



RISK MANAGEMENT IN CONSTRUCTION PROJECTS

¹Mubin M. Shaikh

¹Department of Civil Engineering, Maharashtra Institute of Technology, Pune

Email: ¹mubin_shaikh@rediffmail.com

Abstract— Construction industry is highly risk prone, with complex and dynamic project environments creating an atmosphere of high uncertainty and risk. The industry is vulnerable to various technical, sociopolitical and business risks. The track record to cope with these risks has not been very good in construction industry. As a result, the people working in the industry bear various failures, such as, failure of abiding by quality and operational requirements, cost overruns and uncertain delays in project completion. In light of this, it can be said that an effective systems of risk assessment and management for construction industry remains a challenging task for the industry practitioners. The aim of the this paper is to identify and evaluate current risks and uncertainties in the construction industry through extensive literature survey and aims to make a basis for future studies for development of a risk management framework to be adopted by prospective investors, developers and contractors.

Keywords- Project management; risk management; risk analysis; construction; contractors

I. INTRODUCTION

Risk can be defined as the event that negatively affects the project objectives such as time and schedule, cost, quality of work. Risk Management is the process of identifying the potential risk associated with risk and responding to those risks. Risk in any project is

a choice rather than fate. According to the characteristic of the construction industry, which has high uncertainty, so it will occur many risks during the construction phase and or operational building. Risk in construction has been the object of attention because of time and cost over-runs associated with construction projects. Risk is present in all the activities in a project; it is only the amount which varies from one activity to another.

Risks and uncertainties inherent in the construction industry are more than other industries. The process of planning, executing and maintaining all project activities is complex and time-consuming. The whole process requires number of people with diverse skill sets and the coordination of a vast amount of complex and interrelated activities. The situation is made complex by many external factors. The track record of construction industry is very poor in terms of coping with risks, resulting in the failure of many projects to meet time schedules, targets of budget and sometimes even the scope of work. As a result, a lot of suffering is inflicted to the clients and contractors of such projects and also to the general public. Risk in the construction industry is perceived to be a combination of activities, which adversely affect the project objectives of time, cost, scope and quality. Some risks in construction processes can be easily predicted or readily identified; still some can be totally unforeseen. Construction risks can be related to technical, management, logistical, or sociopolitical aspects or can be related to natural disasters. In the domain of project management, some of the critical effects of

risks are failure to achieve operational requirements and the required quality, non completion of the project within stipulated time and estimated cost.

The current study is focused on concepts of risk management and will cover the related literature on the topic, development of a survey questionnaire and suggestions related to risk management practices in construction industry of Pakistan.

II. OBJECTIVES AND NEED OF STUDY

The development of infrastructure is one of the most important activities that can boost up the business of various industries, thereby increasing the gross domestic product (GDP) of a country. Due to this fact countries stress on infrastructure development and provide finances for the same in their short term and long term financial plans. The vastness of construction projects leaves a lot of scope for various environmental, socio- political and other unforeseen problems during conceptual phase, land expropriation, and execution leading to time and cost overruns in projects and compromise in quality. The cost overruns can be of huge magnitude in a project involving a large amount of money. The loss of services given by the project during the time in which the project overruns can be enormous if put into monetary terms. Hence, to reduce the losses, efficient management of a construction project is required. Application of various project management techniques have to be made from the conception to the completion stage, which include managing various risks associated with the project in its every stage. Risk management becomes an important part of project management. The construction industry, perhaps more than most of other industries, is overwhelmed by risks. If these risks are not dealt with satisfactorily then there is a maximum likelihood of cost overruns, time delays and low quality, resulting in dissatisfaction of clients and public. In India, like other developing countries less importance is given to this aspect of project management. The basic aim of this paper is to identify and assess the current risks and uncertainties in the construction industry around the globe; and to evaluate the current state of risk management practices and make a basis for future studies for

development of a framework for effective risk management which can be adopted by prospective foreign and local investors, developers and contractors in India.

III. METHODOLOGY

In this paper, general focus has been made on the general concepts of project risk management. A questionnaire was developed by going through literature on construction risk management. To achieve the objectives of this paper, questionnaires were deemed to be the most effective tool for gathering information. These questions helped identify any projects that should definitely not be undertaken by the parties and those which, although risky, should be examined further after a more rigorous examination of the potential sources of risk. The questionnaire was designed based on the knowledge of government, consultant, or contractor in large or infrastructure construction projects; the questions were meant to identify their method of risk identification and possible effects of those risks.

The general methodology of this study relies largely on the survey questionnaire which will be collected from the various multi project construction contractors and project manager of different sizes by mail or by personnel meeting. A thorough literature review was initially conducted to identify the risk factors that affect the performance of construction industry as a whole.

IV. CONCEPTS OF RISK ANALYSIS AND MANAGEMENT

The concept of risk is multi-dimensional. In the context of construction industry, the probability that a definite factor detrimental to the overall project occurs is always present. A lack of predictability related to the consequences of a planning situation and the associated uncertainty of estimated outcomes leads to the consequence that results can either be better than expected or can be worse. In addition to the different definitions of risks, risks can be categorized for different purposes as well. The broad categories of construction risks are external risks and internal risks; while some other categories curtail risks as political, social and safety risk etc.

Project Risk: Risk management in a project encompasses the identification of influencing

factors which could negatively impact the cost schedule or quality objectives of the project, quantification of the associated impact of the potential risk and implementation of measures to mitigate the potential impact of the risk. The riskier the activity is, the costlier will be the consequences in case a wrong decision is made. Proper evaluation and analysis of risks will help decide justification of costly measures to reduce the level of risk. Risks cannot be totally avoided but with proper management these can be minimized.

Determination of Risk: There are two methods to determine risks in a project, namely the qualitative and quantitative approach. The quantitative analysis relies on statistics to calculate the probability of occurrence of risk and the impact of the risk on the project. The most common way of employing quantitative analysis is to use decision tree analysis, which involves the application of probabilities to two or more outcomes. Another method is Monte Carlo simulation, which generates value from a probability distribution and other factors.

The qualitative approach relies on judgments and it uses criteria to determine outcome. A common qualitative approach is the precedence diagramming method, which uses ordinal numbers to determine priorities and outcomes. Another way of employing qualitative approach is to make a list of the processes of a project in descending order, calculate the risks associated with each process and list the controls that may exist for each risk.

V. FACTORS AFFECTING RISK:

Several factors expose projects to normal than higher risk.

a) History: Newer projects pose more risk because the process has not been refined with the passage of time. If a project of similar nature has been done many times before, then the likelihood of success with the current project is also enhanced.

b) Management Stability: Management stability means that the whole management team shares the same vision and direction, thereby leading successful achievement of goals. If the management is unstable then it can lead to unrealistic and impractical schedules for the project and inefficient use of resources.

c) Staff expertise and experience: In the

event that the members of a project team lack the direct working knowledge and experience of the area, there is a likelihood of time delays, estimated cost upsets and poor quality.

d) Team Size: In case of large teams, the probability of problem occurrence increases due to the team size. One of the reasons can be the difficulty of communication due to the large team size.

e) Resource Availability: If the availability of resources is easy, the probability of responding to problems in real time also increases. For example, easy availability of money makes securing human, material and equipment resources easy on as needed basis. However, an abundance of resources does not provide quarantine against risks, all it does is to equip the project team with the tactics to respond to risks.

f) Time Compression: In case of highly compressed time schedule, the risks are magnified in the project. When more time is available, more flexibility is present in the project and there is an opportunity to mitigate and reduce the impact of occurring risks.

g) Complexity: In case of a highly complex or sophisticated project, the opportunity of a mistake or a problem is also enhanced.

VI. TYPES OF RISKS:

Risks can be associated to technical, operational or business aspects of projects. A technical risk is the inability to build a product that complies with the customer's requirement. An operational risk arises when the project team members are unable to work cohesively with the customer.

Risks can be either acceptable or unacceptable. An unacceptable risk is one which has a negative impact on the critical path of a project. Risks can either have short term or long term duration. In case of a short term risk, the impact is visible immediately, such as a requirement change in a deliverable. The impact of a long term risk is visible in the distant future, such as a product released without adequate testing.

Risks can also be viewed as manageable and unmanageable. A manageable risk can be accommodated, example being a small change in project requirements. An unmanageable risk, on the other hand, cannot be accommodated,

such as turnover of critical team members.

Finally, the risks can be characterized as internal or external. An internal risk is unique to a project and is caused by sources inherent in the project; example can be the inability of a product to function properly. Whereas, an external risk has origin in sources external to the project scope, such as cost cuts by senior management.

Risks associated with the construction industry can be broadly categorized into:

a) Technical risks:

- Inadequate site investigation
- Incomplete design
- Inadequate of specifications
- Uncertainty over the source and availability of materials
- Change in scope
- Construction procedures

b) Logistical risks:

- Availability of sufficient transportation facilities
- Availability of resources-particularly construction equipment spare parts, fuel and labor

c) Management related risks:

- Uncertain productivity of resources
- Industrial relations problems
- Contractual relation
- Contractors experience
- Attitude of participants
- communication

d) Environmental risks:

- Weather and seasonal implications
- Natural disasters

e) Financial risks:

- Availability and fluctuation in foreign exchange
- Delays in Payment
- Inflation
- Local taxes
- Improper estimation
- Low market demand
- Increase material costs

f) Socio-political risks:

- Change in laws and regulations
- Pollution and safety rules
- Bribery/ corruptions
- Language and cultural barrier
- Law and order
- War and civil disorders
- Requirement for permit then approval

g) Physical Risks

- Damage to structure
- Damage to equipment
- Labour injuries

h) Construction risks:

- Labour productivity
- Labour disputes
- Site conditions
- Equipment failure
- Design changes
- New technologies

VII. COMMON SOURCES OF RISK IN CONSTRUCTION PROJECTS:

The common sources of risks in construction industry are listed below:

- Changes in project scope and requirements
- Design errors and omissions
- Inadequately defined roles and responsibilities
- Insufficiently skilled staff
- Subcontractors
- Inadequate contractor experience
- Uncertainty about the fundamental relationships between project participants
- New technology
- Unfamiliarity with local conditions
- Force majeure

VIII. MAJOR PROCESSES OF PROJECT RISK MANAGEMENT:

Risk management involves four processes namely:

- a. Risk Identification:* Determination of most likely risks affecting the project and documentation of characteristics of each risk
- b. Risk quantification:* Assessment of risks and the possible interactions of risks with project activities to evaluate the possible outcomes of the project
- c. Risk response development:* Definition of response steps for opportunities and threats associated with risks
- d. Risk response control:* Response to the changes implemented to remove risks throughout the project duration

IX. RISK IDENTIFICATION TECHNIQUES

The risk identification can be done by using following techniques

1. **Brainstorming:** This is one of the most popular techniques. Generally, it is used for idea generation; it is also very useful for risk identification. All relevant persons associated with project gather at one place. There is one facilitator who is briefing about various aspects with the participants and then after note down the factors. Before closing it the facilitator review the factors eliminate the unnecessary ones.
2. **Delphi Technique:** This technique is similar to brainstorming but the participants in this do not know each other and they are not at the same place. They will identify the factors without consulting other participants. The facilitator like in brainstorming sums up the identified factors.
3. **Interview/Expert Opinion:** Experts or personnel with sufficient experience in a project can be a great help in avoiding/solving similar problems over and over again. All the participants or the relevant persons in the project can be interviewed for the identification of factors affecting risk.
4. **Past Experience:** Past experience from the same kind of project, the analogy can be formed for identification of the factors. When comparing the characteristics of projects will provide insight about the common factors.
5. **Checklists:** These are simple but very useful predetermined lists of factors that are possible for the project. The check list which contains a list of the risks identified in projects undertaken in the past and the responses to those risks provides a head start in risk identification.

X. RISK CONTROL

Risk control is the final step of the process. After we have implemented response actions, we must track and record their

effectiveness and any changes to the project risk profile. Did the response actions have a positive or negative effect on achieving project objectives? Responses taken in risks should also be documented for future reference and project plans.

XI. ADVANTAGES OF RISK MANAGEMENT:

Following are advantages of risk management:

- a) Achievement of objectives
- b) Shareholders reliability
- c) Reduction of capital cost
- d) Less uncertainty
- e) Creation of value

XII. LIMITATIONS OF RISK MANAGEMENT:

In the event of improper assessment of risks, important time can be wasted in dealing with risk losses which are unlikely to occur. If too much time is spent on the assessment and management of unlikely risks, then important resources can be diverted which otherwise could have been very profitable. Unlikely events can occur, but if the likelihood of the risk occurrence is too low, then it is better to retain the risk and deal with the result if the risk in fact occurs.

XII. CONCLUSION

Formal risk analysis and management techniques are rarely employed by construction industry owing to the lack of experience and knowledge in the area. The industry also holds disbelief that these techniques are suitable to be employed in construction projects, much in the same manner as employed in other industries. The perception of risk by contractors and consultants is mostly based on their intuition and experience. The most utilized risk response measures are risk elimination and risk transfer. However, the respondents have revealed that these practices cause the problems of delays, low quality and low productivity in projects.

XIII. REFERENCES

1. Akintoye, A.S. and MacLeod, M.J.; "Risk analysis and management in construction";

- International Journal of Project Management (1997)
2. Baker, S., Ponniah, D., and Smith, S.,; Risk response techniques employed currently for major projects, *Construction Management & Economics* (1999)
3. Dariusz Skorupka,; “Risk management in building projects”; *AACE International Transactions* (2003)
4. Dilesh Pardhi AnandKumar Patil,; “Risk Management In BOT Projects”,; Thesis (2008)
5. Dr. M. J. Kolhatkar, Er. Amit Bijon Dutta,; “Study of Risk in Construction Projects”,;GRA (2013)
6. Ekaterina Osipova,;“Risk management in construction projects: a comparative study of the different procurement options in Sweden”,; Thesis (2008)
7. F. Y. Y. Ling and L. Hoi,; “Risks faced by Singapore firms when taking construction projects in India,” (2006)
8. Kinnaresh Patel M.E. (C.E.M.)*,; A study on risk assessment and its management in India,; *AJCE* (2013)
9. Mehmood Alam, Dr. Nadeem Ehsan, Ebtisam Mirza, Azam Ishaque,;“Risk Management in construction industry”,;(2010)
10. A Study of Risk Management Techniques for Construction Projects in Developing Countries 142
11. Prof. Shakil S. Malek, Nazneen I. Pathan, Haaris Mal,; “Risk Management in Construction Industry”,; *IJAR* (2013)
12. S. Q. Wang and M. F. Dulami,; “Risk management frame work for construction projects in developing countries,” (2004)
13. Smith, N.J., Tony, M., and Jobling, P.,; *Managing risk in construction projects*, 2th ed: Blackwell Publishing (2006)
14. Soon Kim,; Deepak Bejaj,; *Risk management in construction: An approach for contractors in South Korea*,; (2000)
15. Tsung-ChiehTsai, Min-LanYang,; “Risk assessment of Design-Bid-Build and Design-Build Building projects”; *Journal of the Operations Research Society of Japan* (2010)
16. Uher, T. E. & Toakley, A. R.; *Risk management in the conceptual phase of a project*.*International Journal of Project Management* (1999).
17. Zenghua Kuang,; “Risk Management in Construction Projects”; (2011)