*International Journal of Science and Engineering Research (IJ0SER),*

*Vol 3 Issue 2 February -2015*
3221 5687, (P) 3221 568X

# *A Study On Risk Assessment In The Construction Of High-Rise Buildings*

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***Abstract*-The construction projects are one of the most important one which plays a vital role in development of the country. It is estimated that the High-rise (or) multi storey buildings are the most important part of the construction for the greater development. The major part of the construction leads to high-rise buildings. Hence the risk involved in this part also rates higher in the construction industry. Risks in construction projects is considered one of the most common problems causing a multitude of negative effects on the construction projects. Construction risks can be minimized only when their cause are identified. The objective of this study was to study the risk assessment in the construction of high rise buildings. This study was carried out based on literature review and a questionnaire survey. The data for this study will be gathering through a detailed questionnaire survey. The questionnaire consists of two sections and first section consists of general questions, the second section carries the list of major risks and their sub risks. The two sections consist of thirty five risk factors. The questionnaire form is forwarded to various construction industries through email and in personal. The objectives of the study were successfully achieved. Totally for ten companies the questionnaires were given, out of which three had an effective reply thus the response rate is 60% which is considered a good response in this type of survey. This research seeks to identify and assess the risks in high-rise buildings and improve the risks that occur during the construction of high-rise buildings**

## *INTRODUCTION*

### *1.1 GENERAL*

The construction industry is the second largest industry of the country after agriculture. It makes a significant contribution to the national economy and provides employment to large number of people. The use of various new technologies and deployment of project management strategies has made it possible to undertake projects of mega scale. In its path of advancement, the industry has to overcome a number of challenges and risks. However, the industry is still faced with some major challenges, including housing, disaster resistant, water management and mass transportation. Recent experiences of several new mega-projects are clear indicators that the industry is poised for a bright future. It is the second homecoming of the civil engineering profession to the forefront amongst all professions in the country.

Construction projects are always unique and risks raises from a number of different sources. Risk is defined as any action or occurrence which will affect the achievement of project objectives .Risk management is a technique which is used in many other industries from, IT related to business, automobile, pharmaceutical industry, to the construction sector. Risks and uncertainties inherent in the construction industry are more than any other industries.

Many industries have become more proactive about using risk management techniques in project. However, with respect to the construction industry, the same is not used commonly. Risk is an integral component of any project. Risk is present in all projects irrespective of their size or sector. No project is totally free from risks. If risks are not properly analyzed and strategies are not trained to deal with them, the project is likely to lead to failures. In practice, these new rates would often be valued after the work was executed based on the actual costs. Clearly, under this approach the employer carried the major risks of the change. Many new conditions of contract, for both building and civil engineering works, have now introduced a new methodology for valuing variations requiring the contractor to submit a quotation for the work before the instruction to proceed is given. This approach shifts the risk to the contractor who has to include in the quotation for all forecasted costs including delay, disruption and risk.

Variations are inevitable on building and civil engineering projects and may range from small changes having little consequential effects to major revisions, which result in considerable delay (or) disruption to the project. There are a number of reason for the introduction of changes on construction works including:

- Inadequate briefing from the client
- Inconsistent and late instructions from the client
- Incomplete design
- Lack of meticulous planning at the design stage
- Lack of co-ordination of specialist design work
- Late clarification of complex details

Additionally on civil engineering works there are many cases where changes and new rates are necessary because of the nature of the ground. Furthermore changes may occur due to the client's desire to incorporate the latest technology into the project which will led to deviations of time and cost of the project which indicate the risk in the project.

### 1.1 RISK

Risk is defined as an exposure to the consequences of uncertainty. Risk is usually considered as an unwanted event that can be identified and quantified through its impact and probability of occurrence. The classical definition of risk states that

Risk = Probability x Impact

- A probability of occurrence of that event.
- Impact of the event occurring (Magnitude of amount loss/gain).

A project risk uncertain event (or) condition that, if it occurs, has a positive or a negative effect on at least one project objective. A risk may have one or more causes and, if it occurs, one or more impacts which are inevitable in projects and because of this uncertainty influence project performance. In which the chance of something happening that will have an impact upon project objectives

Traditional methods of coping with project risks and uncertainties mainly consist of establishing a contingency budget which is estimated as a percentage of the various project components. This method of calculating contingencies for risk has a low level of confidence and reliability. Probabilistic risk assessment techniques can provide an analytical basis for establishing contingency budgets by modeling the impact of risk factors using data ranges.

The goal of risk assessment and risk management is to minimize cost overruns and scheduling problems. It has been shown that cost overruns are positively related to project size, engineering uncertainty, inflation, project scope increase, the length of time between planning and completion of a project, delays, and the inexperience of administrative personnel.

Many systems exist for categorizing risks into different categories but the one presented here is fairly simple. In this system each risk item is qualified on two scales likelihood and impact. Each scale is divided into two categories of “low” (or) “high” and risks are rated according to each scale.

Risks and other uncertainties can cause losses, which lead to increased costs and time delays, during the currency of projects and at their end. The need to prevent failures in the construction process and other losses relating to projects has been highlighted many times over the years and figures strongly in a recent major report.

#### 1.1.1 Risk in high-rise buildings

High-rise (or) multi storey buildings are the most important part of the construction which plays a vital role for the development of the country. It is estimated that major part of the construction leads to high-rise buildings. Hence the risk involved in this part also plays a major role in construction industry. Safety managers should be aware of the causes of the accident and proper safety planning is found to be an indirect factor that adversely affects on-site safety. Hazardous environment must be ignored or occupations and process related to the hazard must be protected when the hazardous environment is observed.

### 1.2 RISK MANAGEMENT IN HIGH-RISE BUILDINGS

Risk management is the art and science of anticipating and planning for future uncertain events. It is concerned with identifying and analyzing a range of possible outcomes, then control and mitigate their negative impacts. The objective is to understand, and mitigate (or) control risks.

Understanding the risks inherent with each potential project alternative is important to controlling cost and developing estimates that reflect the cost of accepted risks. To assist project management in understanding and controlling contingency as the project progresses through its development which is a dynamic and continuous process throughout project development.

Construction professionals need to know how to balance the contingencies of risk with their specific contractual, financial, operational and organizational requirements. In order to achieve this balance, proper risk identification and risk analysis is required. Many construction professionals look at risks individually and do not realize the potential impact that other associated risks may have on their business operations. Using a holistic risk management approach will enable a firm to identify all of the organization's business risks. This will increase the probability of risk mitigation with the ultimate goal of total risk elimination.

Since project risk management is the culture, processes and structures adopted by an organization directed towards the effective management of risk in projects. The goal of risk management is to ensure informed decisions are made at the right time and that there is visibility of sources of uncertainty that may impact on the success of a project.

They reduce negative impacts and maximize opportunities and positive outcomes in the interests of projects and stakeholders. It is a systematic approach that allows risks to be embraced, avoided, reduced (or) eliminated through a logical, comprehensive and documented strategy. Serves as a kind of tools and techniques, that will help the project manager maximize the probability and results of positive events and minimize the probability and consequences of adverse events as indicated and appropriate within the context of risk to the overall project objectives of cost, time, scope and quality.

Risk management should be at the earliest stages of project development, it will be helpful in developing an understanding of project uncertainty and in developing an appropriate project contingency. As the project progresses, the monitoring and control processes assist in managing cost escalation resulting from scope growth or the realization of uncertain event.


**Fig 1.1 Risk management process**

*3.2 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 construction of high-rise buildings. Also some interviews with industrial practitioners were conducted to produce to check effectiveness of questionnaires.

*3.2 NEED FOR RISK MANAGEMENT PLAN FOR HIGH-RISE BUILDINGS*

To formulate the needs and goals of the proposed the following purpose are to be done:

1. To define the objectives of the specific risk management plan.
2. Describe the risks target in order to monitor and develop possible mitigation.
3. To develop technical and other requirements needed to mitigate risks.
4. The costs and benefits of risk mitigation measures.
5. A description of the risk management responsibilities including the owner's contractors, and others.

*RISK ASSESSMENT*

*4.1 PROCESS OF RISK IDENTIFICATION*

The Process of identification of risks involves the accurate identification and evaluation of the various variables that have the potential to adversely affect the implementation of the project of the interests of participants. The correct and accurate identification of risks associated with a specific project is critical to its successful development, implementation and subsequent financing.

The risk identification phase as being either one of the most important stages within the risk management process, (Martins, 2006) or even the most challenging and relevant phase in this process (Kloss-Grote and Moss, 2008) Chapman (1998) divided the risk identification phase into three categories.

1. The Risk identification conducted only by a risk analyst and based exclusively in his practice, knowledge and capacity.
2. The Risk identification was conducted through the interview of the risk analyst with one or many members of the project staff in order to analyze the reviewed data and the project life cycle based on the knowledge and expert of the people interviewed.
3. The Risk identification in which the risk analyst guides one or many work groups applying the risk identification techniques.

*4.2 RISK IDENTIFICATION TECHNIQUES*

Risk Identification can be done by the following methods:

- **Brain storming:** 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.
- **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 brain storming sums up the identified factors.
- **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.
- **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.
- **Check lists:** 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.
- **Influence diagram:** it is a graphical representation containing nodes representing the decision variables of a problem. a traditional influence diagram is formed by three types of nodes: utility, decision and informational. the causal relationship occurs between utility and chance nodes and represents a probabilistic dependence.

- **Flow chart:** graphical tool that shows the steps of a process. this technique is applied for a better comprehension of the risks or the elements interrelation.
- **Cause-and-effect diagrams:** these are also called fishbone diagram, illustrate how various factor might be linked to potential problems or effects. The diagram is designed by listing the effect on the right sides and the causes on the left sides.

*4.3 ASPECTS TO ANALYSE RISKS*

In order to identify all the risks associated with a project it would be important to analyze:

- Each aspect of the project
- The stages involved in each of the aspects so identified for the project.
- Each of the main parties involved in the implementation of the project.
- The industry to which the project is related;
- Geographical location of the project facility;
- The basis of commercial feasibility of the project;
- The political scenario;
- The economic factors affecting the project.

By analyzing the above mentioned factors one would be, generally speaking, covering the common sources of risk, namely, the economic, geographical or natural, political and legal factors affecting a project.

*4.5 MANAGING PROJECT RISKS*

- Allocate risk responsibility to parties who have power & capability to best manage them.
- Provide cost cushion for risks which cannot be allocated to others.
- To the extent of non-allocation of risks the project will become costlier and tariff higher to make the project bankable for sponsors and lenders.
- Install risk management mechanism to fulfill risk management needs of lenders

*4.6 DIFFERENT METHODS OF RISK IDENTIFICATION*

- Risk break down structure
- Knowledge of the project
- Discussion with the experts

*RESULTS AND DISCUSSION*

*5.1 RESULT ANALYSIS*

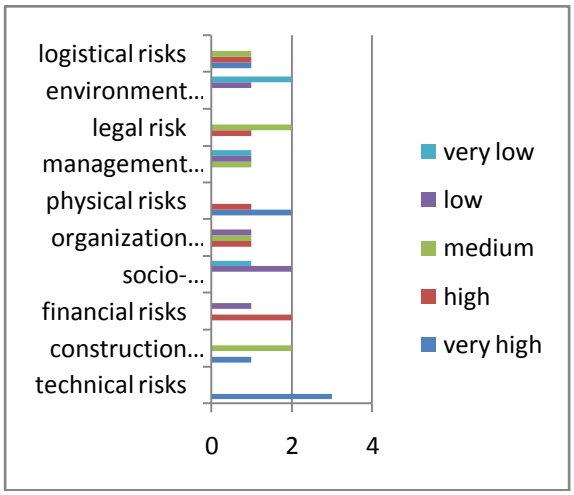


Fig 5.1 Data collected from the companies

*INFERENCE*

As per the results collected from the companies the risks are rated as per the likert scale as legal risk medium, management risk low, physical risk very high, organizational risk low, socio-political low, financial risk high, construction risk medium, technical risk very high.

*CONCLUSION*

According to the methodology, the literature has been reviewed from the various journals and different papers regarding risk assessment in the construction industry. The risks factors are identification based on the literature collected and by consulting the experts, based on this the questionnaires were prepared. Totally for ten companies the questionnaires were given, out of which three had an effective reply. Thus the response rate is 60% which is considered a good response in this type of survey. In those three companies surveyed, all the questionnaire survey was done from project manager, project engineer and other concerned engineers at the site. According to them the major part of risks in high-rise buildings are caused due to technical, financial, physical and constructional problems

As far as the engineers concerned Lack of knowledge of arbitration has the maximum risk rating and other risks are material shortage, shortage in supply of electricity, poor quality of procured materials, loss due to fluctuation of interest rate, accident in site sub-contractor related problems, error in drawings, improper verification of contract documents, and competition from other companies. The least risk rating given by project engineer is environmental risk, relation with government departments, local protectionism and industrial disputes.

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