JETIR.ORG ISSN: 2349-5162 | ESTD Year : 2014 | Monthly Issue
JOURNAL OF EMERGING TECHNOLOGIES AND INNOVATIVE RESEARCH (JETIR)
An International Scholarly Open Access, Peer-reviewed, Refereed Journal

A study on impact of risk management practices on success of construction project

Tafzeel Ahmad[1] , Rajiv Banerjee[2] Mohd Asim[3]
[1]M.Tech Research scholar, Department of Civil Engineering, Integral University Lucknow,
[2] Associate professor, Department of Civil Engineering, Integral university Lucknow,
[3] Assistant professor, Department of Civil Engineering, Integral university Lucknow,

ABSTRACT

There is no way to avoid discussing risk in the era of raging globalisation because it has become a necessary component of daily living. Everywhere, in every aspect of life, there is a risk. One such field is the construction sector, where risk is a constant piece of a complex puzzle. Although it would appear like the cheapest course of action, effective risk management does not apply to risk resignation. The fundamental issue with this choice is its nonsensical economics, since anything that has the potential to be profitable is by definition dangerous, and anything that does not pose a risk is attractive from an economic standpoint but does not result in any real advantages. The "golden mean" in risk management will therefore be determined in connection to the project that is being undertaken. On the one hand, it will include safeguarding against the danger of the negative side through meticulous risk identification and classification, which produced a thorough analysis. In contrast, management should be centred on determining the decisions' maximum advantages while utilising all available mathematical and analytical techniques. We will be able to properly manage risk by doing a thorough analysis that considers all important factors, including stakeholder analysis, and which will result in immediate advantages for our project. Identification of project risks is essentially based on identifying the different categories of hazards that might have an impact on the project, giving a description of their characteristics, and calculating the likelihood that they will occur. The three sorts of investors—risk preference, risk neutrality, and pure risk aversion—as well as their measurement—are preserved under these three categories of conditions: assurance, uncertainty, and risk. A list of occurrences with their causes, probabilities, and final assessments of their environmental impact will be the output of the project's risk identification and analysis.

Keywords: Risk management; Risk management process; Risk management methods; Risk management process.

1. INTRODUCTION

Building construction involves inherent risks due to the complexity and multifaceted nature of the process. These risks can arise from a variety of factors and have the potential to impact the project's timeline, budget, safety, and overall success. Understanding and effectively managing these risks is essential for all stakeholders involved in the construction industry.

One of the primary risks in building construction is the potential for accidents and injuries. Construction sites are inherently hazardous environments, with various activities taking place simultaneously, involving heavy machinery, working at heights, and exposure to hazardous materials. Failure to implement proper safety protocols and training can result in accidents, injuries, and even fatalities. Another risk is related to the financial aspect of the project. Cost overruns and budgetary issues are common risks in construction. Unexpected expenses can arise from factors such as design changes, unforeseen site conditions, fluctuations in material and labour costs, or delays in the construction schedule. Failure to manage these risks effectively can lead to financial strain, delays, or even project abandonment. Construction projects are also exposed to risks associated with project management and coordination. Poor communication, inadequate planning, and lack of coordination among project stakeholders can result in schedule delays, conflicts, and inefficiencies. Additionally, the reliance on multiple subcontractors and suppliers introduces risks related to their performance, delivery delays, or the quality of their work. The complexity of building design and technology can also pose risks. Innovative design features, intricate structural systems, and advanced building materials may introduce uncertainties and challenges during construction. Lack of expertise or experience in implementing these elements can lead to errors, design conflicts, and compromised building integrity. External factors such as changes in regulatory requirements, environmental regulations, or political and economic conditions can also introduce risks in building construction. Compliance with building codes, permits, and environmental standards is crucial, and failure to do so can result in legal issues, fines, or the need for costly rework. Risk mitigation and management strategies are essential in the construction industry. This includes implementing comprehensive safety protocols, conducting regular inspections and audits, providing proper training and supervision, and fostering a culture of safety on construction sites. Thorough planning, clear communication, and effective project management techniques can help identify and address potential risks early on. Additionally, maintaining open lines of communication among project stakeholders, regularly monitoring progress, and addressing issues promptly can help mitigate financial and coordination risks. Embracing innovative technologies, conducting thorough feasibility studies, and engaging experienced professionals can also contribute to risk reduction. In conclusion, building construction inherently involves risks that can impact the project's safety, timeline, budget, and overall success. Identifying, understanding, and effectively managing these risks through proper planning, communication, coordination, and risk mitigation strategies are crucial for successful construction projects.

1.2 RISK AND UNCERTAINTY

Risk can be defined as the Variability of Return. According to Crandall and Al-bahar, risk is the exposure to the chance of occurrence of uncertainty. Uncertainty here represents the probability that an event will occur.

1.3 BUILDING COMPLEXITY

Building complexity refers to the intricate and sophisticated nature of the design, construction, and operation of a building. It encompasses the integration of multiple systems, components, and processes to create a functional and efficient structure that meets the needs of its users. In terms of architectural design, building complexity can arise from unique and unconventional geometries, intricate detailing, and innovative features. Buildings with irregular shapes, complex facades, or interior layouts require specialized expertise and careful coordination to ensure structural integrity and aesthetic appeal. Structural considerations also contribute to building complexity. Structures designed to withstand various forces, such as gravity, wind, earthquakes, or heavy loads, require meticulous analysis and engineering. Complex structural systems, such as those found in high-rise buildings or long-span structures, demand advanced design and construction techniques to ensure stability and safety. Building systems, including mechanical, electrical, plumbing, and fire protection, add another layer of complexity.

These systems must be designed, coordinated, and integrated to ensure optimal performance and efficiency. Factors such as energy conservation, environmental sustainability, and building automation further enhance the complexity of these systems. Construction techniques and technologies also play a significant role in building complexity. Innovative construction methods, such as prefabrication or modular construction, introduce new challenges in terms of coordination, logistics, and assembly. Advanced materials, such as composite structures or smart materials, require specialized knowledge and skills to incorporate into the building process. Building codes, regulations, and standards further contribute to building complexity. Compliance with local building codes, accessibility requirements, fire safety regulations, and environmental guidelines requires careful attention and coordination among design professionals, contractors, and regulatory authorities. The coordination and collaboration among various stakeholders involved in the construction process also add to building complexity.

Architects, engineers, contractors, subcontractors, suppliers, and other professionals must work together to ensure that the design intent is translated accurately into the built form. Effective communication, coordination, and management are essential to overcome challenges and avoid conflicts during the construction process.

1.4 BUILDING CONSTRUCTION

Building construction is a dynamic and multifaceted process that involves the creation of structures such as residential homes, commercial buildings, industrial facilities, and infrastructure. It encompasses a wide range of activities, including planning, design, procurement of materials, site preparation, construction, and finishing touches. Building construction is a collaborative effort that requires the involvement of architects, engineers, contractors, subcontractors, and various skilled workers. The process begins with the planning and design phase, where architects and engineers work together to conceptualize the building and create detailed drawings and specifications. This stage involves considering factors such as the building's purpose, aesthetics, functionality, and structural integrity. It also includes compliance with building codes, zoning regulations, and sustainability standards. Once the design is finalized, the procurement of materials begins. This involves sourcing and purchasing construction materials such as concrete, steel, wood, glass, electrical and plumbing fixtures, and finishing materials like tiles, paint, and flooring materials. The materials selected should meet quality standards, be cost-effective, and suitable for the intended use of the building. Site preparation is the next step, which involves clearing the land, levelling the ground, and preparing the foundation. This stage also includes necessary site infrastructure such as roads, drainage systems, and utilities. The construction phase is where the actual building process takes place. It starts with the laying of the foundation, which provides the base for the entire structure. Structural elements such as columns, beams, and load-bearing walls are erected, followed by the installation of the building envelope, including walls, roofs, and windows. Construction workers also install the building's systems, such as electrical wiring, plumbing, heating, ventilation, and air conditioning (HVAC), fire protection, and communication systems.

Once the structural and system installations are complete, the finishing touches are added. This includes interior work such as flooring, wall finishes, painting, installation of fixtures, and fittings. Exterior finishes, landscaping, and site amenities are also addressed during this phase. Throughout the construction process, project management and quality control play crucial roles. Effective project management ensures that construction activities are properly scheduled, coordinated, and monitored. Quality control ensures that the work meets specified standards and addresses any issues or defects promptly.

1.5 PRINCIPLES OF RISK AND UNCERTAINTY MANAGEMENT

Although there is no universally accepted definition of risk and uncertainty, it is generally accepted that under certain situations, the outcome or activities are likely to diverge from expectations. The impact of the departure from expectation is thought to have a value-neutral, value-negative, or value-positive outcome. These values take the shape of the project's timeline, quality, and cost in the construction industry. Therefore, the impact of risks and uncertainties on project time, quality, and economy is the focus of management and management development in the field of construction project management. The emphasis should be on managing risks and uncertainties, which are issues facing the project management of the construction industry in emerging nations.

- The project's numerous risks and uncertainties should be identified.
- Classification and quantification of the project's risks and uncertainties.
- Project risk and uncertainty sensitivity analysis.
- Giving project risks and uncertainties to those who have the tools and capacity to address each category. This can entail making the customary offering to the god(s) through prayers or by ignoring the dangers and uncertainties. Sometimes, some people deal with it in superstitious ways, whether through fortune-tellers, witch doctors, or customs like making some sort of sacrifice for particular kind of tasks. Contractual terms and conditions should be used to allocate and distribute risks and uncertainties.
- Response and mitigation of project risks and uncertainties by the accountable individuals or parties to whom they were assigned and distributed. To insulate project implementation from their effects when threats occur in part or in full, or to compensate up for those effects

1.6 RISK ANALYSIS

The use of a risk analysis technique is frequently supported by tools with automation capabilities. The tools' primary function is to make it possible to search for, gather, and manage the data required for the various project phases. Different methods use various data and information gathered from various sources using various means, including statistics, inspections, surveys, documentation, and expert opinions. The two primary kinds of project risk analysis techniques are qualitative and quantitative techniques.

1.7 QUALITATIVE ANALYSIS

Although risk assessments are associated with qualitative descriptions and the creation of qualitative scales for the probability and impact of risk-related consequences, qualitative risk analysis techniques do not operate on numerical data and instead present results in the form of descriptions, recommendations, and ordinal scores.

The main qualitative analysis techniques are:

- Brainstorming
- Delphi method
- Cause and affect diagram
- Checklist
- Event Tree Analysis (ETA)
- Risk Breakdown Structure (RBS)

Techniques for qualitative risk analysis may include risk rankings, risk maps, or risk lists. These methods evaluate hazards, combine their impact and chance of occurrence, and then prioritise them for further investigation or action. Depending on the opinions gathered and the organization's limits on risk tolerance, the risk was assessed using more abstract terminology, such as high, medium, or low.

1.8 QUANTITATIVE ANALYSIS

The estimation of risk exposure connected to the use of numerical measures is a quantitative analysis technique. the financial value of the effects and their likelihood given the frequency of risk occurrence based on historical data series. In short, quantitative methodologies use numbers to examine how recognised risks affect project goals.

The main quantitative analysis techniques are:

- Decision Tree Analysis
- Expected Monetary Value (EMV)
- Expert judgement
- Fault Tree Analysis (FTA)
- Fuzzy logic
- Probability distribution

Risk Management is the

- a systematic planning process to identify,
- risk mapping
- risk classification
- risk summary making
- risk analysis
- evaluation process
- respond management process(strategies)
- monitor project risks

The objective of this study is to identify the risk variables that have an overall negative impact on bridge project performance, examine those risks using the right tools and techniques, and create a risk management system.

There are various risk factor in construction industry like-

- Financial risk
- Marketing risk
- Design risk
- Technical risk
- Environmental risk
- Political risk
- Construction risk

2. RISK TREATMENT STRATEGIES

Risk avoidance
Loss reduction & risk prevention
Risk retention and assumption
Risk transfer
Insurance

fig.1.risk management strategies

3. METHODOLOGY

The main goal of thoughtful and deliberate risk management is to maximise positive outcomes and reduce negative ones, increasing the likelihood that a project will succeed. If we have established a suitable project management cycle, then we may take effective activities. A properly implemented scheme not only aids in making contentious and difficult decisions, but also gives investors crucial information on what course of action to take and in accordance with which plan to obtain the best outcomes with the least amount of "negative" risk. An illustration of a risk management cycle with four key stages is provided below:

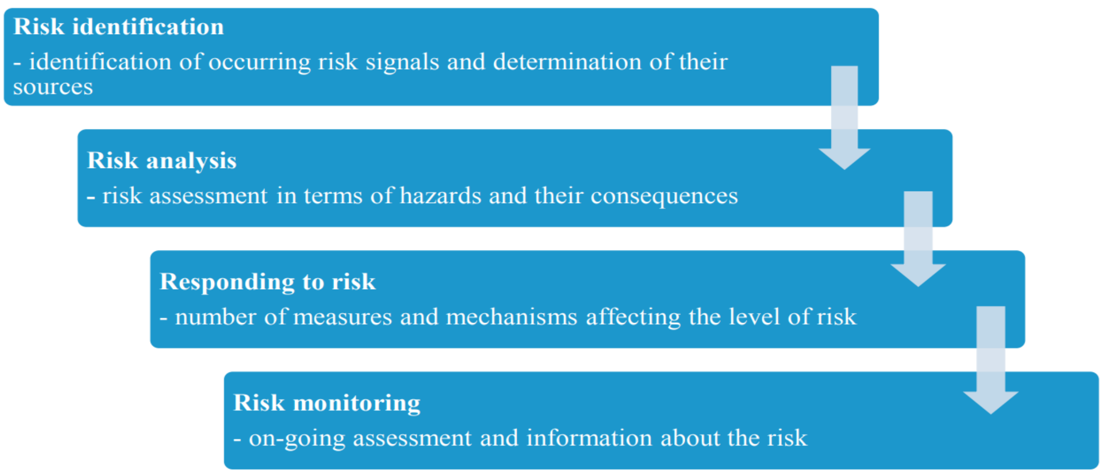

Figure 2 Risk management frame work

3.1 QUESTIONNAIRE PREPARATION

The questionnaire includes twenty-eight risks with less than five risk factors based on in-depth literature reviews and recommendations from experts. A four-point ordinal scale was used to ask respondents to rate the impact of those characteristics on bridge building, with 1 denoting "Ignore," 2 "Low," 3 "Moderately," 4 "High,". The extent of their contribution has However, for a specific degree of project performance, it has been seen that the size of their contribution can vary. The analysis's findings are intended to assist project managers in limiting their focus to a select few elements in order to achieve the best results possible rather than focusing on every aspect and failing to achieve results that are proportionate to it. 4 different categories of risk variables were included in the questionnaire that was created. Although there were several dangers that could effect bridge construction projects, those 4 risk categories were thought to be the most straightforward to compile. The questionnaire's goal was to examine 80 risk indicators associated with building construction projects, but doing so required a lot of time and would keep respondents from taking part. Second, the content of the questionnaire is broad and could not be relevant to specific practitioners in some industries. The effectiveness of the questionnaire survey could be weakened by the huge sample size. The risk factors were divided further into 60 sub-risk factors, which were then put in the appropriate risk factor category according to the kind of risk the building construction project included. The risk factors are as

- Financial Risk
- Insurance Risk
- Contractual Risk
- Management Risk
- Design Risk
- External Risk
- Time Management Risk

The research study will be conducted in a disciplined and systematic manner and will primarily focus on the inherent components of risk analysis and management. The methodologies and procedures employed in this investigation are described in this section. The flow chart that details each action to be taken from this research serves as an illustration of systematic research.

The procedure of categorising the awareness of the application of risk analysis in building construction projects was included in the research methodology of the study. A number of standardised questionnaires were designed as a foundation and used consistently throughout the study

BASIC STEPS OF THE STUDY AND DATA COLLECTING SYSTEM EXPLAINED IN THIS SECTIONS

mock review preparation	conducting survey	classification of factors of risk	quantitative analysis	qualitative analysis	Ranking of risk	Graphical study

Fig.2. basic steps of the study and data collecting system explained in this sections

1. MOCK QUERY PREPARATION

Formulating questions for everyone involved, such as "What causes risk to occur?"

Ranking of risks?

Losses due to risk?

2) **Conducting Survey**- surveying both the site and off-site to gather information

3) **Risk factors are categorised as follows**- financial risk, management risk, insurance risk, design risk, contractual risk, climatic risk, and external risk.

4) **Quantitative Analysis**-management tools like cause and affect diagram, checklist, risk breakdown structure, brainstorming, Delphi method, event tree analysis.

5) **Qualitative Analysis**- management tools like decision tree analysis, expert judgement, expected monetary value, probability distribution, fuzzy logic.

6) **RANKING OF RISK**-levelling of rank by first to last.

7) **GRAPHICAL STUD**Y-representation of risk by graphs

3.2 QUESTIONNAIRE SURVEY

PART(A)

1) OFFICAL ADDRESS OF FIRM-

2) AFFILIATON-

3) WORK PLACE LOCATION-

4) WORK TYPE-

5) WORK EXPERIENCE-

6) NUMBER NAME OF FIRM-

7) OF PROJECT EXECUTED IN LAST 10 YEARS-

Q-1: What is your Designation?

1) Construction Manager

2) Managing Director

3) Resident Engineer

4) Technical supervisor

5) Manager

6) Project Chairman

7) Other.............................

Q-2: Would you mention age group (in yrs)

1) Less than 35

2) 35-45

3) 45 or above

Q-3: Would you be willing to share how long you have worked in the construction industry?

1) Less than 5

2) 5to 10

3) 10 or above

Q-4: May I know your education status?

1) Less than diploma certificate level
2) Diploma certificate level
3) Bachelor level
4) Master level
5) Ph. D level

Q-5: What is the typical project completion time?

1. 1 yrs.
2. 1-2 yrs.
3. 2-3 yrs
4. 3-4 yrs

PART(B)

3.3 QUESTIONS RELATED TO RISK MANAGEMENT PROCESS

1. Do you place a high priority on risk management in your organization?

   [ ] YES [ ] NO

   If yes, please state how do you implement risk management and to what extent.

   Note

   -
   -

2. What benefits can you expect when you use a risk management system in your projects?

   Note

   -
   -

3. What are types of risk associated with the building projects? grade them in the sequence of impact?

   [ ] design risk [ ] financial risk [ ] environmental risk

   [ ] contractual risk [ ] operational risk

   [ ] land acquisition [ ] accidental risk

4. How can your system implement a successful risk management strategy?

Note

-
-

5. What problems does implementing a risk management system present?

Note

-
-

3.4 QUESTIONNAIRE FORMAT

Consider about a typical project you manage that has the characteristics you mentioned.

1. Ignore
2. Low
3 Moderately
4. Higher

N = Total Number of Respondents.

4. RESULT

4.1. Spearman's rank correlation b/w Engineers & Academician

Factors	Rank by Engineer	Rank by Academician	Different $D=R_1-R_2$	Different^2
Delay from clients	13	13	0	0
Failure to meet revenue targets	12	1	11	121
Unpredictable variation in raw material price	9	13	-4	16
Estimated finance than expected	11	2	9	81
Liquidity of company	3	8	-5	25
Inflation	4	10	-6	36
Incomplete project design	4	4	0	0
Improper specification	8	12	-4	16
Complexity of project design	1	9	-8	64
Late changes of design from client side	2	2	0	0
Design error delivered by the owner	8	8	0	0
Change in seismic criteria	5	7	-2	4
Delays and mistakes in producing	7	10	-3	9

design documents				
Disputes on project site	6	8	-2	4
Work permissions	5	4	1	1
Change in sequences of construction activity.	2	8	-6	36
Performance delay	10	7	3	9
Worker and site safety	6	8	-2	4
Chance of sub-contractor walkout	13	14	-1	1
Union issue	10	6	4	16
Pressure from any political party	10	15	-5	25
Revision of price	9	3	6	36
Unexpected licencing requirements or regulatory controls	6	3	3	9
Change in government	13	11	2	4
Failure to achieve satisfactory contractual arrangement	6	4	2	4
Loss of intellectual property rights	9	5	4	16
Unforeseen inclusion contingent liabilities	3	4	-1	1
Environmental board issue	4	3	1	1

$\sum D^2 = \sum = 539$ N=28

$R_s = 1 - 6\sum D^2 \div (N^3 - N)$

$R_s = 1 - [(6*539)/(21952-28)$,

$R_s = 0.85$

4.2. Spearman's rank correlation b/w Engineers & Contractor

Factors	Rank by Engineer(R_1)	Rank by Contractor(R_2)	Different $D=R_1-R_2$	Different^2
Delay from clients	13	15	-2	4
Failure to meet revenue targets	12	3	9	81
Unpredictable variation in raw material price	9	1	8	64
Estimated finance than expected	11	6	5	25
Liquidity of company	3	11	-8	64
Inflation	4	6	-2	4
Incomplete project design	4	12	-8	64
Improper specification	8	6	2	4
Complexity of project design	1	7	-6	36
Late changes of design from client side	2	10	-8	64
Design error delivered by the owner	8	8	0	0
Change in seismic criteria	5	6	-1	1
Delays and mistakes in producing design documents	7	5	2	4
Disputes on project site	6	6	0	0
Work permissions	5	14	-9	81
Change in sequences of construction activity.	2	2	0	0
Performance delay	10	9	1	1
Worker and site safety	6	10	-4	16

Chance of sub-contractor walkout	13	4	9	81
Union issue	10	6	4	16
Pressure from any political party	10	10	0	0
Revision of price	9	7	2	4
Unexpected licencing requirements or regulatory controls	6	10	-4	16
Change in government	13	13	0	0
Failure to achieve satisfactory contractual arrangement	6	6	0	0
Loss of intellectual property rights	9	7	2	4
Unforeseen inclusion contingent liabilities	3	11	-8	64
Environmental board issue	4	7	-3	9

$\sum D^2 = \sum = 707$ N=28

$R_s = 1 - 6\sum D^2 \div (N^3 - N)$

$R_s = 1 - [(6*707)/(21952-28)$

$R_s = 0.80$

4.3 Spearman's rank correlation b/w Contractor & Academician

Factors	**Rank by Contractor**	**Rank by Academician**	**Different D=R1-R2**	**Different^2**
Delay from clients	15	13	2	4
Failure to meet revenue targets	3	1	2	4
Unpredictable variation in raw material price	1	13	-12	144

Estimated finance than expected	6	2	4	16
Liquidity of company	11	8	3	9
Inflation	6	10	-4	16
Incomplete project design	12	4	8	64
Improper specification	6	12	-6	36
Complexity of project design	7	9	-2	4
Late changes of design from client side	10	2	8	64
Design error delivered by the owner	8	8	0	0
Change in seismic criteria	6	7	-1	1
Delays and mistakes in producing design documents	5	10	-5	25
Disputes on project site	6	8	2	4
Work permissions	14	4	10	100
Change in sequences of construction activity.	2	8	-6	36
Performance delay	9	7	2	4
Worker and site safety	10	8	2	4
Chance of sub-contractor walkout	4	14	-10	100
Union issue	6	6	0	0
Pressure from any political party	10	15	-5	25
Revision of price	7	3	4	16
Unexpected licencing	10	3	7	49

requirements or regulatory controls				
Change in government	13	11	2	4
Failure to achieve satisfactory contractual arrangement	6	4	2	4
Loss of intellectual property rights	7	5	2	4
Unforeseen inclusion contingent liabilities	11	4	7	49
Environmental board issue	7	3	4	16

$\sum D^2 = \sum = 802$ N=28

$R_s = 1-6\sum D^2 \div (N^3-N)$

$R_s = 1-[(6*802)/(21952-28)$

$R_s = 0.78$

5. CONCLUSION

1. The analysis of Spearman's rank correlation coefficients revealed significant relationships between the rankings of specific risk factors by Engineers & Academicians, Engineers & Contractors, and Contractors & Academicians in the context of construction projects in building. These correlations provide valuable insights into the relative importance of these factors and their impact on project success.

- Engineers & Academicians: The strong positive correlation (R = 0.85) between the rankings provided by engineers and academicians highlights a shared perception regarding the impact of the specific risk factors you are investigating. This alignment between engineers and academicians supports the validity of your research and demonstrates a consensus within the engineering and academic communities on the significance of these factors.

- Engineers & Contractors: The strong positive correlation (R = 0.80) observed between the rankings provided by engineers and contractors validates the relevance of the specific risk factors you are focusing on. The alignment between engineers and contractors further strengthens the understanding of these factors and their influence on project outcomes from both practical and industry perspectives.

- Contractors & Academicians: The strong positive correlation (R = 0.78) between the rankings provided by contractors and academicians confirms the importance of the specific risk factors you are studying. This alignment between contractors and academicians underscores the value of combining practical industry knowledge with academic insights in comprehensively addressing these factors.

2. The consistent correlations across these professional groups reaffirm the significance of the specific risk factors you are working on. These findings provide valuable insights for project, supporting research objectives and validating the importance of the factors which are to be investigate. By focusing on these factors, we can contribute to the existing knowledge and understanding of risk management practices in construction projects in the building sector.

7. THE EFFECTIVENESS OF A CONSTRUCTION PROJECT SPECIFIC RISK MANAGEMENT STRATEGY.

1. Complexity of project design:

Risk:
Design errors, coordination issues, or delays due to project complexity

Risk Management Strategy:

- Employ experienced and competent design professionals with expertise in handling complex projects.
- Conduct thorough design coordination and clash detection reviews to identify and resolve conflicts early on.
- Implement advanced design technologies, such as 3D modelling or virtual reality, to visualize and simulate complex design elements.
- Establish regular communication channels and collaboration frameworks among the project team members to ensure effective coordination and information sharing.

2. Late changes of design from client side:

Risk:
Design revisions causing delays, cost overruns, or disruption to project schedule

Risk Management Strategy:

- Develop a change management process that clearly outlines the procedure for assessing, approving, and implementing design changes.
- Clearly communicate the impact of design revisions on project timeline, budget, and resources to clients to manage expectations.
- Maintain regular communication and collaboration with clients to identify and address design concerns or changes early on.
- Allocate contingency time and resources in the project schedule and budget to accommodate potential design changes.

3. Liquidity of the company:

Risk:
Insufficient funds to cover project costs or financial instability

Risk Management Strategy:

- Conduct accurate financial forecasting and budgeting to estimate the funding requirements for the project.
- Establish financial reserves or secure lines of credit to ensure sufficient liquidity throughout the project.
- Monitor cash flow regularly and implement efficient financial management practices to optimize resource allocation.
- Maintain positive relationships with financial institutions or investors to secure additional funding if required.

4. Unforeseen inclusion of contingent liabilities:

Risk:
Unexpected legal or financial liabilities arising during the project

Risk Management Strategy:

- Conduct a comprehensive risk assessment and due diligence process to identify potential contingent liabilities.
- Obtain appropriate insurance coverage to mitigate financial risks associated with contingent liabilities.
- Review and understand contractual terms and legal obligations to minimize exposure to unforeseen liabilities.
- Engage legal experts to provide advice and guidance on potential risks and mitigation strategies.

5. Inflation:

Risk:
Increased project costs or reduced purchasing power due to inflationary pressures
Risk Management Strategy:

- Conduct inflation risk analysis and include inflation contingency in the project budget.
- Monitor inflation trends and adjust cost estimates and pricing accordingly.
- Implement proactive cost control measures and negotiate favourable contracts with suppliers to minimize the impact of inflation.
- Explore hedging strategies or index-linked contracts to mitigate inflation risks.

REFERENCE

1. Krantikumar Mhetre, B.A.Konnur, Amarsinh B. Landage, Risk Management in Construction Industry, international journal of engineering vol.5, 8 &9 JAN 2016

2. Mr. N. V. Patil, Risk management in road construction, international journal of modern trends in engineering, 2&4,2015

3. Suchith Reddy Risk Management in Construction Industry - A Case Study, international journal of innovative research in science engineering and technology vol.4A, 10 OCT 2015

4. B.A.K.S. Perera, Indika Dhanasinghe and Raufdeen Rameezdeen, risk management in road construction: the case of Sri Lanka, international journal of strategic property management

5. Mr. Satish K. Kamane, Mr. Sandip A. Mahadik, Risk Management in Construction Industry ISOR journal of mechanical and civil engineering

6. Engineer Rinaj Pathan, Prof. Dr. S. S. Pimpliar, risk assessment of BOT Road projects SOR journal of mechanical and civil engineering

7. T.H. Nguyen, G. Bhagavatulya and F. Jacobs, Risk Assessment: A Case Study for Transportation Projects in India, International Journal of Application or Innovation in Engineering & Management

8. Yadav Ashwini Ashok, Prof. B.V.Birajdar, Risk analysisand management for PPP infrastructure project in India, International Research Journal of Engineering and Technology

9. Jie Li (Dongnan University, Nanjing, China) and Patrick X.W. Zou (Faculty of The Built Environment, University of New South Wales, Sydney, New South Wales

10. Anil Kumar Gupta, Dr. M.K. Trivedi ,Dr. R. Kansal, Risk variation assessment of Indian road project, international journal of science, environment and technology,vol.5,no 5