

RISK MANAGEMENT IN BUILDING CONSTRUCTION

Giduma Bekeshe

PG Student of Construction project management
Parul University, Vadodara, Gujarat, India

Abstract:-Construction industry is one of the most complex, risky, and challenging businesses. Due to this complexity, successful completion of high rise buildings would require a tremendous effort and knowledge. This critical literature review reveals the risk management concepts in building construction. Its objective is to clearly show how to identify risks, assessing their impacts on project objectives and ranking them to give a priority for the purpose of controlling and managing critical risks. It also provides the necessary risk control strategies and proper management practices which should be adopted to get projects completed as per their requirements. This review was organized and collected from different literatures.

I. INTRODUCTION

1. Definition of Risk

Project risk is an uncertain outcome or consideration that, if it occurs, has a positive or negative issue on one or more project objectives such as scope, schedule, price, and quality. A risk may have one or more causes and, if it occurs, it may have one or more impacts. A cause may be a given or potential requirement, assumption, constraint, or condition that opening of negative or positive event. For example, causes could include the requirement of an environmental license to do work, or having limited personnel assigned to design the project. [14]

2. Risks in Building Construction

The construction industry is of very complex and strategic nature. Therefore it is considered as a risk of exposure affair due to its peculiarity. Due to involvement of various stakeholders connected with the project, several internal and external factors the chances of risk are very high level.

Studies reveal that construction industry has a poor track record in risk analysis as compared to other industries.[3] On practical undercoat no construction project is risk free. Danger cannot be fully control in reality. However by taking adequate and timely guard it can be reduced to some extent. [13]

The risk factor in construction business is very high. Construction objects are unique and built only once. Construction projects life cycle is full of various endangerments. Danger comes from many sources: temporary project team that is collected from different companies, construction land site, etc. Moreover, the size and complexity of construction objects are increasing which adds to the risks. This is in addition to the political, economic, social conditions where the object is to be undertaken.

Project risk can be defined as an uncertain event or condition that, if it occurs, has a positive or negative effect on at least one project objective, such as time, cost, and quality. The risks cause cost and time overruns in construction projects.

3. Characteristics of Construction Risks

- Peril and uncertainties are associated with precise issues or activities that can be individually identified.
- A danger issue implies that there is a orbit of final results of each event and each outcome has a chance of natural event.
- Some hazard of exposure offering only the prospect of adverse consequence (loss) a bankruptcy, war, sea or flood damage , these may be low or high probability but of high shock.
- Many common construction risks offer the prospect of either loss or gain as productivity of labour and plant; these are typically of high probability and may be of low or high impact.
- Subjective judgment is usually required to calculate the probability of occurrence of specific outcomes of risk event.
- It is stated that one reason for failure in construction projects has been caused by the selection of the contracting format that did not fit the risk characteristics of the project. For example the use of lump-sum contract on a fast track project can lead to many contract disputes and diversion of management s attention from the critical area work issues. Poor management practices also create problems .the effectiveness of the project management function significantly influences whether the planning project schedule duration will be achieved successfully.

II. CLASSIFICATION AND IDENTIFICATION OF RISKS

According to their nature risks are categorized in the following manner:

Table: 1, Identification and classification of risks

S.N	Risk Category	Typical risks
1	External Environment Specific	Unfavourable economic/ market fluctuations, Labour/ Material Strikes, Shortage of Material/ Labour., Natural Calamities (Force Majeure) , Changing Government, Policies Unfavourable political environment, Sudden unforeseen events
2	Project Specific	Size of the project , Location uniqueness, Clear title of the land , Type of project, Tender selection methodology, Deviation of scope , Surrounding Structures, Construction methods, Delay penalties, Flow of finance, Exposure to accidents Legal disputes and lawsuits
3	Owner Specific	Inadequate definition of project budget, Delay in handing over the site to contractor, Chances of facing financial crisis Delay in revising & approving design document by

		owner, Delay in payments by owner, Sudden termination of work by owner, Changes made by owner during construction, Lack of vision/inability in identifying critical activities, Holding key decisions in abeyance Owner's lack of exposure to changing trends in industry.
4	Contractor Specific	Delay in mobilization Poor site management and supervision by contractor Improper construction methods/ quality variations Delay's in subcontractor's works. Poor qualification/ experience of the contractor. Holding key decisions in abeyance. Frequent change of subcontractors Lack of co-ordination b/w different vendors/ parties/ Head office. Lack of resource management & labor allocation. On time mobilization of PMV equipments Key persons (PM) technical & Managing ability. Lack of support from Head Office.
5	Consultant Specific	Insufficient data collection & survey before designs, Inadequate experience of, consultant with regard to type of project., Delay in performing inspection and testing by consultant., Complex design Timely delivery of drawings Unclear & inadequate details in drawings, Chances of consultant leaving the project midway, Inflexibility of consultant, Non-use of advanced engineering design software
6	Resource Specific	Selection of material & equipment Availability of resource locally Delay in material delivery Changes in material types & specifications during construction Unrealistic price variation in material Improper selection of equipment Equipment breakdowns Poor maintenance of the equipments Non availability of maintenance facility in the vicinity for the equipment Shortage of equipment Quality variations Shortage of labors Unqualified workforce Poor inventory management
7	Project manager Specific	Project manager's technical capability Holding key decision in abeyance Lack of induction & training of human resources Ability to source manpower resource on time Human resource support to sub-ordinates. Lack of support/ motivation to his subordinates. Identification of critical issues Lack of coordinating ability and rapport of project manager with other contractors at site Reluctance in maintaining target schedule by top management Lack of leadership quality of project manager Lack of effective monitoring and feedback by project manager Years of experience in the field of work Chances of project manager leaving the project
8	Finance Specific	Financial policies ,Liquidity, Market risk ,Credit risk, Operational risk, Profitability risk, Contingency risk, Time risk

III. RISK MANAGEMENT PROCEDURES

An overview of the Project Risk Management processes: [14]

- Risk Management plan: the process of defining how to demeanour risk management activities for a project.
- Identify risks: the process of determining which hazard may affect the project and documenting their characteristics.
- Perform Qualitative risk Analysis: the process of prioritizing perils for further analysis or action by assessing and combining their probability of occurrence and shock.
- Perform Quantitative risk Analysis: the process of numerically analyzing the effect of identified risks on overall project aims.
- Plan risk responses: the process of developing options and actions to enhance opportunities and to reduce threats to project objectives.
- Control risks: the process of implementing risk response plans, tracking identified risks, monitoring remainder risks, identifying new risks, and evaluating risk process effectiveness throughout the project.

1. Risk Management Plan

Plan Risk Management is the operation of defining how to conduct risk management activities for a project. The key benefit of this process is it ensures that the degree, type, and visibility of risk management are commensurate with both the risks and the importance of the project to the organization. sThe risk of exposure management design is vital to communicate with and obtain agreement and support from all stakeholders to ensure the risk management process is supported and performed effectively over the project life cycle.

Careful and explicit design enhances the probability of success for other risk management processes. Planning is also important to provide sufficient resources and time for risk management activities and to establish an agreed upon basis for evaluating risks. The Plan Risk Management process should begin when a project is conceived and should be completed early during project planning.

2. Risk Identification

Identify Risks is the process of determining which danger of infection of exposure may affect the project and documenting their characteristics. The tonality benefit of this process is the documentation of existing dangers and the knowledge and ability it provides to the project team to anticipate events.[14]

Participants in risk recognition activities may include the following: project manager, project team members, risk management team (if assigned), customers, subject matter experts from outside the project team, end users, other project managers, stakeholders, and risk management experts. While these personnel are often key fruit player for risk identification, all project personnel should be encouraged to identify potential risks. [14]

Identify risks is an iterative process, because new risks may evolve or become known as the project progresses through its life cycle. [3] The frequency of iteration and participation in each cycle will vary by situation. The formatting of the hazard instructions should be consistent to ensure that each risk is understood clearly and unambiguously in order to backup effective analysis and response development. The risk statement should support the ability to compare the relative effect of one risk against others on the project. The process should involve the project team so they can develop and maintain a sense of ownership and responsibility for the risks and associated risk response actions. Stakeholders outside the project team may provide additional objective information. [14]

Intelligent people had come up with great knowledge of how to identify and analysis possible risks in building industry. Risk can be defined as an event that may or may not occur and can lead to higher costs, extension of the project, failure to quality requirements/ norms, loser to satisfy information requirements/ norms and failure to satisfy specified organizational Risk Management Factors that influence the smooth completion of a project are identified and a risk assessment model is developed. [7] A total of 93 risk factors were identified and listed under various subgroups and the study results are reduced further into two groups for simplification and better understanding [7]. The first group covers owner-, contractor-, project manager-, finance-, and resource-specific risks; and the second group covers risk pertaining to project-, architect/ consultant-, external environment-, and contract-clause-specific factors.

3. Perform Qualitative Risk Analysis

Perform Qualitative Risk Analysis is the process of prioritizing risks for further analysis or action by assessing and combining their chance of happening and impact. The key welfare of this procedure is that it enables project managers to reduce the level of uncertainty and to focus on high-priority risks.[4]

Perform Qualitative Risk Analysis assesses the priority of identified risks using their relative probability or likelihood of occurrence, the corresponding impact on project objectives if the risks occur, as well as other factors such as the time frame for response and the organization's risk tolerance associated with the project constraints of cost, schedule, scope, and quality. Such assessments reflect the risk attitude of the project team and other stakeholders. Effective assessment therefore requires explicit identification and management of the risk approaches of key participants in the Perform Qualitative Risk Analysis process. Where these risk approaches introduce bias into the assessment of identified risks, attention should be paid to identifying bias and correcting for it.[9]

Establishing definitions of the levels of probability and impact can reduce the influence of bias. The time criticality of risk-related actions may magnify the importance of a risk. An evaluation of the quality of the available information on project risks also helps to clarify the assessment of the risk's importance to the project.[5]

Perform Qualitative Risk Analysis is usually a rapid and cost-effective means of establishing priorities for Plan Risk Responses and lays the foundation for Perform Quantitative Risk Analysis, if required. The Perform Qualitative Risk Analysis process is performed regularly throughout the project life cycle, as defined in the project's risk management plan.

4. Perform Quantitative Risk Analysis

Perform Quantitative Risk Analysis is the process of numerically analysing the issue of identified risks on overall project objectives. The key benefit of this process is that it produces quantitative peril information to support decision making in order to reduce project uncertainty.

Perform Quantitative Risk Analysis is performed on risk of exposure that have been prioritized by the Perform Qualitative Risk Analysis process as potentially and substantially impacting the project's competing demands. The Perform Quantitative Risk Analysis process analyses the issue of those risks on project objectives. It is used mostly to evaluate the congeries effect of all risks affecting the project. When the risks drive the quantitative analysis, the process may be used to assign a numerical priority rating to those risks individually.

Perform Quantitative Risk Analysis generally follows the Perform Qualitative Risk Analysis process. In some cases, it may not be possible to execute the Perform Quantitative risk Analysis process due to lack of sufficient data to develop appropriate models. The project manager should exercise expert discernment to determine the need for and the viability of quantitative risk analysis. The availability of some time and budget, and the need for qualitative or quantitative statements about risk and impacts, will determine which method(s) to use on any particular project. Perform Quantitative Risk Analysis should be repeated, as needed, as part of the Control Risks process to determine if the overall project risk has been satisfactorily decreased. Trend may indicate the need for more or less focus on appropriate risk management duties.

Commonly used techniques for quantitative Risk Analysis:-[11]

- a. *Sensitivity Analysis:* Sensitivity investigation helps to determine which risks have the most potential encroachment on the project. It gives service to understand how the variations in project's aims correlate with varieties in different uncertainties. Conversely, it examines the extent to which the uncertainty of each project element affects the objective being surveyed when all other uncertain components are held at their baseline values. The Tornado diagram is also helpful in analysing risk-taking scenarios enabled on particular risks whose quantitative analysis highlights possible benefits greater than corresponding identified negative impingements.
- b. *Expected Monetary Value Analysis:* Expected monetary value (EMV) analysis is a statistical concept that calculates the average outcome when the future brings scenarios that may or may not happen (i.e., analysis under uncertainty). The EMV of chances are generally expressed as positive values, while those of threats are expressed as negative values. EMV requires a risk-neutral assumption— neither risk averse nor risk seeking. EMV for a project is calculated by multiplying the value of each possible outcome by its chance of occurrence and adding the products together.
- c. *Modeling and simulation:* A project simulation uses a model that translates the specified detailed unforeseen of the project into their potential impact on project objectives. Simulations are typically performed using the Monte Carlo technique. In a simulation, the project model is computed many times (iterated), with the input values (e.g., cost approximation or task durations) chosen at random for each iteration from the probability distributions of these variables. A histogram (e.g., total cost or completion date) is calculated from the iterations. For a cost risk analysis, a simulation uses cost estimates. For a schedule risk analysis, the schedule network diagram and duration estimates are used.

5. Plan risk responses

Plan Risk Responses is the process of developing options and actions to enhance opportunities and to reduce threats to project objectives. The key benefit of this process is that it addresses the risks by their priority, inserting resources and activities into the budget, schedule and project management plan as needed.[6]

The Plan Risk Responses process follows the Perform Quantitative Risk Analysis process (if used). Each risk response requires an understanding of the mechanism by which it will address the risk.[6] This is the mechanism used to analyse if the risk response plan is having the desired effect. It includes the identification and assignment of one person (an owner for risk response) to take responsibility for each agreed-to and funded risk response. Risk responses should be appropriate for the significance of the risk, cost-effective in meeting the challenge, realistic within the project context, agreed upon by all parties involved, and owned by a responsible person. Selecting the optimum risk response from several options is often required.[2]

The Plan Risk Responses process presents commonly used approaches to planning responses to the risks. Risks include threats and opportunities that can affect project success, and responses are discussed for each.

Three strategies, which typically deal with threats or risks that may have negative impacts on project objectives if they occur, are: avoid, transfer, and mitigate.[12] The fourth strategy, accept, can be used for negative risks or threats as well as positive risks or opportunities. Each of these risk response strategies have varied and unique influence on the risk condition. These strategies should be chosen to match the risk's probability and impact on the project's overall objectives. Avoidance and mitigation strategies are usually good strategies for critical risks with high impact, while transference and acceptance are usually good strategies for threats that are less critical and with low overall impact. The four strategies for dealing with negative risks or threats are further described as follows:[12]

- **Avoid:** Risk avoidance is a risk response strategy whereby the project team acts to eliminate the threat or protect the project from its impact. It usually involves changing the project management plan to eliminate the threat entirely. The project manager may also isolate the project objectives from the risk's impact or change the objective that is in jeopardy. Examples of this include extending the schedule, changing the strategy, or reducing scope. The most radical avoidance strategy is to shut down the project entirely. Some risks that arise early in the project can be avoided by clarifying requirements, obtaining information, improving communication, or acquiring expertise.
- **Transfer:** Risk transference is a risk response strategy whereby the project team shifts the impact of a threat to a third party, together with ownership of the response. Transferring the risk simply gives another party responsibility for its management—it does not eliminate it. Transferring does not mean disowning the risk by transferring it to a later project or another person without his or her knowledge or agreement. Risk transference nearly always involves payment of a risk premium to the party taking on the risk. Transferring liability for risk is most effective in dealing with financial risk exposure. Transference tools can be quite diverse and include, but are not limited to, the use of insurance, performance bonds, warranties, guarantees, etc
- **Mitigate:** Risk mitigation is a risk response strategy whereby the project team acts to reduce the probability of occurrence or impact of a risk. It implies a reduction in the probability and/or impact of an adverse risk to be within acceptable threshold limits. Taking early action to reduce the probability and/or impact of a risk occurring on the project is often more effective than trying to repair the damage after the risk has occurred. Adopting less complex processes, conducting more tests, or choosing a more stable supplier are examples of mitigation actions. Mitigation may require prototype development to reduce the risk of scaling up from a bench-scale model of a process or product. Where it is not possible to reduce probability, a mitigation response might address the risk impact by targeting linkages that determine the severity..
- **Accept:** Risk acceptance is a risk response strategy whereby the project team decides to acknowledge the risk and not take any action unless the risk occurs. This strategy is adopted where it is not possible or cost-effective to address a specific risk in any other way. This strategy indicates that the project team has decided not to change the project management plan to deal with a risk, or is unable to identify any other suitable response strategy. This strategy can be either passive or active. Passive acceptance requires no action except to document the strategy, leaving the project team to deal with the risks as they occur, and to periodically review the threat to ensure that it does not change significantly. The most common active acceptance strategy is to establish a contingency reserve, including amounts of time, money, or resources to handle the risks.

6. Control Risks

Control Risks is the process of implementing risk response plans, tracking identified risks, monitoring residual risks, identifying new risks, and evaluating risk process effectiveness throughout the project. The key benefit of this process is that it improves efficiency of the risk approach throughout the project life cycle to continuously optimize risk responses.[17]

Planned risk responses that are included in the risk register are executed during the life cycle of the project, but the project work should be continuously monitored for new, changing, and outdated risks.

The Control Risks process applies techniques, such as variance and trend analysis, which require the use of performance information generated during project execution. Other purposes of the Control Risks process are to determine if:

- Project assumptions are still valid,
- Analysis shows an assessed risk has changed or can be retired,
- Risk management policies and procedures are being followed, and
- Contingency reserves for cost or schedule should be modified in alignment with the current risk assessment.

Control Risks can involve choosing alternative strategies, executing a contingency or fallback plan, taking corrective action, and modifying the project management plan. The risk response owner reports periodically to the project manager on the effectiveness of the plan, any unanticipated effects, and any correction needed to handle the risk appropriately.

IV. CONCLUSION

Project risk is an uncertain outcome or consideration that, if it occurs, has a positive or negative issue on one or more project objectives such as scope, schedule, price, and quality.

In this critical literature review a management procedures to control potential risks in building construction have been considered. Simply stating, Identifying Risks is the process of determining which danger of infection of exposure may affect the project and documenting their characteristics. Perform Qualitative Risk Analysis is the process of prioritizing risks for further analysis or action by assessing and combining their chance of happening and impact.

Establishing definitions of the levels of probability and impact can reduce the influence of bias. The time criticality of risk-related actions may magnify the importance of a risk.

Perform Quantitative Risk Analysis is the process of numerically analyzing the issue of identified risks on overall project objectives. The key benefit of this process is that it produces quantitative peril information to support decision making in order to reduce project uncertainty. Plan Risk Responses is the process of developing options and actions to enhance opportunities and to reduce threats to project objectives. The key benefit of this process is that it addresses the risks by their priority, inserting resources and activities into the budget, schedule and project management plan as needed. Control Risks is the process of implementing risk response plans, tracking identified risks, monitoring residual risks, identifying new risks, and evaluating risk process effectiveness throughout the project. The key benefit of this process is that it improves efficiency of the risk approach throughout the project life cycle to continuously optimize risk responses.

ACKNOWLEDGEMENT

Any accomplishment requires some help from many people. This project work is no different. I am grateful to Mr. Dixit Patel who has been my Advisor, inspired and directed me to carry out this work.

I sincerely thank Mr. Sachin Shah for his wonderful encouragement.

REFERENCES

- [1]. Mills, Anthony "A systematic approach to risk management for construction" Deakin Research Online, 2001
- [2]. Forcada, Xavior roca,Alba Fuerters "Mitigating construction safety risks using prevention through design" Journal of Safety Research 2April 2010
- [3]. Shou Qing Wang , Etal"Risk management framework for construction projects in developing countries" Construction Management and Economics, 2004
- [4]. SCOTT BAKER, DAVID PONNIAH & SIMON SMITH "Risk response techniques employed currently for major projects" Construction Management and Economics, 1999
- [5]. Alfredo del cano,P.E,M.ASCE, and M.Pilar de la Cruz, P.E "Integrated methodology for project risk management" JOURNAL OF CONSTRUCTION ENGINEERING AND MANAGEMENT, 2002
- [6]. Patrick. X.W. Zou & Guomin Zhang "Managing Risks in Construction Projects: Life Cycle and stakeholder Perspectives" International Journal of Construction Management, 2009
- [7]. Hariharan Subramanyan1; Priyadarshi H. Sawant2; and Vandana Bhatt3 "Construction Project Risk Assessment: Development of Model Based on Investigation of Opinion of Construction Project Experts from India" Journal of Construction Engineering and Management, March 1, 2012
- [8]. Chaitali S. Pawar* Suman S. Jain Jalinder R. Patil "Risk Management in Infrastructure Projects in India" International Journal of Innovative Research in Advanced Engineering (IJIRAE, April 2015
- [9]. Shankar Neeraj1, Balasubramanian. M2 "ASSESSMENT OF RISK IN CONSTRUCTION INDUSTRY" International Research Journal of Engineering and Technology (IRJET)
- [10]. Ms. Sowmya Rao G.S Prof. V. SrinivasaRaghavan" Construction Risk Identification and Assessment" Indian journal applied research
- [11]. K. Jayasudha and B. Vidivelli " ANALYSIS OF MAJOR RISKS IN CONSTRUCTION PROJECTS" ARPN Journal of Engineering and Applied Sciences.
- [12]. Kinnaresh Patel" A study on risk assessment and its management in India" American Journal of Civil Engineering
- [13] Mubin M. Shaikh" RISK MANAGEMENT IN CONSTRUCTION PROJECTS" Technical research organization
- [14]Project Management Institute, Inc. "A Guide to the Project Management Body of Knowledge" PMBOK® Guide – Fifth Edition 2012