method to respond risk effects early, at the pricing stage of construction project. **(15)**

Sakthiniveditha et al. (2015) carried survey from literature review and made a questionnaire. The required data was gathered through a detailed questionnaire survey. The main risk factors identified from literature review and by referring the relevant experts, from that the questionnaire was organized. The questionnaire survey was surveyed among onsite project manager, onsite project engineer and other site engineers. According them the major risks in high-rise construction is occurred due to technical risks, financial risks, physical risks and constructional risks. **(25)**

Chougule et al. (2015) determined that critical risk factors affect the whole productivity. The main factor is technical risk which affects the high-rise construction regularly with 44.2%, environmental risk with 48.2%, physical risks with 48.8%, financial risks with 49.2%, socio-political risks with 51.2%, and constructional risks with 52.8%. **(1)**

Danish Ali et al. (2016) carried a survey which is occupied the person's works at the construction site of various companies. It determines that the risk management concept is needed for construction activities in minimizing losses and amplifying productivity. **(4)**

Said Ali et al. (2016) observed that RM plan summaries with planned tactic which is accepted for high rise construction projects in Saudi Arabia for identification, risk actions, assessment, qualitative and quantitative risk methods, mitigation and response planning, monitoring and control, communication and reporting. **(23)**

Verma et al. (2017) concluded that the major part of risks in high-rise construction is affected as according technical risks, financial risks, physical risks and constructional risks. According to engineers the extreme risk ranking and further risk factors are shortage of material, electricity supply shortage, poor material quality, loss due to interest rate variation, site accidents, problems of sub-contractors, drawing inaccuracy, verification of inaccurate contract documents, and competition among other firms. **(11)**

Liu et al. (2017) identified that the design risks in design-build projects and prepared a study of their effect on project performance. He found total 23 design risk factors, including 17 risk factors found from literature review and 6 risk factors found from detailed interviews with 5 experienced construction experts. The path modeling results suggested that the risk effects are according to this designer's lack of responsibility, designer's lack of responsibility, designer's experience, and delay of third-party information. **(13)**

Imayanti et al. (2017) found the substitutes for risk event, consequence or impact estimates potentials for control the risk of following high rise construction projects. It used qualitative techniques for data analysis by statistical method. Estimation of this type of risk will be advantage for contractors, particularly in high rise construction to accomplish risk factors, probability and significance. **(12)**

Paul et al. (2018) observed that RA is to classify the risks in the project and manage it consequently with suitable action. The methodology depends on questionnaire survey which was gathered from the local high-rise construction project contractors. A total 24 risks affecting factors in three divisions are identified through pilot study and from expert advice. Formal risk assessment techniques are rarely used in the construction industry in Ernakulum. The RM and RA can be developed through merging qualitative and quantitative methods to investigate the risks. **(18)**

Boris et al. (2018) suggested various project R.M techniques, which easily allow in identification of risks at the high-rise construction projects and to handle it through the life span of their project. Quantitative risk analysis is one of the risk management methods. Quantitative analysis contains the calculation of possible effect of project risks and their possibilities. **(3)**

III. Major Finding from Literature Review

From the Different literatures and papers, various Risk factors affecting in High-Rise construction projects in construction industry as mention in Table 1.have been extracted.

Table 1: Major Risk Factors affecting in High-Rise Construction Projects.

No.	Author	Year	Factors				
			Risk management methods	Major risks	Effect on project	Risk management technique use in initial stage of the project	Safety aspect
1	Patel Kishan et al.	2014				*	
2	Rupali Kavilkar et al.	2014					*
3	Mostafa H. Kotb et al.	2015				*	
4	V.Sakthiniveditha et al.	2015		*			
5	Arati Chougule et al.	2015			*		
6	Danish Ali et al.	2016			*		
7	Said Ali et al.	2016	*				

8	Hanish Verma et al.	2017		*			
9	Junying Liu et al.	2017		*			
10	Imayanti Basari et al.	2017	*				
11	Leenu Paul et al.	2018	*				
12	Boris Titarentko et al.	2018	*				

(*) indicates the factors affecting in high-rise construction industry by literature.

IV. CONCLUSION

Based on Literature Review the following conclusion drawn:

1. To improve the risk management we can combine the quantitative and qualitative method to identify the risk.
2. In the high-rise construction projects the major risks are technical risk, financial risk, physical risk, constructional risk.
3. Risk factors effects on the overall productivity, cost overrun and time overrun.
4. Risk management and risk assessment will be very beneficial if it will be implemented on initial phase of the project.

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