
AN ANALYTICAL STUDY ON RISK MANAGEMENT AND COST OVERRUNS IN CONSTRUCTION PROJECTS

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Article Received: 12 May 2026

Article Revised: 02 June 2026

Published on: 22 June 2026

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DOI: <https://doi-doi.org/101555/ijrpa.5638>

ABSTRACT

Construction projects frequently experience cost overruns and schedule delays due to uncertainties associated with financial, technical, operational, and external risk factors. This study aims to analyze the impact of risk management practices on cost overruns in construction projects and identify the major factors contributing to budget escalation. The research was carried out using quantitative data analysis based on responses collected from 55 construction professionals, including project managers, engineers, consultants, risk management specialists, and other industry participants. Statistical analysis was used to evaluate the relationship between risk factors and project performance.

The findings revealed that ineffective risk identification, inadequate planning, poor monitoring, and insufficient contingency management are the primary causes of cost overruns in construction projects. Financial risks, including material price fluctuations, delayed payments, inflation, and shortage of funds, were identified as the most influential factors affecting project budgets and schedules. Labor-related risks such as shortage of skilled workers, low productivity, absenteeism, and labor disputes also contributed significantly to increased project costs and project delays. Additionally, poor project planning, inaccurate cost estimation, incomplete design information, frequent scope changes, and weak stakeholder coordination were found to reduce overall project efficiency.

The study further highlighted the influence of external factors such as adverse weather conditions, policy changes, legal constraints, and approval delays on project performance. A practical case study analysis of two completed construction projects demonstrated that inadequate risk assessment and ineffective project controls resulted in cost overruns ranging from 16% to 20% and delays of 3 to 5 months. The results confirm that implementing systematic risk management practices—including risk identification, risk assessment, mitigation planning, contingency budgeting, and continuous monitoring—can significantly reduce cost overruns and improve project outcomes. The study concludes that proactive risk management is essential for achieving cost efficiency, timely completion, and sustainable performance in construction projects.

KEYWORDS: -Risk Management, Cost Overruns, Construction Projects, Quantitative Data Analysis, Financial Risk, Project Planning, Contingency Budgeting, Cost Control, Project Delay, Construction Management.

INTRODUCTION

The construction industry plays a vital role in the economic development of every nation by contributing to infrastructure growth, employment generation, and industrial expansion. Construction projects involve large investments, complex activities, multiple stakeholders, and strict time schedules. However, these projects are often affected by uncertainties and risks that lead to delays, quality issues, safety problems, and especially cost overruns. Cost overrun is one of the most common and critical problems in construction projects, where the actual project cost exceeds the estimated budget. This issue negatively affects project profitability, client satisfaction, and overall project performance.

Risk management has become an essential practice in the construction sector to identify, analyze, evaluate, and control potential risks before they adversely impact project objectives. Risks in construction projects may arise due to various factors such as poor planning, design changes, inaccurate cost estimation, and shortage of materials, labor issues, financial instability, environmental conditions, government regulations, and unexpected market fluctuations. If these risks are not properly managed, they can significantly increase project costs and create financial burdens for contractors and clients. Effective risk management helps project managers and stakeholders minimize uncertainties by implementing appropriate mitigation strategies and decision-making techniques. It enables organizations to improve project planning, optimize resource utilization, reduce financial losses, and ensure timely

project completion within the allocated budget. The process of risk management generally includes risk identification, risk assessment, risk response planning, risk monitoring, and continuous control throughout the project lifecycle. In recent years, the increasing complexity and scale of construction projects have highlighted the importance of adopting systematic risk management practices. Many studies have shown that improper risk management is one of the major causes of cost overruns in construction projects. Therefore, understanding the relationship between risk management and cost performance is necessary for improving project success rates. This study focuses on risk management and its impact on cost overruns in construction projects. The research aims to identify major risk factors affecting project costs, examine the effectiveness of risk management techniques, and analyze how proper risk management practices can help reduce cost overruns. The findings of this study may assist project managers, contractors, engineers, and policymakers in developing better strategies for managing risks and improving the financial performance of construction projects.

Types of Risk Management in Construction Projects

Strategic Risk Management

Strategic risk management deals with risks related to long-term business objectives and organizational decisions. These risks may arise due to changes in market conditions, government policies, competition, or economic instability. Proper strategic planning helps organizations minimize financial losses and improve project sustainability.

Financial Risk Management

Financial risk management focuses on controlling risks associated with project finances and budgeting. It helps in preventing cost overruns caused by inflation, inaccurate estimates, delayed payments, and fluctuations in material prices.

Operational Risk Management

Operational risk management involves identifying and controlling risks arising from day-to-day construction activities and operations. It ensures smooth project execution and minimizes disruptions.

Technical Risk Management

Technical risks are related to design, engineering, construction methods, and technology used in the project. Proper technical risk management helps avoid failures and additional costs during construction.

Literature Review

The construction industry is one of the most risk-prone sectors due to the involvement of numerous stakeholders, uncertain environmental conditions, financial constraints, design complexities, and changing client requirements. Cost overruns are a common issue in construction projects worldwide and are often associated with inadequate risk management practices. Researchers have extensively studied the relationship between project risks and cost performance in order to improve project delivery efficiency.

Early studies identified that construction projects frequently exceed their estimated budgets because of poor planning, inaccurate cost estimation, and delays in decision-making, and unforeseen risks. Researchers observed that risks related to labor productivity, material price fluctuations, weather conditions, design changes, and contractor inefficiencies significantly contribute to increased project costs. Effective risk management was therefore considered essential for minimizing uncertainties and ensuring successful project completion within the planned budget.

One of the foundational concepts in construction risk management was introduced through project management frameworks that define risk as an uncertain event that can positively or negatively affect project objectives related to cost, time, and quality. Scholars emphasized that risk management involves systematic processes such as risk identification, risk assessment, risk allocation, risk mitigation, and continuous monitoring. Proper implementation of these processes helps project managers reduce financial losses and improve overall project performance.

Several researchers have examined the major causes of cost overruns in construction projects. Studies revealed that inaccurate estimation during the planning stage is one of the primary reasons for budget escalation. In many cases, project costs increase because initial estimates fail to account for inflation, market instability, or unforeseen site conditions. Researchers also identified scope changes initiated by clients during project execution as a major factor leading to increased costs and delays. Frequent modifications in design and specifications disrupt project schedules and increase material and labor expenses.

Another important area of research focuses on financial risks and their impact on construction costs. Scholars found that delayed payments, cash flow problems, and insufficient financial management significantly affect project progress. Contractors facing financial difficulties

may experience reduced productivity, procurement delays, and inability to maintain adequate workforce levels, ultimately leading to cost overruns. Economic instability and fluctuations in material prices were also identified as critical external risks affecting project budgets.

Studies conducted in developing countries highlighted that weak project management practices, corruption, inadequate technical expertise, and poor communication among stakeholders intensify construction risks. Researchers observed that many projects fail to implement structured risk management techniques due to lack of awareness, insufficient training, or limited organizational support. As a result, risks are often addressed only after problems occur, increasing the likelihood of budget overruns and project failure.

Research on risk identification techniques emphasized the importance of recognizing potential risks at the early stages of a project. Methods such as brainstorming, expert interviews, checklists, Delphi techniques, and historical data analysis were widely recommended for identifying project risks. Scholars argued that early identification enables project teams to prepare mitigation strategies before risks develop into serious problems affecting project costs.

Risk assessment and analysis have also been widely discussed in literature. Researchers classified risk analysis methods into qualitative and quantitative approaches. Qualitative methods involve ranking risks based on probability and impact, while quantitative techniques use statistical models, simulations, and probability analysis to estimate potential financial losses. Many studies concluded that quantitative risk assessment provides more accurate predictions of cost overruns and supports better decision-making in complex construction projects.

The relationship between project delays and cost overruns has been another major research topic. Researchers found that schedule delays directly increase labor costs, equipment expenses, and overhead charges. Delays caused by poor site management, shortages of construction materials, adverse weather conditions, and contractor disputes significantly affect project budgets. Effective risk management strategies such as contingency planning, regular progress monitoring, and proper scheduling were therefore recommended to reduce both delays and additional costs.

Scholars also investigated the role of stakeholder management in reducing construction risks. Effective communication and coordination among clients, contractors, consultants, suppliers,

and government authorities were found to be essential for minimizing misunderstandings and conflicts. Poor stakeholder coordination often leads to design errors, contractual disputes, and decision delays, which eventually contribute to cost overruns.

Recent literature emphasizes the importance of modern technologies and digital tools in construction risk management. Building Information Modeling (BIM), artificial intelligence, data analytics, and project management software are increasingly being used to identify, monitor, and control risks more effectively. Researchers reported that these technologies improve cost estimation accuracy, enhance communication, and support real-time project monitoring, thereby reducing the probability of budget escalation.

Many studies concluded that successful risk management positively impacts construction project performance by improving cost control, reducing delays, enhancing quality, and increasing stakeholder satisfaction. Organizations that adopt proactive risk management practices are better able to manage uncertainties and complete projects within the planned budget. Researchers therefore recommend integrating risk management into every stage of the project lifecycle, from planning and design to execution and maintenance. The literature indicates that cost overruns in construction projects are strongly influenced by ineffective risk management practices. Factors such as poor planning, inaccurate cost estimation, design changes, financial instability, delays, and inadequate communication significantly contribute to increased project costs. Effective risk management processes including risk identification, assessment, mitigation, and continuous monitoring play a critical role in controlling uncertainties and improving project cost performance. Therefore, adopting systematic and proactive risk management strategies is essential for achieving successful and economically sustainable construction projects.

METHODOLOGY

Adopted for the study titled “A Study on Risk Management and Its Impact on Cost Overruns in Construction Projects” involves both qualitative and quantitative research approaches to systematically identify, analyze, and evaluate the risks that contribute to cost overruns in construction projects. Initially, an extensive review of published journals, books, conference papers, government reports, and previous research studies related to construction risk management, project cost control, and causes of cost overruns was carried out to establish the theoretical background and identify major risk factors affecting construction projects. Based on the literature review, various categories of risks such as financial risks, technical risks,

managerial risks, contractual risks, environmental risks, labor-related risks, material price fluctuations, equipment failures, design changes, delays in approvals, and unforeseen site conditions were identified. After identifying the factors, a structured questionnaire survey was prepared and distributed among construction professionals including project managers, site engineers, contractors, consultants, architects, quantity surveyors, and clients working in different construction organizations. The questionnaire was designed using a Likert scale method to measure the probability, severity, and impact of each risk factor on project cost overruns. Data collection was conducted through direct interviews, online forms, and field visits to ongoing and completed construction projects. The collected data were then analyzed using statistical tools and techniques such as Relative Importance Index (RII), Mean Score Analysis, Severity Index, Percentage Analysis, and ranking methods to determine the most critical risks responsible for increasing project costs. In addition, correlation analysis was used to examine the relationship between effective risk management practices and reduction in cost overruns. Case studies of selected construction projects were also examined to understand practical challenges in risk identification, risk assessment, risk mitigation, and monitoring processes. The study further evaluated existing risk management strategies adopted by construction firms, such as contingency planning, proper scheduling, budget monitoring, quality control measures, safety management practices, and stakeholder communication systems. Finally, the results obtained from the analysis were interpreted to provide recommendations for improving risk management practices in construction projects, minimizing uncertainties, controlling unnecessary expenditures, and enhancing project performance in terms of cost efficiency, timely completion, and overall project success.

RESULT AND DISCUSSION

The study on risk management and its impact on cost overruns in construction projects revealed that ineffective risk identification, poor planning, and inadequate monitoring are the major causes of budget escalation in construction activities. Data collected from construction professionals, project managers, contractors, and site engineers indicated that most projects experience cost overruns due to uncertainties related to finance, labor, materials, equipment, and external environmental conditions.

The analysis showed that financial risks were one of the most significant contributors to cost overruns. Fluctuation in material prices, delayed payments from clients, inflation, and shortage of funds directly affected project budgets and schedules. Respondents indicated that sudden increases in the prices of cement, steel, and fuel created major financial pressure on

contractors, leading to additional expenses and delays in project completion. Labor-related risks such as shortage of skilled workers, low productivity, labor disputes, and absenteeism also increased project costs because they affected work efficiency and extended project duration.

The study further identified that poor project planning and inaccurate cost estimation significantly contribute to overruns. Many projects begin without detailed risk assessment or proper feasibility studies. Inadequate site investigation, incomplete drawings, and frequent design changes during execution resulted in rework, wastage of materials, and increased labor costs. Improper scheduling and weak coordination among stakeholders were also found to reduce project performance and increase financial losses.

External risks such as adverse weather conditions, government policy changes, legal issues, and delays in obtaining approvals were also observed to affect project costs. These risks are difficult to predict and often create interruptions in construction activities. The findings indicate that projects lacking contingency planning are more vulnerable to such uncertainties. The study demonstrated that effective risk management practices can significantly reduce cost overruns in construction projects. Projects that adopted systematic risk identification, risk analysis, mitigation planning, and continuous monitoring showed better cost performance compared to projects with weak risk management systems. Techniques such as regular project review meetings, contingency budgeting, safety management, and use of modern project management tools helped organizations control unexpected expenses and improve overall efficiency.

Quantitative data analysis

Quantitative data analytics is the process of transforming numerical data into meaningful, evidence-based insights through the use of mathematics, statistics, and computational methods. Unlike decision-making based on intuition or personal judgment, quantitative analytics relies on measurable and verifiable data to support accurate conclusions and informed decisions. It focuses on analyzing data that can be counted or measured, such as sales revenue, production output, temperature readings, examination scores, customer visits, or website traffic. The primary objective is to identify patterns, relationships, and trends within the data that can help organizations improve performance and plan future actions.

One of the major foundations of quantitative analytics is statistics. Statistical methods are used to organize, summarize, and interpret large volumes of data. Descriptive statistics, such

as mean, median, percentage, and standard deviation, help present data in a simpler form, while inferential statistics enable analysts to draw conclusions and make predictions about future outcomes. For example, a company can study previous years' sales data to forecast future demand and prepare production schedules accordingly.

Another essential component is mathematical modeling. Mathematical models use formulas, equations, and algorithms to represent real-world situations and relationships between variables. These models help organizations understand how different factors influence outcomes. For instance, a business may create a model to study how product pricing affects customer demand or how advertising expenditure impacts sales growth. Such models allow analysts to test different scenarios and make strategic decisions based on data-driven evidence.

Table 1 Role in Construction Industry.

Role in Construction Industry	Number of Responses	Percentage
Project Manager	23	41.82
Engineer	12	21.82
Consultant	6	10.91
Risk Management Specialist	8	14.55
Others	6	10.91
Total	55	100

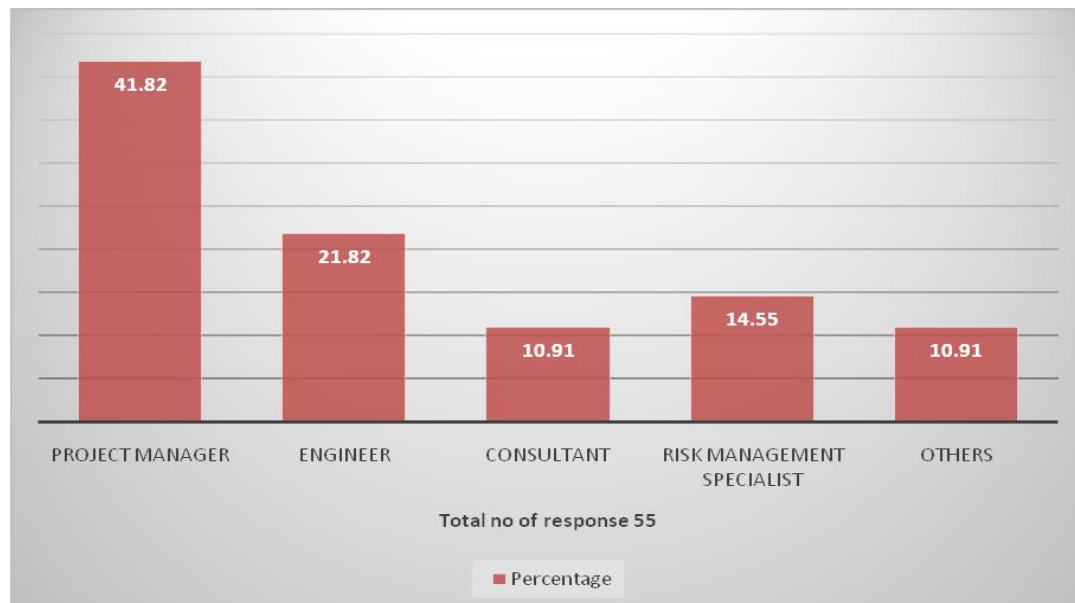


Figure 1 Role in Construction Industry.

The findings of this study clearly indicate that inadequate planning and management of contingency funds remain a significant challenge in large construction projects. Many construction companies fail to accurately assess potential risks or allocate sufficient financial reserves to address unforeseen circumstances. As a result, projects often experience cost overruns and schedule delays. When unexpected events occur, the overall project cost increases, making it difficult to adhere to the planned budget and timeline. Therefore, effective contingency fund planning and risk management are essential for improving project performance and ensuring successful project completion.

Practical Case Study

A practical case study was conducted to analyze the impact of risk factors on cost overruns and project delays in construction projects. Two completed projects were examined to evaluate the relationship between project planning, risk management practices, and overall project performance. The first case involved a commercial building project with an initial estimated cost of ₹100 crore, which increased to ₹120 crore, resulting in a 20% cost overrun and a delay of 3 months. The major causes identified were material price escalation and design changes during execution. The second case involved an infrastructure project with an initial cost of ₹1100 crore that increased to ₹1276 crore, leading to a 16% cost overrun and a delay of 5 months. The key risk factors included material price escalation, scope changes, and delayed approvals.

The analysis of both cases indicates that inadequate risk assessment, changes in project scope, delayed decision-making, and market fluctuations significantly influence project cost and schedule performance. The findings emphasize the importance of effective risk management, early planning, contingency allocation, and strong project control mechanisms to minimize cost overruns and improve project outcomes.

Table 2 Practical Case Study Summary of our project.

Case	Project Type	Initial Cost	Final Cost	Cost Overrun %	Delay	Key Risk Factor	Lesson Learned
Case 1	Commercial Building	₹100 Cr	₹120 Cr	20%	3 Months	Material Price Escalation & Design Changes	Early design finalization, effective change-control procedures, and contingency

							budgeting are essential to minimize the impact of scope modifications and material price fluctuations.
Case 2	Infrastructure Project	₹1100 Cr	₹1276 Cr	16%	5 Months	Material Price Escalation, change of scope & Delayed approvals	Comprehensive risk planning, timely regulatory approvals, and the inclusion of price-escalation clauses in contracts are critical for controlling project costs and schedule overruns.

CONCLUSION

This study concludes that risk management plays a critical role in controlling cost overruns and improving overall performance in construction projects. The findings indicate that ineffective risk identification, poor project planning, inaccurate cost estimation, and inadequate monitoring are among the major factors responsible for budget escalation and schedule delays. Construction projects frequently face uncertainties related to finance, labor availability, material price fluctuations, equipment performance, and external environmental conditions, which directly influence project cost and completion time.

The quantitative analysis revealed that financial risks are the most influential contributors to cost overruns. Factors such as inflation, delayed payments, shortage of funds, and unexpected increases in the prices of construction materials significantly affect project budgets. Labor-related issues including shortage of skilled workers, low productivity, and absenteeism were also found to increase project duration and operational costs. In addition, weak coordination among stakeholders, incomplete planning, design modifications, and inadequate site investigations contribute to rework and unnecessary expenditure.

The practical case study further confirmed that projects with insufficient contingency planning and ineffective risk control mechanisms experience higher cost overruns and project

delays. The commercial building project recorded a 20% cost overrun, while the infrastructure project showed a 16% increase in project cost, mainly due to material price escalation, scope changes, and delayed approvals. These cases demonstrate that unmanaged risks have a direct impact on project success.

The study highlights that adopting structured risk management practices including early risk identification, detailed planning, contingency budgeting, continuous monitoring, stakeholder coordination, and effective change management—can significantly reduce cost overruns and improve project delivery. Construction organizations should integrate risk management into every phase of the project lifecycle to achieve better cost control, timely completion, and sustainable project outcomes.

The study also indicates that if companies adopt advanced risk analysis techniques such as the Profitability Impact Matrix, Risk Breakdown Structure (RBS), and Monte Carlo Simulation, risks can be assessed more effectively. These tools assist project managers in forecasting the severity of risks and their potential impact on project cost and schedule. As a result, it becomes easier to prioritize risks, allocate resources appropriately, and develop effective mitigation strategies. This enables project managers to take a proactive approach by preparing for potential challenges in advance rather than merely reacting to problems after they occur.

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