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RISK MANAGEMENT OF CONSTRUCTION PROJECTS IN MADURAI REGION

Dr.A.M.ArunMohan,
AssociateProfessor, Department of Civil Engineering, Sethu Institute of Technology, Kariapatti.

***Abstract*—** Construction projects are initiated in complex and dynamic environments resulting in circumstances of high uncertainty and risk, which are compounded by demanding time constraints. 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. It is vulnerable to the numerous technical & business risks that often represent greater exposures than those that are traditional. Thus risk assessment need arises. Risk assessment is a tool to identify those risks in a project and manage it accordingly with proper treatment. 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. The survey questionnaire is designed to probe the cross-sectional behavioural pattern of construction risks construction industry.
***Index Terms*— Questionnaire.**

Introduction

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. 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 acomment 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.

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 in to 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.

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

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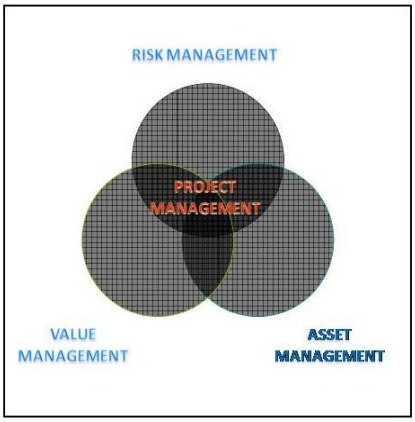
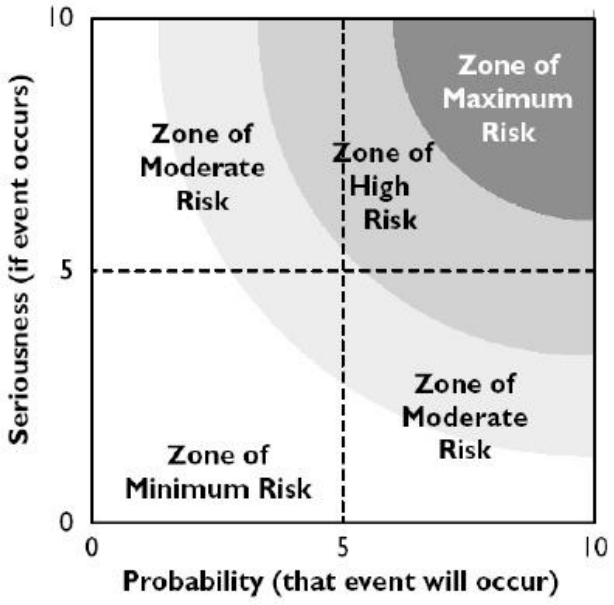
analysis and evaluation is the intermediate process between risk identification and management. It incorporates uncertainty in a quantitative and qualitative manner to evaluate the potential impact of risk. The evaluation should generally concentrate on risks with high probabilities, high financial consequences or combinations thereof which yield a substantial financial impact. Once the risks of a project have been identified and analyzed, an appropriate method of treating risk must be adopted.



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.



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

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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.

RISK EXPOSURE

Several factors can expose projects to higher than normal risk.

- Team size - The larger the team, the higher the probability of a problem arising. For example, communications can be more difficult as the number of participants increases.
- The number of interactions among people increases and thus they require greater coordination.
- History - Newer projects are riskier because the processes have not been refined. The more times a project of a similar nature has been done, the greater the likelihood of success.

- Staff expertise and experience - If the staff lacks direct experience and knowledge of the subject, people will struggle to learn as they go along, robbing the project of time and possibly introducing errors.
- Complexity - The more sophisticated a project, there is a greater the opportunity of a mistake or problem.
- Management stability - Management stability implies unity of direction, which in turn means reaching goals. Management irritability can lead to unrealistic scheduling and inefficient use of resources.
- Time compression - If a schedule is highly compressed, then the risks is magnified. Having more time means greater flexibility and the opportunity to prevent or mitigate the impact of errors.
- Resource availability - The more resources that are available, the greater the ability to respond to problems as they arise. For example, more money brings greater ability to secure equipment or people when needed. Plentiful resources, of course, do not guarantee protection from risk; however they do provide the means to respond to it.

SOURCES OF RISK IN CONSTRUCTION PROJECTS

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

1) Misunderstanding of contract terms and conditions.
2) Design changes and errors
3) Poorly coordinated work
4) Poor estimates
5) Poorly defined roles and responsibilities
6) Unskilled staff
7) Natural hazards
8) Political and legal problems

GENERAL TYPES OF RISKS

Delivery/operation risk

The ability to overcome the risk of delivering and operating the project as conceived. This risk factor involves issues or concerns associated with actual engineering, procurement, construction execution, and operation of the project, including non-traditional approaches such as a public owner's use of design-build contracts.

Technology risk

The ability to overcome the technological risks of the project. This risk factor involves issues or concerns associated with the technologies involved in the execution methods and operational technology of the project**.**

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Financial risk

The ability to overcome the financial risk of the project through to final completion and operation. This risk factor involves issues or concerns associated with the financing of the project, including the execution period and operations or equity financing.

Procurement-contractual risk

The ability to overcome the risks associated with the procurement of, or contracting for, the execution and operation of the project. This risk factor involves issues or concerns associated with the contractual and procurement approaches-systems-processes used for both project execution and operation**.**

Political risk

The ability to overcome the political risk of the project, including local, state, and national political opposition and code and regulatory impediments. This risk factor involves issues or concerns associated with the local, regional, and national political and regulatory situation confronting the project.

Environmental risk

The ability to overcome the environmental risks of the project. This risk factor involves issues or concerns associated with the environmental problems, concerns, and activities confronting the project during the project execution and the project operation**.**

Social risk

The ability to overcome the social risks of the project. This risk factor involves issues or concerns associated with the social and cultural impacts of the project to the community and region within which it is to be located**.**

Economic risk

The ability to overcome the economic impact risks of the project. This risk factor involves issues or concerns associated with the macro economic impact of the project to the community and region within which it is to be located.

Reserves risk -

An operations risk factor

Addresses the extent of reserves and contingency to be transported, and not only the anchor field, but also reserve risk associated with the prospects and discoveries in the area.

Customer credit risk

Customer credit risk is a new risk issue stemming from the large inflow of small capital independents and the formation of many Limited Liability Corporations without any real assets.

Engineering risk-

The exploration and production requirements are continuously pushing the deep water envelope. A large risk consideration is that the meteorological-ocean data current and waves is empirical and is changing with new measurement information becoming available every year.

Materials risks

A procurement risk factor the huge costs of projects are driving the search for the cheapest material that meets specifications which is to be fabricated in a location that has the least cost-often in different countries.

Weather risks

An environmental risk factor Wave currents (storm risks) are plaguing many off-shore projects, yet are increasingly uninsurable.

OVERVIEW OF RISK MANAGEMENT

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.

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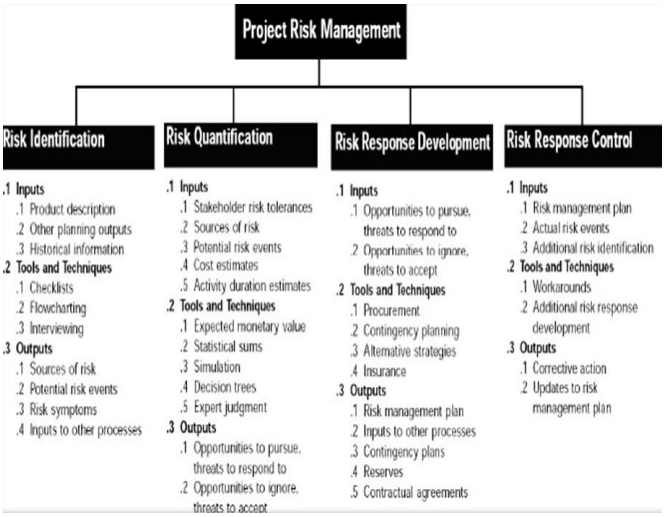

MAJOR PROCESSES OF PROJECT RISK MANAGEMENT

Risk Identification

Determining which risks are likely to affect the project and documenting the characteristics of each.

Risk Quantification

Evaluating risks and risk interactions to assess the range of possible project outcomes.

Risk Response Development

Defining enhancement steps for opportunities and responses to threats

Risk Response Control

Responding to changes in risk over the course of the project.

TOOLS AND TECHNIQUES FOR RISK IDENTIFICATION

Risk can be identified by the following methods:

1) Brainstorming
2) Workshops
3) Interviews
4) Questionnaire survey
5) Feedback from similar projects
6) Use of specialists
7) Previous experience

METHOD OF SURVEYING

The general methodology of this study relies largely on the survey questionnaire which will be collected from the local building contractors 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.

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 etc., and the second part consists of the construction risk factors for evaluation.

QUESTIONNAIRE DESIGN

The survey questionnaire is designed to probe the cross-sectional behavioral pattern of construction risks construction industry. The questionnaire was prepared for the pilot survey was formulated by

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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 interview, to ask for clarifications, and to focus on specific projects, risk practices and knowledge, made the interviews insightful.

RISK RATING

A 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

ANALYSIS OF SURVEY RESULTS

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

$$RS^{i} = \frac{\sum_{j=1}^{T} S_j^i}{T}$$

$$S_j^i = \alpha_j^i \beta_j^i$$

Where,
Si= significance score assessed by respondent j for risk i
j = probability of occurrence of risk i,
assessed by respondent j
βi= degree of impact of risk i, assessed by respondent j.
By averaging scores from all the responses, it is possible to get an average significance score for each risk, and this average score is called the risk index score and is used to rank among all risks.
The model for the calculation of risk index score can be written as
RSi= index score for risk i
; Si= significance score assessed by respondent j for risk i and T = Total number of responses
To calculate Si,
The five point scales for α and β, this will be converted into numerical (Likert scale) scales.

PILOT STUDY

A pilot survey with the questionnaire in the previous phase and follow-up interviews with local contractors were conducted. The purpose was to identify the factors out of the 81 factors that applied overseas could also apply to the local construction industry. The small number interviews and the structure of the questionnaire in the pilot study does not allow for statistical analysis.

Responses to the interviews have been used to identify consistent themes, common practices, and insight provided by active and influential project participants that would provide additional guidance and assistance to the research team. The survey results formed the basis of modifying the questionnaire for the subsequent full-scale survey. The pilot study attempts to short-list locally relevant factors. The criteria for a short-listing are that the chosen factors are relevant in the local construction industry. As a result, only important and relevant factors were chosen for inclusion in the full-scale survey in the second phase of the research.

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RESPONSE TO RISK

1. 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.

2. 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.

3. 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 over runs. It's important to make sure that this fund 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 be expensive.

4. 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 over runs. 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.

5. 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.

ADVANTAGES OF RISK MANAGEMENT

Following are the advantages of risk management

- ✓ Less uncertainty
- ✓ Achievement of objectives
- ✓ Shareholders' reliability
- ✓ Reduction of capital cost
- ✓ Creation of value

LIMITATIONS OF RISK MANAGEMENT

If risks are improperly assessed and prioritized, time can be wasted in dealing with risk of losses that are not likely to occur. Spending too much time assessing and managing unlikely risks can divert resources that could be used more profitably. Unlikely events do occur, but if the risk is unlikely enough to occur, it may be better to simply retain the risk, and deal with the result if the loss does in fact occur.

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CONCLUSION

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 finalization of project.

The following are the conclusions from this thesis work

- 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.
- Since real estate, construction sector are in the boom side, construction companies are in move to make profit as soon as possible in current wave itself; but this creates tremendous pressure to the workers to complete the project in a very short span. This time constraint risk prevails in all the companies surveyed.
- 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.

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For papers published in translation journals, please give the English citation first, followed by the original foreign-language citation [6].

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