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# Risk Assessment in Construction Projects

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**Abstract:** *Construction projects are initiated in advanced and dynamic environments leading to circumstances of high uncertainty and risk, that square measure combined by exacting time constraints. Construction industry has modified considerably over the past many years. It is an industry driven primarily by personal investors; the presence of securitized assists has exaggerated significantly. It is susceptible to the numerous technical & business risks that always represent large exposures than those that are traditional. Thus risk assessment need arises. Risk assessment could be a tool to spot those risks in a very project and manage it consequently with correct treatment. Risk assessment is outline during this study as a method that aims to spot and estimate risks to personnel and property compact upon by a project. The final methodology of this study depends mostly on the survey questionnaire that was collected from the local building contractors of different sizes by mail or by personnel meeting. A thorough literature review is initially conducted to identify the risk factors that affect the performance of construction industry as a whole. The survey questionnaire is designed to probe the cross-sectional behavioral pattern of construction risks construction industry. The questionnaire prepared for the pilot survey was formulated by seeing the relevant literatures in the area of construction risk management. This research seeks to identify and assess the risks and to develop a risk management framework which the investors/ developers/ contractors will adopt once getting construction work in India.*

**Keywords:** *Risk, Types of risk, Risk Analysis, Risk assessment, Risk Management.*

## I. INTRODUCTION

Risks are often outlined because the event that negatively affects the project objectives like time and schedule, cost, quality of labor. Risk Management is that the method of distinctive the potential risk related to risk and responding to those risks. Risk in any project could be a alternative instead of fate. In line with the characteristic of the development business, this has high uncertainty, thus it'll occur several risks throughout the development section and or operational building. Risk in construction has been the article of attention thanks to time and price over-runs related to construction comes. Risk is gift altogether the activities in an exceedingly project; it's solely the number that varies from one activity to a different. Risks and uncertainties inherent within the industry square measure over alternative industries. The method of coming up with, corporal punishment and maintaining all project activities is complicated and long. the complete method needs variety of individuals with various talent sets and therefore the coordination of a massive quantity of complicated and reticulate activities. matters is created complicated by several external factors. The record of industry is incredibly poor in terms of dealing with risks; leading to the failure of the many comes to satisfy time schedules, targets of budget and generally even the scope of labor. As a result, a great deal of suffering is inflicted to the shoppers and contractors of such comes and conjointly to the overall public. Risk within the industry is looked as if it would be a mix of activities that adversely have an effect on the project objectives of your time, cost, scope and quality. Some risks in construction processes are often simply foretold or without delay identified; still some are often entirely unforeseen. Construction risks are often associated with technical, management, logistical, or sociopolitical aspects or are often associated with natural disasters. Within the domain of project management, a number of the vital effects of risks square measure failure

## II. CONCEPT OF RISK

Risk could be a multi-facet idea. within the context of housing industry, it might be the probability of the prevalence of a particular event/factor or combination of events/factors that occur throughout the total method of construction to the hurt of the project an absence of sure thing concerning structure outcome or consequences in an exceedingly call or coming up with scenario, the uncertainty related to estimates of outcomes – there's an opportunity that results might be higher than expected yet as worse than expected etc. additionally to the various definitions of risk, there area unit varied ways that for categorizing risk for various functions too. Some reason risks in construction comes generally into external risks and internal risks whereas others classify risk in additional careful classes of political risk, monetary risk, market risk, holding risk, social risk, safety risk, etc. The categorization of the risks appears to rely primarily upon whether or not the project is native (domestic) or international. the interior risks area unit

relevant to any or all comes regardless of whether or not they area unit native or international. International comes tend to be subjected to the external risk like unconsciousness of the social conditions, economic and political eventualities, unknown and new procedural formalities, regulative framework and governing authority, etc. Risk is inherent and troublesome to alter, and this needs a correct management framework each of theoretical and sensible meanings. Important improvement to construction project management performance could also be achieved from adopting the method of risk assessment. the kinds of exposure to risk that a corporation is sweet-faced with area unit wide-ranging and vary from one organization to a different. These exposures might be the chance of business failure, the chance of project monetary losses, the occurrences of major construction accidents, default of business associates and dispute and organization risks. it's fascinating to know and determine the risks as early as doable, in order that appropriate strategy may be enforced to retain specific risks or to transfer them to attenuate any possible negative side they'll have. the chance management method begins with the initial identification of the relevant and potential risks related to the development project.

1) *Determination of Risk*: There square measure 2 ways to work out risks in a very project, particularly the qualitative and quantitative approach. The quantitative chemical analysis depends on statistics to calculate the chance of incidence of risk and therefore the impact of the danger on the project. the foremost common method of using quantitative chemical analysis is to use call tree analysis, that involves the appliance of chances to 2 or additional outcomes. Another technique is town simulation that generates price from a chance distribution and different factors. The qualitative approach depends on judgments and it uses criteria to work out outcome. a standard qualitative approach is that the precedence schematization technique, that uses ordinal numbers to work out priorities and outcomes. in our own way of using qualitative approach is to create an inventory of the processes of a project in digressive order, calculate the risks related to every method and list the controls which will exist for every risk.

#### A. *Identified Risk Factors*

- 1) *History*: Newer comes cause additional risk as a result of the method has not been refined with the passage of your time. If a project of comparable nature has been done persistently before, then the probability of success with the present project is additionally increased.
- 2) *Management Stability*: Management stability means the entire management team shares constant vision and direction, thereby leading booming accomplishment of goals. If the management is unstable then it will result in phantasmagoric and impractical schedules for the project and inefficient use of resources.
- 3) *Staff experience expertise and information and skill*]: within the event that the members of a project team lack the direct operating knowledge and experience of the world, there's a probability of your time delays, calculable value upsets and poor quality.
- 4) *Team Size*: just in case of huge groups, the chance of downside incidence will increase thanks to the team size. one among the explanations are often the problem of communication thanks to the big team size.
- 5) *Resource Availability*: If the supply of resources is simple, the chance of responding to issues in real time additionally will increase. for instance, straightforward availableness of cash makes securing human, material and instrumentation resources straightforward on pronenata basis. However, associate abundance of resources doesn't give quarantine against risks; all it will is to equip the project team with the techniques to retort to risks.
- 6) *Time Compression*: just in case of extremely compressed time schedule, the risks square measure exaggerated within the project. once longer is on the market, additional flexibility is gift within the project and there's a chance to mitigate and scale back the impact of occurring risks.
- 7) *Complexity*: just in case of a extremely advanced or refined project, the chance of an error or a tangle is additionally increased.

### III. TYPES OF RISKS

Risks are often associated to technical, operational or business aspects of comes. A technical risk is that the inability to make a product that complies with the customer's demand. associate operational risk arises once the project team members square measure unable to figure cohesively with the client. Risks are often either acceptable or unacceptable. associate unacceptable risk is one that incorporates a negative impact on the crucial path of a project. Risks will either have short term or long run length. just in case of a brief term risk, the impact is visible straightaway, like a demand modification in a very deliverable. The impact of an extended term risk is visible within the distant future, like a product discharged while not adequate testing Risks can even be viewed as

manageable and unmanageable. A manageable risk are often accommodated, example being a little modification in project necessities. Associate unmanageable risk, on the opposite hand, can't be accommodated.

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

A	Technical Risks
1	Inadequate site investigation
2	Incomplete design
3	Inadequate of specifications
4	Uncertainty over the source and availability of materials
5	Change in scope
6	Construction procedures
B	Logistical risks:
1	Availability of sufficient transportation facilities
2	Availability of resources-particularly construction equipment spare parts, fuel and labor
3	Management related risks:
4	Uncertain productivity of resources
5	Industrial relations problems
6	Contractual relation
7	Contractors experience
8	Attitude of participants
9	Communication
C	Environmental risks
1	Weather and seasonal implications
2	Natural disasters
D	Financial risks:
1	Availability and fluctuation in foreign exchange
2	Improper estimation
3	Inflation
4	Increase material costs
5	Low market demand
6	Local taxes
E	Socio-political risks:
1	Change in laws and regulations
2	Pollution and safety rules
3	War and civil disorders
4	Requirement for permit then approval
F	Physical Risks
1	Damage to equipment
2	Labour injuries
3	Construction risks:
4	Labour productivity
5	New technologies
6	Equipment failure
7	Site conditions
8	Design changes

#### IV. RISK IDENTIFICATION TECHNIQUES

The risk identification can be done by using following techniques

- 1) *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
- 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.
- 6) *Sensitivity Analysis*: This is carried out to identify the uncertain project components which will have maximum impact on the outcome of the project. After a risk model is made a sensitivity analysis is carried out to check the sensitivity of different elements of the model on project outcome. To do these the values of one variable at a time is changed and the impact of these changes is then seen on the project.
- 7) *Scenario Analysis*: Scenario analysis gives the impact of different scenario of the project or impact of different risk if that occurs simultaneously. A fair decision can be made after this analysis, the option which will give lesser loss or hazards that option can be opted.
- 8) *Monte Carlo Simulation*: A project simulation is done using a model to show the potential impact of different level of uncertainties on project objectives. Monte Carlo Simulation is generally used for this analysis. It can quantify the effect of uncertainties and risks on project budget and schedule. It simulates the full system many times, each time randomly choosing a value for each factor from its probability distribution. It uses three point estimates like most likely, worst case and best case duration for each task in time management. Decision Trees: This analysis is carried out by decision tree diagram. Decision trees are very helpful to these projects. Formulate the problem and evaluate options. In this analysis there are graphical models used to represent a project and can clearly reflect the effects of each decision taken in the project

#### V. METHODOLOGY

To assess the relative significance among risks, previous literatures work study suggests establishing a risk significance index by calculating a significance score for each risk. For Calculating the significance score, multiply the probability of occurrence by the degree of Impact. The significance score for each risk assessed by each respondent can be obtained through the mode.

$$S_j^i = A_j^i * B_j^i$$

Where  $S_j^i$  = Significance score assessed by respondent j for risk i  
 $A_j^i$  = Occurrence of risk i, assessed by respondent j  
 $B_j^i$  = degree of impact of risk I, assessed by respondent j.

By averaging scores from every one of the reactions, it is conceivable to get a normal importance score for each hazard, and this normal score is known as the hazard record score and is utilized for positioning the dangers. The model for the figuring of hazard list score can be characterized as

$$R_s^i = \sum_j^T = 1 S_j^i / T$$

Where  $R_s^i$  = index score for risk i

$S_j^i$  = Significance score assessed by respondent j for risk i

T= total number of responses

To calculate the five point scales for  $\alpha$  and  $\beta$ , there will be converted into numerical (Likert scale) scales as shown in table

Table 5.1: Numerical conversion for the rating attributes

$\alpha, \beta$	
Rating Attributes	Numerical Conversion
0	0.0
1	0.2
2	0.4
3	0.6
4	0.8
5	1.0

After obtaining index score for each risk factor, standard deviation and coefficient of variation of each risk factor is also determined. Subsequently, ranking of risk factors is done based on index score.

## VI. DATA COLLECTION

Field survey is done to study the prevalent environmental in the building construction industry. The objective of doing field survey is to obtain the opinion of field personnel with respect to various types of risks associated with building construction industry. For the survey, based on literature review a questionnaire is developed to obtain the opinion of respondent. The questionnaire is designed probability level of the risk occurrence and degree of impact or the level of loss if the risk occurs. Survey was carried out among the various projects participants.

## VII. CONCLUSIONS

It is required to carry out further for risk assessment and mitigation especially for large building construction projects based on a survey at national level, so as to frame detailed recommendations for professionals in the building construction industry.

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