

# Comparative Study on Various Methods of Risk Analysis

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**Abstract**—This paper aims to contribute a study on various methods of risk analysis. Compared to any other industries, construction projects have distinctive features and face more risks. Risk is defined as the measurement of consequences of uncertain events, situation or condition which may occur in construction field. Project risk management is the art and science of managing risks and is carried out in five major stages as plan risk management, classification of risks, identification of risks, analysis or assessment of risks, and risk responses or risk mitigations. In this paper the different methods of assessment were explained, and a comparative study of those methods were carried out.

**Keywords**—Risk, Risk Analysis, Risk Management, Probability of occurrence, Impact

## I. INTRODUCTION

In the early days, the construction projects were much more stable and have short duration compared to the current scenario where the infrastructure projects having project life spread over many years. The stability of modern construction projects constantly subjected to certain sensitive and volatile, external and internal environments. The unique features of construction industry are the reason for which they are usually considered as high-risk business. The construction projects may face, the lack of adequate environmental information and many other data, experience etc. Similar construction projects may have entirely different risk factors in different region.

## II. RISK MANAGEMENT

Risk Management may be described as a systematic way of looking at area of risk and consciously determining how each should be treated. Compared with many other industries, the construction industry is subjected to more risk due to the unique features of construction activities, such as long period, complicated processes, abominable environment, financial industry and dynamic organizational structure [4]. In most major projects, there is some critical element, the lateness of which would results in costs to the owner that were far in excess of the value of the projects. [7] In construction projects, the reasons of occurring risks may be internal and external. Internal risks are mainly the uncertainties exists in the project itself and external risks are due to the environmental impacts. Risk is a measure of probability and consequence of not achieving a defined project goal. [2] Favorable risk events are opportunities and unfavorable are the threats. A threat is something which has an adverse effect on the activities of an organization. [8] An effective risk management method may help to find out and assess the risks which can be occur during the construction period and help to manage them during the stages of construction.

A construction project become successful when it is completed on scheduled time, within budget and in accordance with the specifications. Risk engineering is a term associated with the use of the approach outlined here for identifying and measuring risk to the extent that it is useful to do so and developing the insight to change associated risks through effective and efficient decisions. [6] A systematic approach to risk management has five stages which are as follows:

- Plan Risk Management
- Risk Classification
- Risk Identification
- Risk Analysis and assessment
- Risk Response

Risk Management can be defined by the principle steps as a continuously monitored integrated formal process for defining objectives, identifying sources of uncertainties analyzing these uncertainties and formulating managerial responses, to produce an acceptable balance between risk and opportunities. [3]

### 2.1 Plan Risk Management:

Plan of risk management or risk planning is defined as the process of developing and documenting an organized, comprehensive and interactive strategy. Risk planning includes the methods for identifying and analyzing risks, developing risk response plans and monitoring and controlling how risk have change. Plan risk management is the detailed formulation of action for the management. Risk planning consists of the entire risk management process, which includes with activities to identify, analyze, respond, monitor and control risks.

### 2.2 Risk Classification:

Due to the lack of required information and experience, construction projects are considered as a high-risk business. Similar construction projects may have totally different risk factors which depends on the environment, region, the characteristics of the work site and the project team, and many other conditions. A systematic frame work for classifying the risks in construction projects is necessary, because risk factors in construction projects cover such huge areas. Sources of risks are generally independent and mutually exclusive. Classification of risk can be done by many ways, as per the nature of the risks, with their occurrence in different construction stages, accordance with their origin and to the location of their impact in the project.

### 2.3 Risk Identification

Risk factors otherwise known by risk sources and they are divided into risk events. Risk factors and risk events are different for different projects. Risk identification have various risk sources and the risk events.

### 2.4 Risk Analysis / Risk Assessment:

Risk assessment can be explained as systematic process to estimate the level of risk, which involves the overall ranking of risks using qualitative risk assessment approach and qualifying the risk exposures for mitigating high exposure risks. Risk analysis is the process to measure the probability of occurrence and the consequence of the risk and to convert the risks to a corresponding risk level. Risk structure is used to describe the uncertainties with in the projects and oriented according to the project execution. Risks are classified as a combination of qualitable and qualitable based on the risk structure. In the qualitative approach of risk analysis, the probability of occurrence and the consequence of occurrence scales are uses together with a risk mapping matrix to convert the values to risk levels. Quantitative approach is done by using an approved structure repeatable methodology rather than a subjective approach.

As the idea about the project increases, the risks decrease since the probability of occurrence of risk decreases by planning the project according to the situations, data available and scheduled as per the sequence of the project. Specific risk occurs as the project proceeds, the effects on the cost of which can therefore be assessed, while other risks cannot occur bond a particular point on account of their scheduled dates in the project sequence. [5]

Methods of risk analysis and assessment techniques

There are different methods to analyses the risk by expert judgment, classical models and conceptual models. Expert judgement method includes the Delphi method, normal group techniques, ABC analysis. Classical models consist of probability analysis, Monte Carlo simulation etc. and conceptual models includes fuzzy logic.

- Delphi Method
- Nominal Group Techniques
- ABC Analysis
- PERT/PDM
- Monte Carli Simulation
- Sensitivity Analysis
- Break-Even Analysis
- Decision Tree Analysis
- Fuzzy Logic

The comparison of these methods of risk analysis are given in the Table No.1. The features of each method discussed in the table, from which the method can be selected as per the situation of risk.

**Table No.1.**  
**Comparison of different risk assessment methods**

Method of risk analysis	Features
Delphi Method	Individual feedback from experts without discussion Process continue until get feedback which supports everyone's opinion.
Nominal Group Techniques	Selection of a panel of experts Risk identification- combined decision by discussion
ABC Analysis	Specific target-oriented investigation A risks – attention given to those which have greatest effect on project risk situations Risk identification by simplified time schedules and cost estimates
PERT/PDM	To get the probability of completion of the project on varying time period Duration of the project by adding duration of critical path activities
Monte Carlo Simulation	Problems solved by mathematical programming and experimentation with actual system Quantification of variables are difficult Simulation models are flexible Does not produce optimum solutions Costlier and time consuming in number of situations
Sensitivity Analysis	Deals with changes in parameters (like market situations, cost of the job produced, raw materials, men etc.) in the optimal solution Profit produced also changed Used for increasing the performance of the system
Break-Even Analysis	Costing technique To find out the effect of change in price, whether to make or buy, whether to accept the order or not etc
Decision Tree Analysis	To analyze a decision Decision tree approach makes it possible to see at least the major alternatives and the fact that subsequent decision may depend upon event in the future
Fuzzy Logic	Flexible Modelling of vague input is successfully done with the use of membership functions Highly subjective Easy to understand Fastest method

### 2.5 Risk Response:

Risk response is done by risk mitigation strategy.[1] Risk mitigation measures plan to reduce the loss, destruction or disruption in a project due to unforeseen events. The risk responses or mitigation measures are listed below.

- Risk Transfers
- Risk deferred
- Risk Reduction
- Risk acceptance
- Risk avoidance
- Risk sharing

### III. CONCLUSION

Construction projects are faced by many unexpected, unpredictable and uncertainties everyday which leads to the complexity of the project. Risk management helps to manage the risks which caused by unforeseen changes. An effective risk management analyses the risks at the earliest, helps to reduce the issues during the project and there by successfully complete of the project. Risk management is the science of managing risks which consists of the stages, risk planning, classification, identification, risk analysis/risk assessment, and risk response. They explain to plan before starting the project, classify the risks that affects the project, identify the major risks, analyze and ranking them as per risk values and suggest risk responses.

Form this study it is summarized that, fuzzy logic is the best method for risk analysis. Fuzzy logic can be applicable for the situations where there are vague input and number of uncertainty or risks.

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