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A Review of Risk Management Techniques for 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 changed significantly over the past a few years. It is AN trade driven primarily by personal investors; the presence of securitized assists has exaggerated considerably. It is at risk of the many technical & business risks that forever represent massive exposures than people who area unit ancient. Thus risk assessment need arises. Risk assessment may be a tool to identify those risks in a {very} very project and manage it consequently with correct treatment. Risk assessment is define throughout this study as a technique that aims to identify and estimate risks to personnel and property compact upon by a project. The final methodology of this study depends totally on the survey form that was collected from the native building contractors of various 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 form is intended to probe the cross-sectional behavioral pattern of construction risks industry. The form ready for the pilot survey was developed by seeing the relevant literatures within the space of construction risk management. This analysis seeks to spot and assess the risks and to develop a risk management framework that the investors/ developers/ contractors can adopt once obtaining construction add India***
Keywords: Risk, Types of risk, Risk Analysis, Risk Assessment, Risk Management.

I. INTRODUCTION

Risks square measure usually made public as a result of the event that negatively affects the project objectives like time and schedule, cost, quality of labor. Risk Management is that the strategy of distinctive the potential risk associated with risk and responding to those risks. Risk in any project may well be a different rather than fate. In line with the characteristic of the event business, this has high uncertainty, so it's going to occur many risks throughout the event section and or operational building. Risk in construction has been the article of attention due to time and worth over-runs associated with construction comes. Risk is gift altogether the activities in associate passing project; it's exclusively the quantity that varies from one activity to a special. Risks and uncertainties inherent inside the business area unit over different industries. the strategy of turning out with, penalization and maintaining all project activities is sophisticated and long. the entire methodology desires type of people with varied talent sets and so the coordination of a vast amount of sophisticated and reticulate activities. matters is formed sophisticated by many external factors. The record of business is unbelievably poor in terms of addressing risks; resulting in the failure of the numerous involves satisfy time schedules, targets of budget and usually even the scope of labor. As a result, an excellent deal of suffering is inflicted to the consumers and contractors of such comes and together to the public. Risk inside the business is looked as if it'd be a mixture of activities that adversely have a bearing on the project objectives of some time, cost, scope and quality. Some risks in construction processes square measure usually merely predicted or at once identified; still some square measure usually entirely unforeseen. Construction risks square measure usually related to technical, management, logistical, or sociopolitical aspects or square measure usually related to natural disasters. inside the domain of project management, variety of the important effects of risks area unit failure

II. OBJECTIVE

The objective of this paper is to spot the key risk factors that associate degree impact on} construction method and gift an affection recommendation for adoption to avert the threat that causes severity effect to construction project. The risk management technique is employed terribly less as a result of less data and awareness among the individuals. The account is additionally terribly poor in terms of cope up with risks in comes, leading to the love of project objectives. Risk management is adopted to contain the doable future risks proactively instead of being reactive.

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III. CONCEPT OF RISK

Risk may be a multi-facet plan. inside the context of construction industry, it would be the chance of the prevalence of a selected event/factor or combination of events/factors that occur throughout the whole methodology of construction to the hurt of the project Associate in Nursing absence of certainty regarding structure outcome or consequences in Associate in Nursing extremely decision or turning out with situation, the uncertainty associated with estimates of outcomes – there is a chance that results can be on top of expected nevertheless as worse than expected etc. to boot to the assorted definitions of risk, there unit of measurement varied ways in which for categorizing risk for varied functions too. Some reason risks in construction comes typically into external risks and internal risks whereas others classify risk in extra careful categories of political risk, financial risk, market risk, holding risk, social risk, safety risk, etc. The categorization of the risks seems to swear primarily upon whether or not or not the project is native (domestic) or international. the inside risks unit of measurement relevant to any or all comes despite whether or not or not they unit of measurement native or international. International comes tend to be subjected to the external risk like cognitive state of the social conditions, economic and political eventualities, unknown and new procedural formalities, restrictive framework and governing authority, etc. Risk is inherent and hard to change, and this desires an accurate management framework every of theoretical and wise meanings. necessary improvement to construction project management performance may even be achieved from adopting the tactic of risk assessment. the styles of exposure to risk that an organization is faced with unit of measurement wide-ranging and vary from one organization to a distinct. These exposures can be the possibility of business failure, the possibility of project financial losses, the occurrences of major construction accidents, default of business associates and dispute and organization risks. it's fascinating to understand and confirm the risks as early as achievable, so as that applicable strategy could also be implemented to retain specific risks or to transfer them to attenuate any potential negative aspect they will have. the possibility management methodology begins with the initial identification of the relevant and potential risks associated with the event project.

1) *Determination of Risk:* There square measure two 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.

IV. TYPES OF RISKS

Risks square measure usually associated to technical, operational or business aspects of comes. A technical risk is that the shortcoming to form a product that complies with the customer's demand. associate operational risk arises once the project team members unit unable to work cohesively with the shopper. Risks square measure usually either acceptable or unacceptable. Associate unacceptable risk is one that comes with a negative impact on the crucial path of a project. Risks can either have short term or long-standing time length. Simply just in case of a quick term risk, the impact is visible straightaway, sort of a demand modification terribly} very deliverable. The impact of an extended term risk is visible among the distant future, sort of a product discharged whereas not adequate testing Risks will even be viewed as manageable and unmanageable. A manageable risk square measure usually accommodated, example being a bit modification in project wants. Associate unmanageable risk, on the alternative hand, cannot be accommodated. Risks is viewed as business, technical, or operational. A technical risk is that the inability to make the merchandise that may satisfy necessities. An operational risk is that the inability of the client to figure with core team members. Risks square measure either acceptable or unacceptable. an appropriate risk is one that negatively affects a task on the non-critical path. AN unacceptable risk is one that negatively affects the essential path. Risks square measure either short or long run. A short-run risk has an instantaneous impact, like dynamical the necessities for a deliverable. A long risk has an impression someday within the distant future, like emotional a product while not adequate testing. Risks square measure viewed as either manageable or unmanageable. A manageable risk is one you'll accept, like a minor demand amendment. AN unmanageable risk is not possible to accommodate, like a large turnover of core team member.

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Risk factors for this study are classified into eight categories namely.

S.No.	Types of risks
1.	Construction risk
	➢ Disputes between labours ➢ Changing sequences in construction activity ➢ Non availability of resources ➢ Revision of design ➢ Availability of camp for labours ➢ Change in quantities of work ➢ In Time work permissions for executing work ➢ Safety of workers
2.	Design risk
	➢ Late changes of design from client side ➢ Will the level of details of design delivered by the owner affect over all construction time? ➢ Improper specifications ➢ Inadequate and incomplete design
3.	Environmental risk
	➢ Impact of weather condition on completion of project ➢ Pollution by construction waste ➢ Procedure to facilitate construction waste cleanup or disposal
4.	Financial risk
	➢ Delay from clients ➢ Increment for staff benefits ➢ Unprecedented price in raw materials ➢ Fluctuations in Estimated finance than expected
5.	Management Risk
	➢ Documents and process directed as per agreement for mitigation of risk ➢ Project team discussions on risk ➢ Use of WBS and project milestones to help identify project risks ➢ Time for planning ➢ Loosing of critical staff at crucial point of construction ➢ Documented process for identifying project risks
6.	Political Risk
	➢ Pressure from any political party ➢ Local bodies (political/rowdies) compelling to use their resources ➢ Union Issue
8.	Sub-Contractors Risk
	➢ Chances of sub-contractor walk out ➢ Delay in work execution of sub-contractor ➢ Revision of price
9.	Technology Risk
	➢ Knowledge on equipment's ➢ Service for damaged equipment's ➢ Loss of data or software/hardware of computer

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V. 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.
9) *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.

VI. METHODOLOGY

The general methodology of this study depends for the most part on the survey form which can be collected from the native building contractors of various sizes by mail or by personnel meeting. a radical literature review was at first conducted to spot the chance factors that have an effect on the performance of industry as a full. This study has adopted the additional general and broad definition of risk as conferred by Shen et al (2001) on China's construction joint ventures and additional risk factors from alternative literature. additionally some interviews with industrial practitioners were conducted to supply to visualize effectiveness of questionnaires.

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.

$$S^i_j = A^i_j * B^i_j$$

Where S^i_j = Significance score assessed by respondent j for risk i

A^i_j = Occurrence of risk i, assessed by respondent j

B^i_j = degree of impact of risk I, assessed by respondent j.

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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 α and β, there will be converted into numerical (Likert scale) scales as shown in table

Table 5.1: Numerical conversion for the rating attributes

α , β	
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.

VII. QUESTIONNAIRE SURVEY

The questionnaire survey is divided into two parts. The first part consists of general information like name of the respondent, type of company, experience, designation value of their project etc. and the second part consists of the construction risk factors for evaluation of the risk assessment.38 risk factors are given based upon the pilot study. The questionnaire was prepared for the pilot survey was formulated by 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. 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.

VIII. CONCLUSION

Risk management technique seldom employed by the participants in construction comes. The participants wont to handle the risks with a casual approach. this system isn't used as a result of less data and awareness among the development business. the danger management technique ought to be applied into any construction project at the initial stage of the project to induce most good thing about the technique. Hence, there's thriving ought to have a well-documented procedure that ought to be a 1 stop resolution to all or any hazards that square measure doubtless to occur throughout project life cycle. There ought to be a lot of wholesome approach towards risk management rather than this scattered approach towards the risks. 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.

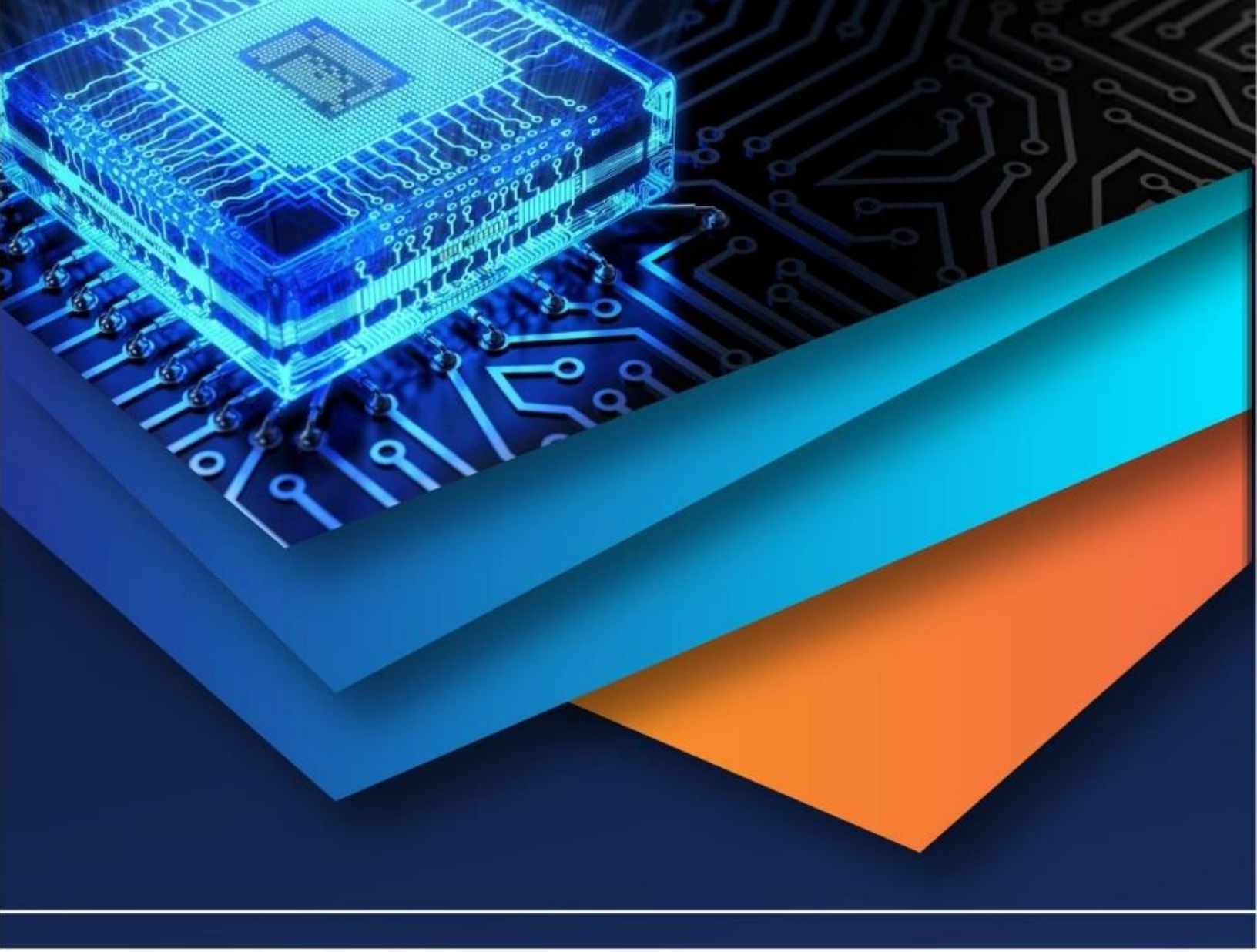
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