



# AN EXPERT SYSTEM FOR RISK ASSESMENT & MANAGEMENT IN CONSTRUCTION PROJECTS

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**Abstract- 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. It includes maximizing the results of positive events and minimizing the consequences of adverse events.**

## 1.1 INTRODUCTION

Generally, risk is a choice in an environment rather than a fate. BS 6079 (British Standard Institution 1996) defines risk as „It is the uncertainty inherent in plans and possibility of something happening that can affect the prospects of achieving, business or project goals“. 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. 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”. About Uncertainty he defines as “Unpredictability of environmental and organizational 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. It includes the possibility of loss or gain, or variation from a desired or planned outcome.

## 1.2 RISKS IN CONSTRUCTION INDUSTRY

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.

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. 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 sophistication.

The recent move by the Indian government to introduce risk-rating system at the pre-bid stage has evoked a positive response from industry. The rating agencies have come up with detailed analysis of the various risk parameters such as identification, availability of land and project related infrastructure; status of statutory clearances; resettlement and rehabilitation requirements or status; accessibility to site and other site related infrastructure; availability and pricing of inputs; technology risk; off-take arrangement and market risk and credit risk of off-taker; and payment security mechanism envisaged. The grading of a project at the pre-bid stage would essentially be a comment on the risks involved in undertaking the project. Credit rating agencies like Crisil, Fitch Ratings have been asked to develop a grading methodology for risk-rating the projects. But some industry experts feel that a risk rating system will discourage private participation in rural development projects on a large scale. Most of the rural development projects are likely to get lower ratings which may drive away private investors and

financiers from participating in such projects.

## 2.0 CONCEPTS OF RISK ANALYSIS AND MANAGEMENT

### 2.1 RISK CONCEPTS

Risk is a multi-facet concept. In the context of construction industry, it could be the likelihood of the occurrence of a definite event/factor or combination of events/factors which occur during the whole process of construction to the detriment of the project a lack of predictability about structure outcome or consequences in a decision or planning situation, the uncertainty associated with estimates of outcomes – there is a chance that results could be better than expected as well as worse than expected etc. In addition to the different definitions of risk, there are various ways for categorizing risk for different purposes too. Some categorize risks in construction projects broadly into external risks and internal risks while others classify risk in more detailed categories of political risk, financial risk, market risk, intellectual property risk, social risk, safety risk, etc.

Risk is inherent and difficult to deal with, and this requires a proper management framework both of theoretical and practical meanings. Risk management is a formal and orderly process of systematically identifying, analysing, and responding to risks throughout the life-cycle of a project to obtain the optimum degree of risk elimination, mitigation and/or control. Significant improvement to construction project management performance may be achieved from adopting the process of risk management.

The risk management process begins with the initial identification of the relevant and potential risks associated with the construction project. It is of considerable importance since the process of risk analysis and response management may only be performed on identified potential risks. Risk analysis and evaluation is the intermediate process between risk identification and management. The process of risk management does not aim to remove completely all risks from

Its objective is to develop an organized framework to assist decision makers to manage the risks, especially the critical ones, effectively and efficiently.

### 2.2 PROJECT RISK MANAGEMENT

Risk management in a project encompasses identifying influencing factors that could

potentially negatively impact a project's cost schedule or quality baselines; quantifying the associated potential impact of the identified risk; and implementing measures to manage and mitigate the potential impact.

The riskier the activity is, the costlier the consequences if the wrong decision is made. Businesses would like to quantify risk for many reasons. Knowing how much risk is involved will help decide if costly measures to reduce the level of risk are justifiable. It can also help to decide if sharing the risk with an insurance company is justified. Some risks, such as natural disasters, are virtually unavoidable and affect many people. All choices in life involve risk. Risks cannot be totally avoided, but the choice can be made so that risk is minimized.

Probability of an event  $\times$  consequence of loss due to that event  

$$\text{Risk} = \frac{\text{Probability of an event} \times \text{consequence of loss due to that event}}{\text{per event}}$$

Graphical representation of risk ratings can be made by plotting graph between probability and seriousness, Figure 2.1 explains this.

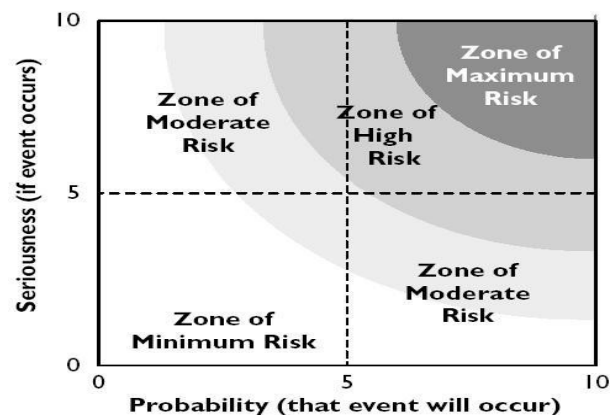


Figure 2.1 Graphical representations of risk rating

### 2.3 RISK ASSESSMENT

Risk assessment is defined in this study as a technique that aims to identify and estimate risks to personnel and property impacted upon by a project. 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, subjective analytical methods that rely on historical information and the experiences of individuals and companies have been used to assess the impact of construction risk and uncertainty.

#### 2.4 DETERMINATION OF RISK

There are mainly two methods to determine risk, namely the quantitative and the qualitative approach. The quantitative approach relies on statistical calculation to determine risk, its probability of occurrence, and its impact on a project. A common example of the quantitative approach is decision tree analysis, applying probabilities to two or more outcomes. Another approach is the Monte Carlo simulation, which generates a value from a probability distribution and other factors.

The qualitative approach relies on judgments, using criteria to determine outcome. A common qualitative approach is a precedence diagramming method, which uses ordinal numbers to determine priorities and outcomes. An example of a qualitative approach is to list in descending order specific processes of a project, the risk or risks associated with each process, and the control or controls that may or should exist for each risk.

#### 2.5 GENERAL TYPES OF RISKS

Risks can be viewed as business, technical, or operational. A technical risk is the inability to build the product that will satisfy requirements. An operational risk is the inability of the customer to work with core team members. Risks are either acceptable or unacceptable. An acceptable risk is one that negatively affects a task on the non-critical path. An unacceptable risk is one that negatively affects the critical path. Risks are either short or long term. A short-term risk has an immediate impact, such as changing the requirements for a deliverable. A long-term risk has an impact sometime in the distant future, such as releasing a product without adequate testing. Risks are viewed as either manageable or unmanageable. A manageable risk is one you can live with, such as a minor requirement change. An unmanageable risk is impossible to accommodate, such as a huge turnover of core team members. Finally, risks are either internal or external. An internal risk is peculiar to a project, such as the inability to get the parts of a

product to work. An external risk originates from outside the scope of the project, such as when senior management arbitrarily cuts funding by 20 percent.

- Delivery/operation risk
- Technology risk
- Financial risk
- Procurement-contractual risk
- Political risk
- Environmental risk
- Social risk
- Economical risk
- Reserves risk
- Credit risk
- Engineering risk
- Materials risks
- Weather risks
- Insurance risks
- People risks
- Interface risks
- Underground risks
- Joint venture risks
- Design-build risks
- Security risks
- Green risks
- Right of way risks
- Payment risk

#### 2.6 SOURCES OF RISK IN CONSTRUCTION PROJECTS

The common sources of risk in construction projects are listed below:

- Misunderstanding of contract terms and conditions.
- Design changes and errors
- Poorly coordinated work
- Poor estimates
- Poorly defined roles and responsibilities
- Unskilled staff
- Natural hazards

## 2.7 MAJOR PROCESSES OF RISKMANAGEMENT

Risk management involves four processes, namely

1. RiskIdentification
2. RiskQuantification
3. Risk ResponseDevelopment
4. Risk ResponseControl

## 2.8 TOOLS & TECHNIQUES FOR RISKIDENTIFICATION

Risk can be identified by the following methods: (A.K.Garg 2005)

1. Brainstorming
2. Workshops
3. Interviews
4. Questionnairesurvey
5. Feedback from similarprojects
6. Use of specialists
7. Previousexperience

## 2.9 RESPONSE TORISK

There are basically five categories of classic risk response strategies: accepting, avoiding, monitoring, transferring, and mitigating the risk (Eric Verzuh 2005).

### *Accepting the Risk*

Accepting the risk means, understand the risk, its consequences, and probability, and choose to do nothing about it. If the risk occurs, the project team will react. This is a common strategy when the consequences or probability that a problem will occur are minimal. As long as the consequences are cheaper than the cure, this strategy makes sense.

### **Avoid the Risk**

Avoid a risk by choosing not to do part of the project. This deletion of part of the project could affect more than the project-the business risk could also be affected. Changing the scope of the project might change the business case as well, because a scaled-down product could have smaller revenue or cost-saving opportunities. Risk/return is a popular expression in finance-high return on an investment, probably more risk is involved. Avoiding risks on projects can have the same effect-low risk, low return.

### **Monitor the Risk and Prepare Contingency Plans**

Monitor a risk by choosing some predictive indicator to watch as the project nears

the risk point. The risk strategy in is to monitor the risk by being part of the test team. Contingency plans are alternative courses of action prepared before the risk event occurs. The most common contingency plan is to set aside extra money, a contingency fund, to draw on in the event of unforeseen cost overruns. It's important to make sure that thisfund is used only for unforeseen cost overruns-not to make up for underestimating or substandard performance. Contingency plans can be looked on as a kind of insurance and, like insurance policies, they can beexpensive.

### **Transfer the Risk**

Many large projects purchase insurance for a variety of risks, ranging from theft to fire. By doing this, they have effectively transferred risk to the insurance company in that, if a disaster should occur, the insurance company will pay for it. While purchasing insurance is the most direct method of transferring risk, there are others. For example, hiring an expert to do the work can also transfer risk. A fixed-price contract states that the work will be done for an amount specified before the work begins. Fixed schedules may also be added to such a contract, with penalties for overruns. With fixed-price contracts, project

managers know exactly what the cost of this part of a project will be. They have effectively transferred the cost and schedule risks from the project to the subcontracting firm; any overruns will be the responsibility of the subcontractor. The risk of cost and schedule overruns is borne completely by the project on these contracts. The project is not able to transfer risk with this kind of contract, but when the work to be performed is poorly defined, or the type of service is open-ended, a reimbursable contract is the only type a subcontractor will sign. Clearly, transferring risk to another party has advantages, but it also introduces newrisks.

### **Mitigate the Risk**

Mitigation is a process of response to the risk after impact affects the project. Mitigation covers nearly all the actions the project team can take to overcome risks from the project environment.

## 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. Third party risk rating would certainly raise critical points, which are not normally raised during finalisation of project The following are the conclusions from this thesis work 1. Shortage of skilful workers is the major risk faced by almost all the companies. This is because; the skilled workers are migrating between companies very often due to the high demand in the market. And also huge vacuum is created by the workers who move to Middle East countries where they are offered very high packages when compared to India. 2. Sub-contractor related risks are also high, since most of the sub contractors are not able to meet the standards of the main contractor and the client due their size of work. Thus from the above points the management risk has been found to be the critical risk from this survey. 3. Delay in the project is also one of the main risks, but this delay is looped with various others factors and risks directly or indirectly. 4. Political risk is substantially very low for the large firms when compared to other risk. 5. Legal risk is also very low, but the implementation of court directive is not proper; this was the complaint seen from this survey. 44 6. Large companies are accepting that there are few environmental effects due to their project, but says that it is a global phenomena and it cannot be nullified, but only can be reduced. 7. Overall market, management, and the financial risks are high when compared to other risks.

**Few suggestions to the companies:**

1. During the planning stage itself a full fledged risk assessment about the project should be made as a effective measure to curb risks.
2. Financial part of the risk is a global phenomena and this risk should be handled carefully using financial consultants since this

cannot be handled by engineers alone.

3. Most of the company's management follow Top to down approach which is a traditional approach, but Down to top approach should be followed so that the employees' voices are heard.
4. It is better to involve a risk consultant in a project who can both owner and the contractor in a better way.

**SUGGESTIONS FOR FUTURE WORK**

1. Currently risks faced by foreign AEC companies working in India are much more than the Indian companies, so this can be analysed in future 2. India government is allowing a lot Special economic zones (SEZ) which encourages many private players. But the social risks are much more SEZ activity and a research can be made in risk assessment and mitigation for SEZ alone. 3. Third party risk assessment and management effectiveness can be analysed.

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