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A Review on Risk Management Processes Early in the Project Lifecycle

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Abstract

Risk management early in the project lifecycle plays a critical role in enhancing the chances of project success by proactively identifying, assessing, and mitigating potential threats before they escalate. This review explores various processes and frameworks used in the early stages of project planning to manage risks effectively, including risk identification, qualitative and quantitative analysis, and strategic response planning. Emphasis is placed on the importance of early stakeholder involvement, structured risk assessment tools, and the integration of risk management into decision-making processes. The study highlights that addressing risks at the inception phase can significantly reduce project delays, cost overruns, and performance failures, ultimately contributing to better resource allocation and improved project outcomes.

Key Words:-risk management, frameworks, cost overruns, performance failures, improved project outcomes

Introduction

Insufficient or underdeveloped infrastructure remains a major impediment to economic growth and social progress across the globe, as it hampers the efficient movement of goods, people, and services, and limits access to markets, education, and healthcare. In countries like Brazil, for instance, economic development is hindered by inadequate transportation infrastructure such as narrow roads, insufficient rail networks in expanding agricultural regions, and congested ports that cannot accommodate the demands of a growing consumer base. Recognizing these challenges, governments worldwide are prioritizing infrastructure development, with a staggering global investment pipeline currently estimated at $9 trillion. A significant portion of this investment—around one-third—is concentrated in Asia, reflecting the region's rapid economic expansion and infrastructure needs. India alone plans to invest approximately $550 billion over the next five years, focusing heavily on energy and utility projects, which are vital for sustaining industrial growth and improving quality of life. Meanwhile, developed nations are also undertaking major infrastructure initiatives; for example, the United Kingdom has outlined a pipeline comprising more than 500 infrastructure projects, collectively valued at over £250 billion, aimed at modernizing its transport, energy, and digital systems to support future economic competitiveness and sustainability.

Literature Review

Nitish Kumar et al (2024) this study explores risk management strategies in large-scale construction projects through a comparative analysis that utilizes a mixed-methods approach, integrating data from a quantitative survey of 438 participants and qualitative insights from 20 semi-structured interviews. The results indicate that the most commonly employed techniques for risk identification and assessment are brainstorming sessions, expert interviews, probability-impact matrices, and reliance on expert judgment. In terms of response strategies, risk mitigation, risk transfer, and contingency planning are widely adopted. Notably, infrastructure projects demonstrate a significantly higher application of these risk identification and assessment practices compared to other types of projects. However, interviews reveal persistent challenges such as the absence of standardized risk management procedures, limited technical expertise, and poor communication among stakeholders. On the positive side, best practices identified include strong support from top management, initiating risk management processes early in the project lifecycle, and aligning risk management with other core project processes. Based on these findings, the study recommends fostering a culture that prioritizes risk management, providing targeted training and allocating adequate resources, and improving communication and reporting frameworksto enhance the overall effectiveness of risk management in construction projects.

RubinaCanesi et al (2024) the study highlights the growing concern over declining infrastructure investment, especially in transportation, and emphasizes the critical role of risk assessment in ensuring the economic and financial sustainability of infrastructure projects. Focusing on the SSv-51 variant of "State Road No. 51 of Aleman Vittorio Veneto," it proposes a forecasting model for potential cost overruns using the National Anti-Corruption Authority's (ANAC) risk matrix. This matrix, comprising 21 risk types across four categories, evaluates risks based on their probability and cost impact, helping anticipate a cost increase of 7.53%, closely aligning with the actual overrun of 8.87%. The study demonstrates that integrating risk

assessment into early project planning can effectively manage uncertainties, control expenditures, and enhance the efficiency of infrastructure project execution. The adaptable and practical nature of the proposed tool supports its application across various future projects to improve cost management and planning outcomes.

Ala'aSa'dIssaAlkhawaja et al (2023) the Jordanian building sector contributes greatly to the country's GDP. However, Jordanian road projects are notorious for cost overruns throughout construction and operation. Risks to infrastructure services in Jordan are identified, studied, and evaluated in this report. Having this information will make it easier for project stakeholders to effectively manage risks. Additionally, it is trying to find ways to improve the connection between road implementation authorities, government agencies, and the business sector. A list of 32 hazards was compiled based on a literature assessment that analyzed the project's managerial, technological, financial, social, location-specific, and operational issues. Engineers and other professionals in Jordan were then requested to complete a survey. Cost overruns on the Jordan Crossing Jordan project have been blamed on eight factors, according to Jordanian experts. More than 300 people were polled to determine the likelihood and magnitude of each possible danger. According to the results of the survey, infrastructure projects are most likely to encounter the greatest number of hazards. Lack of infrastructure is the greatest threat to the project's success, with an effect of 0.862. Problems with the contract between the project's running firm and the government authorities in control; reorganization of corporate structures and processes; and accidents that occur as a result of inadequate safety measures are all possibilities with a RII of 0.858. An essential part of project risk management is the identification and evaluation of potential hazards. In this study, it will be looked at for the first time how risk management strategies affect infrastructure project risks.

Mohammed Al mougher et al (2021)this study focuses on identifying and addressing the risks associated with the work environment in infrastructure projects, aiming to minimize these risks and safeguard both human and material resources. It also seeks to highlight key indicators used in the assessment, management, and prevention of such risks. To achieve these goals, the study adopts an analytical descriptive approach, which involves describing the phenomenon of risk and analyzing the measures currently taken within the framework of risk management practices. A key finding of the study is the absence of well-defined risk management models within governmental institutions, which hinders the implementation of a unified national strategy for managing risks in infrastructure projects. Furthermore, there is a notable deficiency in knowledge and expertise related to risk management among stakeholders. As a result, the study recommends the development and adoption of a comprehensive program aimed at training and qualifying professionals, organizations, and communities in risk management practices. Additionally, it emphasizes the need to implement a consistent and nationally recognized risk management framework across all infrastructure projects to ensure systematic identification, evaluation, and mitigation of risks.

Jana Korytárová et al (2021) this article presents a detailed examination of risk assessment in large-scale infrastructure projects, specifically focusing on road and motorway construction. Given the significant financial investment made by the Department of Transport in preparing and implementing such projects, it is crucial to allocate funds effectively, which requires a thorough understanding of potential risks. To support financing decisions, the study includes a qualitative risk analysis using data from the national risk register to track the frequency of specific risk factors. It also identifies dependent variables that influence project economic efficiency, such as investment costs and user time savings, and compares these through sensitivity analysis to determine which variables most critically affect outcomes. These critical variables are then further analyzed for their impact on project efficiency using the Monte Carlo simulation method, which accounts for the uncertainty and interaction among these variables. A key part of the research focuses on the probability distribution of input variables, emphasizing how the statistical characteristics—especially for investment costs and user time savings—must be accurately defined, as they directly influence the calculation of economic indicators used to decide whether a project should receive funding. The findings underscore the importance of proper risk quantification and variable analysis to ensure sound financial decision-making in infrastructure development.

Sanatan D. Patel et al (2021) Risk identification and analysis for complex mega infrastructure projects, such as the Ahmedabad Metro, is a critical aspect of modern project management due to the high level of uncertainty and potential for significant cost and time overruns. This study employs a combination of qualitative and quantitative methods—probabilistic analysis, risk severity analysis, and the risk matrix method—to assess risks. Primary data was collected through expert interviews and questionnaire surveys to identify major risk activities. These risks were then evaluated based on their likelihood, impact, and overall severity. By comparing the results from different analytical methods, the study highlights common high-rated risk factors such as land acquisition delays, utility shifting issues, contract mismanagement, design changes, and political or regulatory interference—factors consistently rated as critical due to their significant influence on project cost, schedule, and overall success.

EsraTepeli (2020) infrastructure construction projects are inherently complex due to their long life cycles, intricate organizational structures, demanding resource management, and numerous technical, contractual, and macro-environmental challenges. These complexities give rise to interdependent and often unpredictable risks that are difficult to manage effectively. Given the substantial investment required, both the risks and the opportunities associated with these projects play a critical role in determining their ultimate success or failure. Therefore, it is essential to identify and thoroughly analyze these risk factors early in the project lifecycle, particularly during the planning phase. However, since infrastructure projects typically span many years and involve multiple stakeholders and companies, it is impossible to foresee all potential scenarios and challenges. To address this uncertainty, a robust and strategic risk analysis methodology must be employed at a very early, strategic level—specifically before entering the contracting phase. This allows project teams to proactively allocate risks and negotiate risk-sharing strategies with the project owner. In this context, the paper proposes a formalized multi-criteria decision-making (MCDM) approach that supports strategic-level risk analysis in highly complex environments, enabling better-informed decisions, more effective risk allocation plans, and a foundation for successful project negotiation and execution.

Shubham S. Shinde et al (2020) construction projects are launched in complex, ever-changing environments where uncertainty and risk are inherent and often intensified by strict time constraints. Over recent years, the construction industry has undergone significant transformations, demanding more sophisticated risk management practices. Risk management, in this context, refers to the systematic identification, analysis, and response to potential project risks, aiming to enhance the likelihood and impact of positive events while reducing the probability and consequences of negative events that may hinder project objectives. This study leverages the insights and experiences of engineers, managers, builders, and contractors by collecting and analyzing data through the Relative Importance Index (RII) method. The approach involved identifying the frequency of various risk factors and calculating their severity based on their impact on project outcomes. The findings provide valuable guidance for prioritizing risk factors that require focused attention during construction, ultimately supporting the timely and efficient completion of projects by enabling more informed decision-making and proactive risk mitigation strategies.

Ashwini R. Patil et al (2019) the construction industry, being one of the largest sectors globally, plays a crucial role in national budgets and overall economic growth. However, infrastructure projects within this sector often face performance challenges due to their complex nature, involving multiple stakeholders and a general lack of systematic risk identification and control. These challenges frequently lead to project failures, adversely impacting both the economy and institutions. The numerous risks encountered throughout a project's lifecycle—particularly during the construction phase—necessitate a scientific and structured approach for effective risk identification, analysis, planning, and control. This research aims to address these issues by applying such a scientific approach to manage risks and ensure the successful, timely, and quality completion of infrastructure projects without compromising environmental and social standards, and staying within the allocated budget. The study focuses on identifying, assessing, and mitigating risks through interviews and questionnaire surveys conducted with industry professionals, government officials, and project management consultants across various levels.

MuhammedMufazzal (2018) the study titled “Construction Schedule Delay Risk Assessment by Using Combined AHP-RII Methodology for an International NPP Project” primarily contributes by identifying the most significant causes of schedule delays in Nuclear Power Plant (NPP) construction projects executed under turnkey contractual approaches. A key outcome of the research is the development of a multi-criteria decision-making model that prioritizes NPP construction delay risk factors based on their severity and frequency of occurrence. Utilizing a combination of the Analytic Hierarchy Process (AHP) and Relative Importance Index (RII) methodologies, the study provides both qualitative and quantitative insights into the delay factors, emphasizing the importance of using measurable criteria in managing schedule risks. The findings reveal that the main contractor is the leading source of delay risk, followed by the utility company, regulatory agencies, and financial and geopolitical factors. This comprehensive assessment framework offers a robust tool for stakeholders in the NPP industry to better manage and mitigate schedule delay risks.

Hatkar K B et al (2016)the study titled "Delay Analysis by Using Relative Importance Index Method in Infrastructure Projects" identified a total of 76 factors contributing to delays, which were categorized into eight major groups, with contractor-related and finance-related delays being the most significant. Among the top ten critical delay factors were local political interference, inadequate fund allocation, improper planning and scheduling by contractors, delayed payments by clients, rising material costs, adverse weather conditions, payment delays to suppliers and subcontractors, lack of construction equipment (kit), incomplete drawings or design details, and natural disasters such as floods and earthquakes. The primary effects of these delays were recognized as time overruns, cost overruns, and project disputes. To mitigate such delays, the study analyzed 32 different strategies and concluded that the most effective methods include the deployment of a competent and capable project manager and conducting thorough preconstruction planning, emphasizing the need for experienced leadership and proactive project setup to foresee risks, allocate resources efficiently, and maintain control over project timelines and costs.

K. Jayasudha et al (2016) the study titled “Analysis of Major Risks in Construction Projects” aims to support management in identifying critical project activities where financial, time-related, and construction-related risks may arise, providing a foundation for making informed decisions to mitigate these risks to an acceptable level. The research emphasizes the importance of risk management as a fundamental tool for assessing and guiding project success. Data was collected and evaluated using a 5-point Impact Grid covering a wide range of risk factors, and the perceived differences in risk assessments among General Managers, Project Managers, Project Engineers, and Site Engineers were analyzed using SPSS software. The findings are essential for implementing targeted risk-reduction measures and ensuring the strategic direction of future construction project development.

AshwiniYadav et al (2015)this paper presents a method for measuring project risk using the risk matrix approach, which is particularly effective in addressing uncertainties related to cost, time, and activity-specific risks within a project network. The study identifies major sources of risk in a complex infrastructure project and quantifies them based on three key parameters: likelihood, impact, and overall severity. Expert opinions from professionals involved in this and similar projects were utilized to assess and validate the risks. Using the risk matrix method, each identified risk is evaluated and classified according to its severity level, enabling prioritization of risks for effective management and mitigation strategies.

Desai Megha et al (2013) The study titled “A Methodology for Ranking of Causes of Delay for Residential Construction Projects in Indian Context” focuses on identifying and ranking the key causes of delays specific to residential construction projects in India, with a case study in the central Gujarat region. By conducting a comprehensive literature review and structured interviews with industry professionals, the study developed a framework of delay factors and proposed a methodology to prioritize these causes using two quantitative techniques: the Relative Importance Index (RII) and the Importance Index, which are based on the degree of severity and frequency of each delay factor. The objective of this research is to assist stakeholders—such as contractors, developers, and project managers—in recognizing the most critical causes of delay so they can take informed and targeted actions to mitigate their impact and improve project timelines.

Methodology

The selected studies were filtered based on relevance, credibility, and quality. Papers focusing on risk management practices in later phases of projects or unrelated industries were excluded. Studies that detailed risk identification, analysis, and mitigation strategies during project initiation and planning phases were prioritized.Risk management processes early in the project lifecycle involve the systematic identification, assessment, and prioritization of potential risks before project execution begins. This proactive approach includes key methods such as risk identification through expert judgment, brainstorming, and checklists; qualitative and quantitative risk analysis using tools like risk matrices and simulation models; and risk response planning that outlines strategies for avoiding, transferring, mitigating, or accepting risks. Early integration of these processes enables project teams to make informed decisions, allocate resources efficiently, and establish contingency plans, ultimately increasing the likelihood of project success by minimizing unforeseen disruptions during later stages.

Conclusion

Implementing risk management processes early in the project lifecycle is essential for the successful execution of any project, particularly in complex and high-stake sectors like construction and infrastructure development. Early risk identification, assessment, and mitigation planning allow project teams to proactively address potential threats before they escalate, leading to better cost control, timely delivery, and improved quality. This approach fosters informed decision-making, enhances stakeholder confidence, and significantly reduces the likelihood of project failure. Therefore, integrating structured and continuous risk management strategies from the initial phases is not just beneficial but critical for achieving project objectives efficiently and sustainably.

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