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# An Assessment of Budget Overruns in Road Infrastructure Projects: A Case Study of Roads in Ndola

Dr. Chimbomba Kelvin[1]; Dr. Lyon Sakala Chipandwe[2]

[1,2]School of Humanities and Social Sciences Information and Communication University

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Advisor: Dr. Chimbomba Kelvin

By
Dr. Lyon Sakala Chipandwe
School of Humanities and Social Sciences
Information and Communications University

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Approved by
Lusaka, Zambia
Novermber 18, 2024.

(Signed)
Name of Academic Advisor
Major Advisor

November 11, 2024.

Approved by
Dr. Lyon Sakala Chipandwe

(Signed)
Chairman of the Committee
Name of Academic advisor
School of Humanities and Social Sciences

(Signed)
Committee Member

(Signed)
Committee Member

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# DEDICATION

I would like to offer this study as a dedication to my family and friends. Their constant love, support, and motivation have been the driving force behind my academic pursuits. Their guidance and sacrifices have played a pivotal role in shaping the person I have become, and I will forever appreciate their presence in my life. This achievement stands as evidence of their unwavering belief in my capabilities, and I aspire to honor them by applying the knowledge I have gained through this study.

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## ABSTRACT

**Project cost overruns in construction projects have significant and far-reaching effects, impacting financial performance, project timelines, and stakeholder relationships. Financially, cost overruns can strain budgets, and lead to additional borrowing, thereby increasing the overall project cost. The rationale of this study was to analyze the causes, effects, and mitigation strategies of project cost overruns in road construction projects in Ndola, Zambia, with the aim of identifying key factors contributing to cost overruns. A cross-section survey was used in the study, enabling quatitative statistical analysis. Primary data was gathered using a structured questionnaire consisting of closed-ended questions. STATA and the Statistical Package for the Social Sciences (SPSS) version 26 was used for data entry and statistical analysis. Road projects in Ndola frequently face cost overruns, with 58% of survey participants reporting that these overruns occur "often" and 4% stating they happen "always." A Chi-Square analysis revealed a significant relationship between participants' educational background and the frequency of cost overruns, indicating that those with higher educational qualifications, such as Master's and PhD degrees, experience fewer overruns compared to those with a Bachelor's degree. The most common cost increases reported were in the 6-10% range, primarily driven by inflation (78%), poor project management (12%), and labor costs (10%). Changes in project scope and contractor delays were also significant contributors. While time delays are less frequent, when they occur, they can lead to substantial increases in material costs, with 86% of respondents noting that extended project timelines often result in higher expenses. Additionally, changes in project design were highlighted as a critical factor in causing both cost and time overruns. The study recommends several key strategies to address the issue of cost overruns in road projects. First, there is a need to improve inflation mitigation strategies, as inflation was identified as the leading cause of cost overruns. This can be done by incorporating more accurate inflation forecasting and financial buffers into project budgets to account for rising material and labor costs. Additionally, strengthening project management practices, particularly in the areas of project planning, execution, and oversight, will be crucial in minimizing cost overruns and delays. Regular budget reviews are also necessary, as infrequent reviews were highlighted as a contributing factor to cost overruns. Risk assessment and monitoring should be prioritized by implementing continuous risk management frameworks to anticipate and mitigate potential cost overruns.**

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## LIST OF ABBREVIATIONS

DBSA: Development Bank of Southern Africa (DBSA)
NRA: National Roads Authority (NRA)
PAC: Parliamentary Accounts Committee (PAC)
RII: Relative Importance Index (RII)
RDA: Road Development Agency (RDA)
SADC: Southern African Development Community
SABDF: Southern African Business Development Forum (SABDF)

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# CHAPTER ONE
# INTRODUCTION

➢ *Overview*

The aim of this chapter is to cover the context within which the study was conducted. This chapter explains the background of the study, statement problem, purpose of the study, research objectives, research question, conceptual framework, significance of the study, scope of the study, operational definitions of the study.

➢ *Background*

Project cost overruns have been the subject of debate among academics and practitioners down the passage of time. These debates have cut across the entire project management spectrum encompassing industries and sectors globally. There has been disagreement on the definition of cost overruns as pointed out by Invernizzi, Locatelli and Brookes (2018). Some researchers view cost overruns as the difference between expected and actual construction costs (Jadhav, 2016); actual costs less estimated costs expressed as a percentage (Ansar, 2014); while others noted that cost overruns existed where the final cost of the project was greater than the 110% of the original estimate adjusted for inflation (Locatelli, 2017).

Examples of road construction projects and cost overruns are evident on the African continent. Gituro and Mwawasi (2016) sampled 10 road construction projects out of a total of 24 that had been successfully completed by Kenyan authorities. They identified increase in scope of work, delayed payments to contractors, poor cost control, foreign exchange fluctuations, poor or inadequate specifications in the contract and poor weather. A related study focused on rural road construction in Kenya found a mean cost overrun of between 5.31% and 24.92% (Moyi, 2018). The study further established that project scope and the nature of work had a positive relationship with cost overruns.

Tadewos and Patel (2018) stated that none of the road construction projects completed in Ethiopia from historical data and that there were no signs of improvement in the cost overruns characterising these projects. Tadewos and Patel reviewed 10 construction projects and determined that time and cost overruns ranged between 25%-264.38% and 4.11%-135.06% respectively. This study was limited in the sense that it was not empirical but rather secondary and used existing literature to ascribe reasons for the time and cost overruns. A study of another SADC region country, Namibia, utilised both historical and empirical data to draw comparisons in cost and time overruns and ultimately listed overarching factors that provided a balanced view of the phenomenon (Shimete and Wall, 2017). Shimete and Wall streamlined their list of time and cost overruns to ten and these included increase in quantities due to increase in scope of work, poor site management and supervision, contractor cash flow and financial difficulties, inadequate or poor estimates, Material cost increase on the other hand was noted to be single contributor to construction cost overruns prior to the 2010 world cup in South Africa (Baloyi and Bekker, 2011). Ndlovu (2020) provided poignant findings in a study of road construction projects in the Free State in South Africa. Ndlovu found that the average cost overrun was 24.48% and 10 factors accounted for the cost overruns and all were similar to previous studies with the exception of labour unrest, corruption, under-pricing of the work due to misrepresentation and overconfidence of contractors.

The Zambian context of cost overruns in road construction projects were investigated by Kaliba, Mumba and Muya (2009), Muya, Kaliba and Sichombo (2013), Mkuni (2016) and Sichone and Chibombo (2020). Sichone and Chibombo (2020) investigated the monitoring of risks in road construction projects in Lusaka. They determined that risk monitoring was ineffective due to lack of continuous supervision, inexperienced project staff, lack of communication, lack of stakeholder engagement, poor reporting, lack of adopting and implementing best practices and use of ad hoc approaches to risk monitoring. This may account for the continued rise in road construction cost overruns in Zambia.

Mkuni (2016) focused on road construction project planning which by then had not received significant attention. In the study, Mkuni identified constraints in the manner in which projects were planned. These included poor project prioritisation, uncoordinated contract procurement, political interference, procuring contracts before confirmation of funds, non-adherence to strategic plans and Government bureaucracy among others. On the other hand, Muya et al (2013) confirmed the prevalence of cost overruns in Zambia. Further, they identified insufficient initial cost analysis and change orders as being the major contributors of cost overruns.

➢ *Statement of the Problem*

Despite extant studies on cost overruns and subsequent mitigation strategies, the problem of project cost overruns continues to persist across the world. Studies on road construction cost overruns have been largely based on secondary data (Andric et al, 2018; Herrera et al, 2020), others have focused on time and cost overruns (Gituro and Mwawasi, 2017; Shimete and Wall, 2017). The problem of road cost overruns in Zambia is not a new problem. An audit of the Road Development Agency (RDA) for the period 2006-2009, revealed that the agency went over its budget by more than K1 billion (Parliamentary Accounts Committee (PAC) Report, 2009). The PAC report further stated that the RDA delayed in disbursing funds to contractors and underfunded road projects which ultimately led to cost overruns. Interestingly, the same report identified factors that led to cost overruns in road projects. These included lack of drawings and condition surveys, lack of consideration of engineers' estimates, lack of negotiation meetings and late engagement of consultants and their supervision among others (PAC report, 2009).

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- *General Objectives*
  To assess the contributors of road cost overruns in Ndola, Zambia.

- *Specific Objectives*

✓ To evaluate the cost overruns of road projects in Ndola.
✓ To examine the relationship between time delay and cost overruns.
✓ To evaluate construction manager experience with cost overruns.
✓ To develop a management strategy for checking road cost overruns.

➢ *Research Questions*

- What is the average cost overrun of projects in Ndola?
- What is the relationship between time delay and cost overruns?
- Does construction manager experience affect cost overruns?
- What management strategy will be best suited for controlling road cost overruns?

➢ *Theoretical Framework*

Prospect theory, developed by Daniel Kahneman and Amos Tversky, is a behavioral economics theory that describes how people make decisions between alternatives that involve risk and uncertainty (Heutel, 2019). Unlike traditional economic theories, which assume that individuals act rationally, prospect theory posits that people value gains and losses differently, leading to irrational decision-making. Key elements of prospect theory include loss aversion, reference dependence, and probability weighting. Prospect theory, devbeloped by Daniel Kahneman and Amos Tversky, is pivotal in understanding how individuals make decisions under conditions of risk and uncertainty (Ruggeri, 2020). One of its key elements, loss aversion, asserts that people have a stronger preference for avoiding losses than for acquiring equivalent gains. This principle highlights that the psychological impact of a loss is significantly more potent than that of an equivalent gain. Essentially, the discomfort or pain associated with losing a certain amount of money is greater than the joy or satisfaction of gaining the same amount (Mrkva, 2020).

In the context of road construction projects in Ndola, Zambia, the concept of loss aversion is particularly relevant. Project managers and stakeholders in these projects often prioritize avoiding cost overruns, which are perceived as losses, over maximizing cost savings, which are perceived as gains (Sanane, 2020). This inclination can profoundly influence their risk management strategies and decision-making processes. A project manager may prefer to allocate additional resources to mitigate the risk of a potential cost overrun rather than invest in opportunities that might lead to cost savings but also carry some risk. This behavior stems from the desire to avoid the negative consequences associated with exceeding the budget, such as potential penalties, damage to reputation, or loss of future business opportunities.

Loss aversion can lead to conservative decision-making. Managers might opt for safer, more predictable options even if they are not the most cost-effective. A project manager might choose a well-known contractor with higher rates over a less expensive but less familiar one to minimize the risk of project delays or quality issues that could result in cost overruns. This conservative approach, while reducing the immediate risk of losses, can sometimes lead to missed opportunities for innovation and cost savings (Etemad, 2020). Furthermore, the fear of losses can impact the way project managers respond to unforeseen events or challenges during the project. If unexpected issues arise, managers who are heavily influenced by loss aversion might opt for quick, short-term fixes that minimize immediate costs, rather than investing in more sustainable, long-term solutions that could ultimately be more cost-effective. This approach can lead to a cycle of escalating costs and reactive decision-making, where the focus remains on avoiding losses rather than strategically managing the project's overall budget.

Additionally, loss aversion can affect stakeholder communication and expectation management. Project managers might underreport potential cost overruns or downplay risks to avoid negative reactions from stakeholders (Rivadeneira, 2019). This lack of transparency can result in a lack of trust and can hinder collaborative problem-solving efforts. When stakeholders are not fully informed about potential risks and challenges, they are less able to contribute to finding effective solutions, which can ultimately lead to greater cost overruns. Reference dependence is another critical element of prospect theory, which explains how decisions are made based on potential gains or losses relative to a specific reference point, rather than absolute outcomes (Bhatia, 2019). In this context, individuals evaluate the value of outcomes based on how they compare to this reference point, which serves as a benchmark for what is perceived as a gain or a loss. This contrasts with traditional economic theories that assume decisions are made based on final asset values or outcomes, independent of the initial starting point.

In construction projects, especially those like road construction projects in Ndola, Zambia, the initial budget estimate typically serves as this crucial reference point. This budget is set during the planning phase of the project and forms the baseline against which all subsequent costs are measured. When actual project costs exceed this initial estimate, stakeholders perceive this excess as a loss. This perception of loss can have significant implications for the behavior and decisions of those managing the project. This pressure can lead to riskier decisions, as the primary focus shifts to minimizing the perceived losses rather than optimizing overall

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project outcomes (Virine, 2019). One common reaction might be cutting costs in areas that can have long-term detrimental effects, such as reducing spending on quality control or maintenance. While these measures might temporarily reduce costs and bring the project closer to the budget, they can lead to higher costs down the line due to poor construction quality and increased maintenance needs.

Moreover, the fixation on the initial budget as a reference point can result in a phenomenon known as "escalation of commitment." This occurs when stakeholders continue to invest in a failing course of action due to the substantial resources already committed, rather than reevaluating the project's feasibility with a fresh perspective. In road construction projects, this might mean continuing to fund and push forward with an over-budget project in hopes of eventually aligning costs with the initial estimates, rather than considering alternative solutions or re-scoping the project (FitzGerald, 2020). The emphasis on the initial budget as a reference point can also affect stakeholder communication and expectations. Project managers might underreport cost overruns or delays to avoid the negative perception associated with failing to meet the original budget. This lack of transparency can hinder effective decision-making and collaboration among stakeholders, as important information is withheld (Mattsson, 2019). When stakeholders are not fully aware of the project's financial status, they cannot contribute effectively to finding viable solutions to manage costs.

Furthermore, reference dependence can influence how project managers prioritize tasks and allocate resources. The pressure to stay within the initial budget might lead them to prioritize short-term cost savings over long-term project benefits. They might choose cheaper materials that meet immediate budget constraints but are less durable, leading to higher long-term maintenance costs and potentially compromising the project's overall success. Probability weighting is another fundamental concept within prospect theory, highlighting how people tend to misjudge the likelihood of events (Tsiga, 2019). Specifically, individuals often overestimate the probability of rare, extreme events while underestimating the likelihood of more common, moderate ones. This cognitive bias leads to skewed perceptions and, consequently, can significantly impact decision-making processes, particularly in fields that involve risk and uncertainty, such as construction project management.

In the context of road construction projects in Ndola, Zambia, this bias can manifest in various ways. Project managers, influenced by the tendency to overestimate the probability of rare but catastrophic events, might allocate resources disproportionately to mitigate these perceived risks. Severe weather conditions such as floods or heavy storms, although infrequent, might be seen as highly probable. Consequently, managers may invest heavily in preventive measures like enhanced drainage systems or reinforced structures to safeguard against these extreme events. While such precautions are undoubtedly important, an overemphasis on rare events can lead to an inefficient allocation of resources. This disproportionate resource allocation can divert funds away from addressing more probable, moderate risks that may have a higher cumulative impact on the project's overall success. These moderate risks, if not adequately addressed, can lead to incremental delays and cost increases that cumulatively result in significant project overruns.

Moreover, the skewed perception induced by probability weighting can affect the development of contingency plans. Project managers might design extensive contingency plans for rare catastrophic events, which, while providing a sense of security, can lead to complacency regarding more likely moderate risks. This can result in a lack of preparedness for dealing with issues that are more likely to occur and can disrupt the project flow. Additionally, the influence of probability weighting can extend to stakeholder communication and decision-making processes (De Wit, 2021). Project managers might emphasize the importance of rare events in their reports and meetings, creating a sense of urgency and justifying the allocation of resources to mitigate these perceived threats. This focus can skew the stakeholders' understanding of project risks, leading them to support disproportionate spending on low-probability events while neglecting more likely issues that could have been managed more efficiently with proper planning and resource allocation. The financial implications of probability weighting are also significant. Overestimating rare events can lead to budget overruns due to the high cost of unnecessary preventive measures. These costs, compounded by the underestimation of moderate risks, can create a scenario where the project exceeds its budget without effectively mitigating the most likely risks. This not only affects the project's financial viability but also its overall success and timely completion.

- *Significance of the Study*

There is a paucity of literature on road cost overruns in Ndola and yet a number of construction projects have been carried out over time. Some studies that have been carried out in Zambia on cost overruns have been either literature based; Lusaka based (Sichone and Chibombo, 2020); generally at a national level (Kaliba, Mumba and Muya, 2009; Muya, Kaliba and Sichombo, 2013). This study will unearth the contributors of road cost overruns in the road construction industry of Ndola and seek to assess the impact of road cost overruns with the view to develop a management strategy that will minimise such overruns. The researcher will operate on the strong assertion that factors that contribute to cost overruns in one area, may not be similar in other jurisdictions due to innate nuances that exist. The study will further make a contribution in terms of prescribing an appropriate strategy that can be used to minimise road cost overruns. The strategy will be shared with practitioners and academics on how best they can advise their clients in containing road cost overruns. The Government as a key stakeholder will benefit immensely from this study as the recommendations can be incorporated into their policies and procedures to ensure that cost overruns are checked from inception of the project.

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➢ *Scope of the Study*

The scope of this study focuses on analyzing project cost overruns in road construction projects, using Ndola, Zambia, as a case study. Geographically, the research will be confined to road construction projects within Ndola, selected due to its active road construction landscape and the availability of relevant data. The study will cover a range of projects, including those funded by the government and public-private partnerships, and will consider both completed and ongoing projects to provide a comprehensive analysis. Key variables analyzed will include inaccurate cost estimates, strategic misrepresentation, inflation, labor costs, risk management, monitoring and reporting, stakeholder engagement, and adaptive contracting.

➢ *Definition of Operational Terms*

Project Cost Overruns: The amount by which the actual expenditures exceed the planned budget in a construction project. It includes any unexpected costs incurred due to delays, additional work, changes in material costs, or unforeseen complications.

- *Construction Projects:*

Structured endeavors undertaken to build, renovate, or maintain physical structures. In this context, it specifically refers to the road construction projects in Ndola, Zambia.

- *Road Construction Projects:*

Construction projects specifically aimed at developing, improving, or maintaining roads. This includes activities such as paving, surfacing, grading, and drainage installation.

- *Ndola, Zambia:*

A city in Zambia's Copperbelt Province, serving as the case study location for this analysis. Ndola is a key industrial and commercial center in the region.

- *Budget Estimate:*

The initial financial plan that outlines the expected costs of the construction project. This estimate is used as a baseline for measuring cost overruns.

- *Risk Management:*

The process of identifying, assessing, and prioritizing risks, followed by coordinated efforts to minimize, monitor, and control the probability and/or impact of unfortunate events on the project.

- *Contingency Plans:*

Predefined strategies and actions designed to address potential risks and unforeseen events during the construction project, ensuring that these do not lead to significant cost overruns.

- *Resource Allocation:*

The process of assigning available resources, including labor, materials, and equipment, to various tasks and phases of the construction project to optimize efficiency and effectiveness.

- *Catastrophic Events:*

Rare but severe occurrences, such as natural disasters (e.g., floods, storms), that can significantly disrupt the construction project and lead to substantial cost overruns.

- *Moderate Risks:*

More common, less severe events that can affect the project, such as minor delays, equipment malfunctions, or labor shortages. These risks are often underestimated but can cumulatively impact project costs.

- *Escalation Of Commitment:*

A psychological phenomenon where stakeholders continue to invest in a failing project due to the significant resources already committed, rather than re-evaluating the project's feasibility.

- *Financial Viability:*

The ability of the project to be completed within the budget and deliver the expected economic benefits. It includes managing costs effectively to avoid overruns that could compromise the project's success.

- *Operational Efficiency:*

The capability of the project to maximize outputs while minimizing inputs, ensuring that resources are used optimally to achieve the project's goals without unnecessary expenditures.

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- *Strategic Decision-Making:*
  The process of making long-term decisions that align with the overall goals of the project and organization, considering both risks and opportunities to ensure successful project outcomes.

- *Performance Measurement:*
  The process of assessing the project's progress and success through various metrics, such as time, cost, quality, and scope, to identify areas for improvement and ensure alignment with the initial budget and objectives.

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# CHAPTER TWO
# LITERATURE REVIEW

- *Overview*

This chapter reviews literature to understand the current state of knowledge, identify critical gaps and points of disagreement in this field and how this current study can contribute to it.

- *Cost Overruns of Road Projects*

Cost overruns are a pervasive issue in road construction projects, often stemming from inaccurate cost estimates (Asiedu, 2020). These inaccuracies can manifest in several ways, primarily through initial underestimation and inflation, both of which have significant impacts on the overall project budget and timeline. During the early stages of a project, detailed information is often scarce. Initial cost estimates are typically based on preliminary designs and rough assessments. Without comprehensive data, it becomes challenging to account for all potential expenses accurately. This lack of detailed information can result in significant gaps between estimated and actual costs (Mahmud, 2021).

Another common reason for underestimation is the reliance on overly optimistic assumptions. Planners and estimators might assume best-case scenarios for various factors such as weather conditions, labor availability, and equipment efficiency. While optimism can be a motivating factor, it often leads to unrealistic cost projections. When these optimistic assumptions fail to materialize, the project can face substantial cost overruns (Fitzsimons, 2022). In some cases, there may be an intentional underestimation of costs to secure project approval. This phenomenon, known as "strategic misrepresentation," occurs when project proponents intentionally downplay costs and overstate benefits to make the project appear more attractive to decision-makers and stakeholders. This tactic can backfire once the project is underway, as the true costs become apparent, leading to budgetary shortfalls and the need for additional funding.

Inflation is another critical factor that can lead to cost overruns. The prices of construction materials such as steel, concrete, and asphalt can fluctuate significantly over time (Pandey, 2023). These fluctuations are often influenced by global market conditions, trade policies, and supply chain disruptions. Such unforeseen increases in material costs can derail budgets and necessitate reallocation of funds from other areas of the project. Similarly, labor costs are subject to inflationary pressures. Wage rates for construction workers can rise due to factors such as labor shortages, union negotiations, and changes in minimum wage laws. A project that was estimated based on current labor rates might find itself over budget if those rates increase significantly over the course of the project. Additionally, skilled labor shortages can force projects to hire more expensive contractors or offer higher wages to attract the necessary workforce, further inflating costs (Melaku, 2021).

Inflation can also have a compounded effect on projects with extended timelines. The longer a project takes to complete, the more susceptible it is to inflationary pressures. Over this extended period, inflation can progressively increase the costs of both materials and labor, exacerbating budget overruns. Inaccurate cost estimates, driven by initial underestimation and inflation, pose significant challenges to the successful completion of road projects (Melaku, 2021). Addressing these issues requires more accurate and detailed initial assessments, realistic assumptions, and contingency planning to accommodate potential cost increases. By improving estimation processes and accounting for inflationary pressures, project managers can better manage budgets and reduce the risk of cost overruns, ultimately ensuring that road projects are completed within their financial constraints and contribute effectively to infrastructure development.

Design changes are a significant factor contributing to cost overruns in road projects. These changes can stem from various causes, including scope creep and unforeseen conditions, both of which can lead to substantial increases in costs and delays in project timelines. Scope creep refers to the continuous or uncontrolled growth in a project's scope after the initial project requirements have been set (Ammar, 2022). This phenomenon often occurs due to evolving project needs, stakeholder demands, or changes in regulatory requirements. While some scope changes may be necessary to enhance the project's value or functionality, they typically result in increased costs and extended timelines. Effective scope management is crucial to mitigating the impact of scope creep. This involves setting clear project objectives, establishing a robust change control process, and maintaining constant communication with stakeholders. Project managers should ensure that any proposed changes undergo a thorough review to assess their impact on the project's budget and timeline before approval (Kerzner, 2022). Additionally, incorporating contingency funds into the budget can help absorb the financial impact of necessary scope changes without causing significant overruns.

Unforeseen conditions refer to unexpected site-specific factors encountered during construction that were not identified during the planning and design phases. These conditions can include geological issues, hidden utility lines, archaeological finds, or contaminated soils. When such conditions arise, they often necessitate design modifications and additional work, leading to increased costs and delays (Habtemariam, 2022). These conditions may require the use of specialized construction techniques or additional materials, such as retaining walls, pilings, or drainage systems, which were not accounted for in the original design and budget. Hidden utility lines, such as gas, water, or electrical lines, can also pose significant challenges. If these lines are not accurately mapped or documented, their discovery during excavation can require rerouting or additional protective measures, both

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of which can be costly and time-consuming. Archaeological discoveries are another potential source of unforeseen conditions (Kerzner, 2022).

To mitigate the impact of unforeseen conditions, thorough site investigations and risk assessments should be conducted during the planning phase. Techniques such as geotechnical surveys, ground-penetrating radar, and utility locating services can help identify potential issues before construction begins (Habtemariam, 2022). Additionally, maintaining flexibility in the project design and schedule can accommodate necessary adjustments without causing significant disruptions. Implementing a risk management plan that includes contingency funds for unforeseen conditions is also essential. These funds can provide a financial buffer to address unexpected issues without severely impacting the overall project budget. Regular monitoring and adaptive project management practices can further ensure that any unforeseen conditions are promptly identified and addressed. Poor project management is a critical issue that can severely undermine the success of any project, particularly in complex and dynamic environments. One of the most significant aspects of poor project management is scheduling issues. Inadequate planning and scheduling can lead to inefficiencies and delays, which in turn can escalate costs and extend timelines. Effective scheduling is crucial because it ensures that all project activities are logically sequenced and appropriately timed. Without a well-structured schedule, tasks may overlap incorrectly, resources may be over or under-allocated, and critical milestones may be missed. This can result in a cascading effect where one delay impacts subsequent tasks, creating a bottleneck that is difficult to resolve. Moreover, poor scheduling often leads to rushed work towards the end of a project, increasing the likelihood of errors and reducing overall quality (Kerzner, 2022).

Another major factor contributing to poor project management is the lack of coordination among stakeholders, contractors, and subcontractors. Effective communication and coordination are essential for ensuring that everyone involved in the project is aligned with the project goals, timelines, and expectations. When communication channels are not clear or efficient, misunderstandings and misinterpretations can occur (Kerzner, 2022). This can lead to mistakes and rework, which are both costly and time-consuming. For instance, if a subcontractor is not informed about a change in the project scope or schedule, they may proceed based on outdated information, resulting in work that needs to be redone. This not only wastes resources but also damages the morale and trust of the project team. In the context of scheduling issues, poor project management can manifest in several ways. One common issue is the lack of a comprehensive project timeline that considers all phases of the project, from initiation to completion. This often happens when project managers do not adequately consult with all relevant parties during the planning stage, leading to unrealistic deadlines and overlooked dependencies. Additionally, poor scheduling can result from inadequate risk management. Projects are inherently uncertain, and without a robust plan to identify and mitigate potential risks, unexpected events can derail the project timeline (Mwawasi, 2015). This is compounded by the failure to allocate buffer time for unforeseen delays, which can cause minor setbacks to become major disruptions.

The lack of coordination, on the other hand, often stems from insufficient stakeholder engagement. Stakeholders, including clients, team members, and external partners, need to be kept informed and involved throughout the project lifecycle. Poor project management may result in stakeholders receiving inadequate or untimely updates, leading to misaligned expectations and priorities (Okate, 2019). Furthermore, ineffective coordination can be exacerbated by the absence of a centralized communication system. When information is scattered across different platforms or communicated informally, it increases the risk of critical details being missed or misunderstood.

Market conditions play a pivotal role in shaping the financial landscape of construction and development projects. Two of the most significant factors influenced by market conditions are material costs and labor costs (Samarghandi, 2016). Fluctuations in the prices of raw materials, such as steel, concrete, and asphalt, can profoundly impact the overall project cost. These materials are fundamental to most construction projects, and their prices are subject to market dynamics driven by supply and demand, geopolitical factors, and economic conditions. Conversely, disruptions in supply chains, such as those caused by political instability or natural disasters, can lead to scarcity and further drive up prices. These fluctuations can significantly alter the projected costs of a project, leading to budget overruns and necessitating revisions to financial plans (Mattsson, 2019).

In addition to material costs, labor costs are another critical element influenced by market conditions. Variations in labor costs can arise from shifts in market demand, labor disputes, and changes in labor regulations. In periods of high demand for skilled labor, such as during economic booms or in regions experiencing rapid growth, wages tend to increase. This can be particularly pronounced in specialized fields where skilled workers are scarce (Idrees, 2021). Consequently, projects may face higher-than-anticipated labor expenses, which can strain budgets and potentially delay timelines if adjustments are not made promptly. Labor disputes, such as strikes or negotiations for better wages and working conditions, can also disrupt project schedules and escalate costs. These disputes can lead to work stoppages or slowdowns, causing delays that not only affect direct labor costs but also have a ripple effect on other project expenses, such as equipment rental and administrative overheads (Shehu, 2014).

Moreover, market conditions can influence the availability and productivity of labor. During economic downturns, while labor costs might decrease due to lower demand, the availability of skilled workers may also diminish as individuals leave the industry or relocate to areas with better employment prospects. This can result in a talent gap that impacts the quality and efficiency of the work performed. Furthermore, regulatory changes, such as new labor laws or changes in immigration policies, can affect labor costs and availability. For example, stricter immigration policies can reduce the pool of available workers, particularly in industries that rely

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heavily on immigrant labor, thereby driving up wages and impacting project budgets (Larsen, 2016). The interplay between material and labor costs under varying market conditions necessitates robust risk management and contingency planning. Project managers and financial planners must continuously monitor market trends and be prepared to adjust their strategies accordingly. This might involve locking in prices for key materials through forward contracts to hedge against price volatility or maintaining flexible labor agreements that can adapt to changing market conditions. Additionally, adopting advanced project management software and techniques can help in better forecasting and managing these costs, allowing for more accurate budgeting and financial planning (Shehu, 2014).

Contractual issues are a significant source of challenges in project management, often leading to delays, additional costs, and strained relationships between stakeholders. One of the most prevalent problems is the occurrence of claims and disputes. Disputes can arise over various aspects of a contract, including the interpretation of contract terms, the scope of work, or performance standards (Larsen, 2016). When parties have different understandings of their contractual obligations, it can lead to disagreements that stall progress. For instance, if a contractor believes that a particular task was outside the agreed-upon scope, they might refuse to complete it without additional compensation. Conversely, the client might insist that the task was included in the original agreement, leading to a standoff. These disputes often require mediation, arbitration, or even litigation to resolve, all of which consume time and resources. During this period, work on the project may be halted or slowed, causing delays that ripple through the project timeline and increase costs (Lukale, 2018).

Another critical aspect of contractual issues is the structuring of incentives and penalties. Contracts often include clauses that offer incentives for early completion or high-quality work, as well as penalties for delays or substandard performance. While these clauses are intended to align the contractor's priorities with the project's goals, they can sometimes have unintended consequences. Ineffectively structured incentives and penalties can lead to misaligned priorities and cost overruns. For example, if the incentives for early completion are too high, contractors might rush the work, compromising quality and safety (Melaku, 2021). This can result in additional costs for repairs, rework, and potential liability issues. On the other hand, if penalties for delays are too severe, contractors might adopt overly cautious approaches, inflating their bids to cover potential risks, which increases the overall project cost. Furthermore, if penalties are not enforceable or sufficiently deterring, contractors might not prioritize timely completion, leading to delays.

The complexity of contracts can also contribute to these issues. Construction and development projects often involve multifaceted agreements with numerous stakeholders, including owners, contractors, subcontractors, suppliers, and consultants. Each party has its own set of interests and priorities, which must be carefully balanced in the contract (Mydin, 2014). Misunderstandings or ambiguities in these agreements can easily lead to conflicts. Additionally, changes in project scope or unforeseen conditions can necessitate contract modifications, which, if not managed properly, can become sources of contention. Change orders, for example, can be contentious if parties disagree on their necessity, scope, or cost.

To mitigate these contractual issues, it is essential to have clear, comprehensive, and well-drafted contracts that detail the scope of work, performance standards, and dispute resolution mechanisms. Effective communication and collaboration among all stakeholders during the contract negotiation phase can help align expectations and minimize misunderstandings (Pandey, 2023). It is also crucial to regularly review and update contracts to reflect any changes in project scope or conditions. Implementing robust contract management systems can facilitate this process, ensuring that all parties are aware of their obligations and any amendments to the contract. Additionally, involving legal and project management professionals in contract drafting and review can help identify and address potential issues before they escalate into disputes (Raykar, 2016).

External factors significantly influence the success and efficiency of construction and development projects. Among these, weather conditions and political and economic factors are particularly impactful. Adverse weather can cause considerable delays and damage, necessitating additional work and increasing costs (Rivadeneira, 2019). These interruptions not only extend project timelines but also incur additional costs for labor, equipment idle time, and site maintenance. Furthermore, severe weather events like hurricanes, floods, or storms can cause physical damage to ongoing projects, leading to repair costs and potential redesigns. Even minor weather-related delays can disrupt the carefully planned schedules of construction projects, causing a ripple effect that impacts subsequent tasks and milestones (Ruggeri, 2020). The unpredictability of weather makes it a critical factor that project managers must continuously monitor and plan for, often necessitating the inclusion of contingency buffers in project timelines and budgets.

Political and economic factors also play a crucial role in shaping the landscape of construction and development projects. Changes in government policies, economic instability, or fluctuations in funding availability can significantly impact project costs and feasibility (Sanane, 2020). Similarly, changes in tax policies or government incentives can alter the financial viability of projects. Economic instability, such as inflation, currency fluctuations, or recession, can affect the cost of materials and labor, as well as the availability of financing. Additionally, economic downturns can lead to tighter credit conditions, making it more challenging for developers to secure necessary funding. This can delay project initiation or cause interruptions if funding is withdrawn or reduced. Political factors, including changes in leadership, geopolitical tensions, and government stability, can also influence project outcomes. Geopolitical tensions can affect supply chains, leading to delays in the delivery of materials and equipment. Additionally,

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political instability or corruption can create an uncertain environment that deters investment and complicates project execution (Tsiga, 2019).

To mitigate the risks associated with these external factors, project managers need to adopt a proactive and flexible approach. For weather-related risks, this involves detailed planning and scheduling that accounts for seasonal variations and includes contingency plans for adverse conditions. This might include adjusting work schedules, implementing protective measures on-site, or having standby arrangements for alternate tasks that can be performed during weather disruptions. For political and economic factors, it is crucial to stay informed about relevant developments and engage in strategic planning that anticipates potential changes. This can involve diversifying supply sources to mitigate the impact of geopolitical tensions, incorporating flexible contract terms to address regulatory changes, and maintaining robust financial planning to handle economic fluctuations. Mitigation strategies are essential to ensure the successful execution of projects, especially in environments characterized by uncertainty and complexity (Virine, 2019). Implementing improved estimation techniques, developing comprehensive risk management plans, establishing regular monitoring and reporting systems, ensuring effective stakeholder engagement, and employing adaptive contracting are crucial steps to mitigate potential challenges and enhance project outcomes.

One of the primary strategies for mitigating risks and ensuring project success is the use of improved estimation techniques. Accurate and detailed estimation methods are critical for creating realistic budgets and timelines (Wanjari, 2016). By incorporating advanced tools and methodologies, such as parametric estimating, bottom-up estimating, and the use of historical data and benchmarks, project managers can produce more precise cost and time forecasts. These techniques allow for a detailed breakdown of project components, consideration of various cost factors, and adjustment for potential contingencies. Improved estimation not only helps in setting realistic expectations but also provides a solid foundation for resource allocation and financial planning, reducing the likelihood of budget overruns and schedule delays (Zulu, 2015).

Developing comprehensive risk management plans is another key strategy. A robust risk management plan involves identifying potential risks, assessing their impact and likelihood, and developing mitigation strategies to address them (Susanti, 2020). This proactive approach allows project managers to anticipate challenges and implement measures to minimize their effects. Risk management plans typically include contingency plans for various scenarios, ensuring that the project team is prepared to respond effectively to unexpected events. Regular risk assessments and updates to the risk management plan are essential to address emerging risks and changing project conditions, thereby enhancing resilience and adaptability (Tsiga, 2019).

Regular monitoring and reporting are crucial for tracking project progress and identifying issues early. Implementing robust project monitoring systems, such as project management software and performance dashboards, enables real-time tracking of key performance indicators (KPIs) and milestones. Regular progress reports and status meetings ensure that all stakeholders are informed about the project's current status, potential risks, and any deviations from the plan. Early detection of issues allows for timely corrective actions, preventing minor problems from escalating into major setbacks. Consistent monitoring and reporting also facilitate transparency and accountability, fostering a culture of continuous improvement (Sanane, 2020). Effective stakeholder engagement is vital for preventing misunderstandings and conflicts. Ensuring clear and open communication among all stakeholders, including clients, team members, contractors, and suppliers, is essential for aligning expectations and fostering collaboration. Regular stakeholder meetings, clear communication channels, and collaborative decision-making processes help in addressing concerns, resolving conflicts, and maintaining a shared vision for the project. Stakeholder engagement also involves actively involving stakeholders in planning and decision-making, ensuring that their needs and perspectives are considered, which enhances buy-in and support for the project (Susanti, 2020).

Adaptive contracting is a flexible approach to managing contracts that can accommodate changes and unforeseen circumstances without significant cost impacts. Traditional fixed-price contracts may not be suitable for projects with high uncertainty and potential for change. Adaptive contracting strategies, such as cost-plus contracts, time and materials contracts, and incentive-based contracts, provide the flexibility to adjust terms based on actual conditions and performance (Susanti, 2020). These contracts allow for adjustments in scope, time, and costs, ensuring that both parties can respond effectively to changes and maintain alignment with project objectives. Adaptive contracting also encourages collaboration and risk-sharing between the client and contractor, fostering a more cooperative and dynamic project environment.

Fyvbjerg, Holm and Buhl (2004) conducted the first statistically significant study on the causes of cost overruns in transport infrastructure projects. The study was based on a sample of 258 rail, bridge, tunnel and road projects totalling $90 billion. The study found that there was a statistically significant relationship between cost escalation and the length of the implementation phase. The study further found that the cost escalation for road projects was 20%. Developed countries have experienced project mishaps similar to those experienced by developing countries. Herrera, Sanchez, Castaneda and Porras (2020) closed the gap between road cost overruns factors and the frequency and importance with which they occur. Herrera et al found that there were five most frequent and important cost overrun factors, and these included failure in design, price variations in materials, inadequate project planning, project scope changes and design changes.

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Canales et al (2023) found that the major causes of cost overruns in road construction in the Colombia-carribean region were land purchase and permits, weather conditions, design and plans, execution errors, materials, financial and contract issues, utility services, machinery and equipment and geo-technical conditions. Canales et al (2023) found that the major causes of cost overruns in road construction in the Colombia-carribean region were land purchase and permits, weather conditions, design and plans, execution errors, materials, financial and contract issues, utility services, machinery and equipment and geo-technical conditions. Design and plans as a cost overrun factor was corroborated by Anastasopoulos, Haddock and Peeta (2014) in a study of 601 road construction contracts in the United States of America. Anastasopoulos, Haddock and Peeta affirmed that poor estimation of project costs at the planning stage contributed majorly to the subsequent cost overruns that ensued.

Andric et al (2019) studied cost overruns in Asian countries and concluded that railway projects had the highest cost overruns while road projects followed with a cost overrun of 10.75%. In Qatar, a study of public construction projects revealed that cost overruns increased when contract prices increased for building construction projects (Senouci et al, 2016). In other words, there was a positive relationship between contract prices and cost overruns. Senouci et al further concluded that projects completed at a later time frame (2007-2013), showed lower project cost overruns compared to those completed between 2000-2007. This may be an indicator of implementation of mitigation strategies that may have resulted in lower project cost overruns. India is one of the largest countries in the world by size and population. Project cost overruns are common in India and the following factors were identified as contributors of the phenomenon; design related, material related, site related, finance related, owner related, miscellaneous factors and contractor related (Rathi and Khandve, 2014). An investigation of road construction overruns in Pune, India by Lende and Rathod (2018) clarified that change in cost services, delay in payment and design changes during construction, change in quantity due to actual site conditions, delay in design and approval of design, delay in shifting existing utilities and poor communication between Government bodies. It is evident that the factors that account for road construction overruns are both pre-construction and construct phase factors.

There have been a number of studies on cost overruns in the construction industries of various countries. Andric, Mahamadu, Wang and Zou (2018) studied cost overruns in Asian countries; In India (Jain and Singh, 2012; Subramani, Sruthi and Kavitha, 2014; Tadewos and Patel, 2018; Rajan, Gopinath and Behera, 2014; Lende and Rathod, 2018); Pakistan (Sohu et al, 2019; Nasir, Gabriel and Choudhry, 2011; ); Africa (Anigbogu, Ahmad and Molwus, 2019; Belachew, Mengesha and Mohammed, 2017; Lukale, 2018; ); Americas (Bordut, McCullouch, Labi and Sinha, 2004;); Australia (Creedy, Skitmore and Wong, 2010;); Korea (Lee, 2008); Iran (Heravi and Mohammadian, 2017); These These studies focused on various aspects of project cost overruns and unearthed important findings that have broadened knowledge in the area. There are extant studies that linked project cost overruns to project delays while other investigations showed factors that cause project cost overruns and remedial strategies that can be adopted to curb the problem. Other studies were deterministic and correlational in that they tried to establish a relationship between cost overruns and time delays (Venkateswaran and Murugasan, 2017; Senouci, Ismail and Eldin, 2016). A consideration of studies and findings in cost overruns globally, in Africa and Zambia in particular are necessary to give a balanced view of the phenomenon.

Road construction is one of the most important and sensitive industries in a country and thus requires careful planning and organising in order to deliver a high quality project (Oad, Kajewski, Kumar and Xia, 2020). Herrera, Sanchez, Castaneda and Poras (2020) added that road infrastructure projects are essential for social and economic development. The construction industry of Zambia is said to have grown by 5.7% in the second quarter of 2023 (Central Statistics Office, 2023). Business Wire (2022) however reported that the construction industry of Zambia grew by 10.9% in 2021. The report further forecasted that the construction industry of Zambia would grow by an average of 2.7% per annum for the period 2023-2026. It was envisaged that 2000kms of roads in four provinces would be constructed, namely Copperbelt, North western, Western and Southern. The Southern African Business Development Forum (SABDF) would invest ZMK68.7 billion ($3.2 billion) for the project and included the construction of the Livingstone-Katima Mulilo Road, Kasempa-Kaoma Road, Luampa Junction-Machile-Simungoma Road, Tapo-Kalabo-Sikongo-Angola Border Road, Kankolonkolo-Lufwanyama-Kasempa Road and Sioma-Shangombo Road, including an 8.5km bridge across the Kwando River at Shangombo Boma. This was corroborated by the Development Bank of Souther Africa. DBSA (n.d.). DBSA added that the ambitious road development projects would lead to the following outcomes: promotion of Zambian contractors; job creation and poverty alleviation; increased Government tax revenue; private sector development enabler; linkage to regional corridors; reduction of environment and health risks; improvement of internal accessibility.

Cost overruns emanate from the excess of actual project costs over budgeted project costs (Canales et al, 2023; Belachew, Mengesha and Mohammed, 2017; Sohu et al, 2019). Others presented cost overruns as a percentage of excess actual costs over budgeted costs (Anigbogu, Ahmad and Molwus, 2019; Bordat, McCullouch, Labi and Sinha, 2004). A cost overrun on the other hand occurs where the actual costs are less than the budgeted costs and a project completed within budget shows that both actual and planned costs are even.

Andric et al (2019) carried out a study of Asian road construction projects and found that 56.68% of all road projects had cost overruns, 2% were completed on budget and 41.18% had cost underruns. Cost overruns in road construction in Korea were found to be 50% and 95% of all road projects had cost overruns (Lee, 2008). A study of literature on road cost overruns revealed that there are many factors that lead to the status quo and they vary depending on the context. The researcher noted that these factors can be grouped into at least two categories, that is, pre-contract implementation and contract implementation factors. These two categories

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are discussed below. It is worth noting that other researchers have argued that cost overruns and time delays are inseparable in that time delays lead to cost overruns (Nasir, Gabriel and Choudhry, 2021; Dlamini and Cumberlege, 2021; Asmitha, 2019).

Muhwenzi, Kirenzi and Bangi (2020) noted that there were 37 identified design flaws in literature which affect project costs. They identified in their study less number of drainage culverts, inadequate quarries and earthen materials investigations, inadequate geotechnical investigations for road subgrade, underestimation of quantities of rock fill and provision of less volumes of cut and fill. Further, Muhwenzi et al found that the effect of the major design flaws on cost overruns was measured at 33.3%.

Previous studies on the relationship between project size and cost overruns showed different than expected outcomes. One such study was done by Odeck (2004) in which it was found that smaller projects in Norway had more cost overruns than larger projects between 1992 and 1995. It would be expected that larger road projects with their complexities would result in more cost overruns than smaller projects. Odeck seems to have looked at project size as an independent entity that had no drivers. Park and Papadopoulou (2012) recognised that project size does not exist as an independent factor but is made up of other elements that influence its behaviour and this would ultimately affect cost overruns differently. The study by Park and Papadopoulou confirmed the findings that there was a relationship between project size and cost overrun. However, their findings revealed that awarding contracts to the lowest bidder significantly drove cost overruns upwards and this was considered a determinant of project size. It is apparent in literature that project size has a number of tentacles which include estimated duration, resource requirements, budget complexities, risk and visibility. The shifts in these elements would instigate changes in cost overruns in a road project.

The Indian construction industry is a crucial part of the country's economy and growth, serving as a major channel for development investments. It plays a vital role in building the country's infrastructure, which is essential for high levels of economic growth. However, most construction projects experience cost overruns, placing a significant financial burden on the client or owner. Subramani's 2014 research aimed to identify the causes of cost overruns in construction projects. The study utilized a combination of desk research and a questionnaire survey to identify these causes. A total of 30 completed questionnaires were collected from clients, consultants, and contractors. Respondents rated the listed causes based on their probability of occurrence and severity of impact. The importance of each cause was calculated based on the cumulative effect of occurrence and impact. Spearman rank-order correlation analysis was used to determine if there was a consensus of opinions among the groups of respondents (client versus consultant, client versus contractor, and consultant versus contractor). The analysis showed a consensus among respondents on the causes of cost overruns. The results indicated that slow decision-making, poor schedule management, rising material/machine prices, poor contract management, poor design/delay in providing design, rework due to incorrect work, land acquisition problems, incorrect estimation/estimation methods, and the long period between design and bidding/tendering were the major causes of cost overruns. These major causes were compared with findings from other countries, revealing fairly relevant similarities (Subramani, 2014).

Cost overruns are a common issue in the construction industry worldwide, and Jordan is no exception. The primary objective of this study was to identify the causes of cost overruns in construction projects in Jordan. The research included a comprehensive literature review from various sources and a questionnaire survey to pinpoint the causes related to clients, consultants, contractors, financial management, resources, and external factors. Over 100 respondents participated in the survey, which identified the 15 most significant causes of cost overruns from a list of 49 different factors. The most important causes included schedule delays (time overruns), frequent design changes, additional work requests by owners, design mistakes and errors, inadequate planning and scheduling, inflation and price fluctuations, changes in the scope of work by owners, incomplete drawings and detailed designs at the time of tender, a shortage of skilled site workers, and construction mistakes and defective works. Overall, the study revealed that all parties share responsibility for cost overruns in construction projects in Jordan (Bekr, 2015).

The success of any construction project is linked to its timely completion within the specified budget, with the right quality and environment. Cost overruns have been identified as a major issue in many construction industries of developing countries, with few projects being completed within the originally estimated cost. Ahady et al. (2017) provided an overview of the causes of cost overruns in many developing countries, noting that while not all factors are similar for every project, some common issues include poor management, fluctuating material prices, inaccurate material estimates, and the financial status of the contractor. The study highlighted that fluctuations and increases in material prices were the most significant problem leading to construction cost overruns in developing countries. Although not all factors are identical across projects, most common issues include poor management, inaccurate material estimates, and contractors' financial status. The study emphasizes the need for considerable attention to developing policies to reduce the impact of these identified factors on infrastructure development in developing countries. Managing cost overruns is crucial, and ignoring it will not address the issue. Cost overruns were observed to be a major setback in the construction industry. To control and mitigate cost overruns in building construction projects, material prices and labor rates should be continuously updated. The quality of activities must be constantly monitored by consultants and quality professionals to establish the required quality system and minimize or avoid mistakes that may lead to rework. Top management must respond positively to environmental and political changes through financial and managerial policies. Developing nations need to implement policies, rules, and regulations to curb cost overruns in construction projects (Ahady, 2017).

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Delay and cost overruns are common issues in construction projects worldwide, but they are particularly severe in developing countries. According to a MOSPI report, 235 out of 410 projects in India experienced significant cost overruns due to various factors. A short questionnaire listing 15 prominent factors responsible for cost overruns was distributed to 190 construction professionals across India, with 85 responses received. The data was analyzed using statistical tools such as ANOVA and factor analysis with SPSS. The study identified the top three factors affecting cost overruns as the price escalation of raw materials, delays in planned activities, and a lack of coordination between construction parties. Factor analysis grouped the factors into three components: client control, project management, and contractor control. These components are useful for the various parties involved in construction activities. The paper also provides suggestive frameworks developed after discussions with a large number of construction professionals and experts (Wanjari, 2016).

Cost performance is a crucial consideration for construction parties, and cost overruns are a recurring problem in the construction industry, adversely impacting project success in terms of time, cost, quality, and safety. This study aimed to investigate cost overruns in construction projects in Saudi Arabia to identify the causes and their significance according to contractors, using a questionnaire survey. The survey involved 43 contractors working on construction projects in the Northern Province of Saudi Arabia. Through a literature review, 34 causes of cost overruns were identified. The study concluded that the top causes of cost overruns in Saudi Arabian construction projects, from the contractors' perspective, are awarding bids to the lowest bidder, frequent design changes, improper planning, long periods between design and implementation, and payment delays (Alghonamy, 2015).

Cost is a fundamental component of any construction project, and cost overruns are a major phenomenon in the construction industry worldwide. Numerous factors contribute to cost overruns, prompting many studies to investigate them. The aim of El-Ahwa's 2016 study was to identify the most significant factors causing construction cost overruns in both developed and developing countries over the last three decades. Through a comprehensive literature review, the study listed the most common and frequently occurring causes of cost overruns globally and specifically in developing countries. These factors were prioritized based on their frequency of occurrence. Although cost overrun factors vary considerably across countries, studying these factors provides a reference for other projects executed under similar circumstances and offers valuable information for international companies planning to undertake construction projects (El-Ahwa, 2016).

Lukale (2018) conducted research to examine the nature and extent of cost overruns in rural roads infrastructure projects in Kenya, along with the factors contributing to these overruns. The study utilized a mixed-method explanatory design to provide a comprehensive understanding of the issue. Data analysis involved reviewing contract data from 68 projects to compute cost overruns based on initial contracted sums compared to actual costs and revised contract sums. A survey was also conducted using structured questionnaires with 100 respondents from the subsector, employing a five-point Likert scale to assess the significance of various determinants identified from literature. Multiple regression analysis was employed on the project data to identify predictors of cost overruns, while the Relative Importance Index (RII) and factor analysis were utilized on survey data to rank latent determinants contributing to cost overruns. The study found an average cost overrun of 5.31%, with a maximum of 24.92%. Factors such as project size and nature of work were significantly correlated with cost overruns. Financial management factors ranked highest in importance with an RII of 0.7373, whereas labor and equipment factors ranked lowest with an RII of 0.5839. Factor analysis identified 15 key factors from an initial set of 65 determinants, highlighting the complex interrelationships among these factors. The study recommended a collaborative approach among stakeholders to enhance project management practices and minimize time and cost overruns. It emphasized the need for improved contract management by implementing agencies and contractors, along with consultants reviewing their methodologies to reduce mid-stream design changes. It's important to note that the findings are based on the 68 reviewed projects, and the frequency and magnitude of cost overruns could change if ongoing projects currently without overruns experience them upon completion (Lukale, 2018).

Kimemia (2015) conducted a study focused on roads maintained or constructed by KeNHA in the Coast region of Kenya. The study aimed to achieve four primary objectives: assess the influence of construction project financing on project delays in the road sector, investigate the impact of construction project planning on project delays, examine how contractor experience affects project delays, and analyze the role of work supervision in project delays. Using a survey research design, the study gathered data from 55 respondents, including contractors, surveyors, engineers, and others. Questionnaires were distributed via email, collected in person, or administered by research assistants. Data collected were analyzed using SPSS, and results were presented using frequency tables. Hypothesis testing with Chi-Square tests indicated significant relationships between the variables explored in the study. Findings revealed that construction project financing significantly influences project delays, with only 5 respondents agreeing that road projects received adequate funding, while 45 disagreed and 7.4% were unsure. Based on these findings, the study recommended three main actions: first, increase budgetary allocation to KeNHA by the national government; second, enhance comprehensive and thorough planning processes at all levels within KeNHA to ensure timely project delivery; and third, rigorously assess contractors' experience and track records, implementing robust procedures for evaluating contractor capabilities (Kimemia, 2015).

Cost overruns in construction projects have long been a major concern for all project stakeholders. Numerous studies have been conducted over the years to understand the root causes of these overruns. However, empirical evidence remains unclear due to the fragmented approach typically used to examine these causes. Asiedu's study aims to advance the discussion by examining the causes of project cost overruns from a systems perspective, particularly in less-studied environments. Data was gathered and

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analyzed from 131 respondents involved in public procurement construction projects in Ghana. A two-stage data collection method was used. The first stage involved interviews with key informants in the Ghanaian construction industry to identify detailed causes of cost overruns. The second stage involved validating these factors with a broader group of stakeholders through questionnaires. Factor analysis was used to consolidate these detailed factors into major causes of cost overruns. The results indicate four primary causes of cost overruns in public sector construction projects: poor contract planning and supervision, change orders, weak institutional and economic project environments, and lack of effective coordination among contracting parties (Asiedu, 2020).

Fitzsimons (2022) investigated whether cognitive biases affect the accuracy and reliability of cost estimates and forecasts for road transport projects in Ireland. The study focuses on overconfidence, often referred to as optimism bias, which can lead to underestimating risks and other project costs. The research specifically examines construction cost forecasts for road transport projects managed by the National Roads Authority (NRA) in Ireland. A literature review on cost overruns and optimism bias revealed that project managers' overconfidence can be mitigated by using historical data from completed projects. The study analyzed both quantitative and qualitative data to determine if cost forecasts and budgets are exceeded upon project completion and to identify the causes of cost increases. A new detailed coding framework was developed to analyze and assess cost management issues and the factors causing additional or increased costs. Quantitative analysis did not find systematic evidence of cost overruns, and the risk contingencies applied were deemed appropriate for these projects. Most risks that materialized during construction were known and could be assessed statistically. The qualitative data provided insights into the actual delivery of projects and described the various reasons why costs can change throughout the lifecycle of a road transport project (Fitzsimons, 2022).

Many developing countries today face challenges in improving the cost and time performances of major infrastructure projects due to various factors. Cost overruns and delays are significant issues in the construction and infrastructure sector. Melaku, 2021 study aimed at exploring the extent of these issues in building and road infrastructure projects in Ethiopia. Primary data was collected through a structured questionnaire survey to assess the potential risks contributing to these challenges. Various data analysis tools were used to identify the critical causes of cost overruns and delays. The findings revealed that in building construction projects, the minimum cost overrun is 2%, with the maximum and average cost overruns at 248% and 35%, respectively. For road infrastructure projects, the minimum, maximum, and average cost overruns are 1%, 61%, and 18%, respectively. Similarly, building construction projects recorded minimum, maximum, and average delays of 9%, 802%, and 143%, respectively, while road infrastructure projects had delays of 3% (minimum), 312% (maximum), and 110% (average). The study identified the top risk factors leading to cost overruns as inflation, inaccurate cost estimates, and variations, while the major risks causing schedule delays were variations, economic conditions, and material price escalation. The study also provided practical implications and key recommendations to address cost overruns and delays in infrastructure projects (Melaku, 2021).

- *The Relationship Between Time Delay and Cost Overruns*

Time delays are a common issue in project management, often leading to extended project durations and subsequent cost overruns (Gómez, 2024). These delays can stem from various factors and have a compounding effect on project costs, making it crucial to understand their causes and implications. One primary cause of time delays leading to cost overruns is the extended duration of the project itself. When a project takes longer than anticipated, the prolonged use of resources becomes inevitable. This extended use of labor, equipment, and materials directly increases the overall project costs. For example, workers may need to be employed for longer periods, leading to higher labor costs, especially if overtime or extended contracts are necessary. Similarly, equipment that is rented or leased must be kept on-site for a longer time, accruing additional rental fees. Furthermore, materials may need to be stored for longer durations, potentially leading to storage costs or material degradation, which would require replacement or additional quality control measures (Etemad, 2020).

The implications of extended project durations and their associated cost overruns are manifold. Firstly, prolonged project timelines can strain financial resources, requiring additional funding or reallocating existing budgets. This financial strain can affect not only the project at hand but also other projects and operations within the organization. Secondly, extended durations can impact the project's profitability and return on investment (Al-Hazim, 2015). Furthermore, stakeholders, including investors and clients, may lose confidence in the project's management and feasibility, potentially jeopardizing future funding and collaboration opportunities.

To mitigate the risk of time delays and their resultant cost overruns, effective project management practices are essential. This includes meticulous planning, realistic scheduling, and robust risk management strategies. Project managers should employ accurate and detailed estimation techniques to create realistic timelines and budgets, incorporating contingencies for potential delays and cost escalations (Al-Hazim, 2015). Regular monitoring and reporting can help identify issues early, allowing for timely corrective actions. Additionally, flexible contracting strategies that can accommodate changes and unforeseen circumstances can provide the necessary agility to manage extended project durations effectively. By adopting these practices, project managers can better navigate the complexities of time delays, minimizing their impact on project costs and ensuring successful project completion (Etemad, 2020).

Time delays in project management are a major concern because they often lead to increased costs and compromised project quality. Two significant factors contributing to these delays and subsequent cost overruns are increased risk exposure and the

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necessity for rework and additional efforts. Increased risk exposure is a critical issue that arises from prolonged project timelines. As projects extend beyond their planned durations, they become more susceptible to a variety of risks, such as adverse weather conditions, regulatory changes, and economic fluctuations. Each of these risks can introduce unplanned additional costs. For instance, adverse weather conditions can significantly disrupt construction activities. Extended exposure to weather extremes, such as heavy rainfall, snow, or high winds, can cause damage to materials and unfinished structures, leading to additional expenses for repairs and protective measures. Moreover, prolonged timelines increase the likelihood of encountering regulatory changes. Governments and regulatory bodies may introduce new laws or modify existing regulations, which projects must comply with. This can entail additional documentation, adherence to new safety standards, or environmental impact assessments that were not initially accounted for, leading to increased administrative and compliance costs. Economic fluctuations, such as inflation or changes in currency exchange rates, can also impact the cost of materials and labor, further escalating project expenses. These increased risk exposures necessitate a robust risk management strategy to identify, assess, and mitigate potential risks proactively, ensuring that the project remains on track and within budget despite unforeseen challenges (Ammar, 2020).

Rework and additional efforts are another significant cause of time delays leading to cost overruns. Delays can necessitate rework or additional efforts to maintain the quality and integrity of the project. Prolonged exposure to environmental elements can degrade unfinished structures, requiring repairs or modifications that were not part of the original plan (Mwawasi, 2015). This not only adds to material costs but also requires additional labor and time. Rework can also arise from evolving project requirements or changes in project scope. As projects extend, stakeholders might change their expectations or requirements, leading to modifications in design or functionality. These changes often require revisiting and revising completed work, which consumes additional time and resources. Moreover, quality control becomes more challenging as project timelines extend, necessitating more rigorous inspections and testing to ensure that the final product meets the desired standards. This can involve additional efforts from the project team and external consultants, further driving up costs (Okate, 2019).

To address these issues, it is crucial to implement effective project management practices that anticipate and mitigate the risks associated with time delays. Developing comprehensive risk management plans is essential for identifying potential risks early and preparing appropriate responses. Regular monitoring and reporting can help detect issues promptly, allowing for timely interventions to prevent delays from escalating. Additionally, ensuring robust quality control measures throughout the project lifecycle can minimize the need for rework and maintain project integrity. Engaging stakeholders actively and maintaining clear communication can also help manage changing requirements and expectations, reducing the likelihood of scope creep and associated delays (Okate, 2019).

Senouci et al. (2016) examined the issues of cost overruns and delays in public construction projects in Qatar. They conducted a comprehensive review of both regional and international studies to better understand the problem and the different methodologies used for analysis. Data were collected from Qatar's public works authority, ASHGHAL, encompassing 122 public road, building, and drainage projects. They utilized the ANOVA method for data analysis and inference, and also performed a regression analysis to explore the relationships between project contract prices and cost overruns, as well as to develop predictive models for estimating these overruns. Specifically, two linear regression models were created to predict cost overruns for building and drainage projects. The findings revealed that cost overruns in building projects increased with higher contract prices, whereas for drainage projects, cost overruns decreased as contract prices increased. Significant effort was invested in gathering data on cost overruns and delays in public construction projects; however, due to data confidentiality, the collected data were insufficient to ensure the robustness of the developed regression prediction models (Senouci, 2016).

Undesirable delays in construction projects lead to excessive costs and prolonged durations. Investigating Iran, a developing Middle Eastern country, Samarghandi (2016) focused on the reasons for construction project delays. Several interviews were conducted with owners, contractors, consultants, industry experts, and regulatory bodies to accurately identify specific delay factors. Based on the results of these industry surveys, a statistical model was developed to quantitatively determine the importance of each delay factor in construction project management. The statistical model categorizes the delay factors into four major classes and identifies the most significant factors in each class: owner defects, contractor defects, consultant defects, and law, regulation, and other general defects. In the owner defects category, the most significant delay factors are lack of attention to inflation and inefficient budgeting schedules. In the contractor defects category, inaccurate budgeting and resource planning, weak cash flow, and inaccurate pricing and bidding are the most significant factors. For consultant defects, inaccuracies in the first draft and technical documents are the major contributors. Regarding law, regulation, and other general defects, outdated standard mandatory items in cost lists, outdated mandatory terms in contracts, and weak governmental budgeting are the most important delay factors. Moreover, regression models indicate a significant difference between the initial and final project duration and cost. According to these models, the average delay per year is 5.9 months, and the overall cost overrun is 15.4%. The findings are useful in two ways: first, addressing the root causes of significant delay factors could greatly improve project performance; second, the regression models could help project managers and companies revise initial timelines and estimated costs. This study does not consider all types of construction projects in Iran; it is limited to certain types of private and publicly funded projects. The data for this study were gathered through a detailed questionnaire survey.

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Al-Hazim (2015) conducted a study to pinpoint the primary factors causing delays in road construction projects in Jordan, which result in cost and time overruns. These overruns create significant challenges for both developers and contractors. The discrepancy between the actual completion cost and the initially estimated cost, known as cost overrun, is a key indicator of project success. In the public sector, expenditures on project change orders increase construction time, consequently reducing the number and size of projects that can be completed within a fiscal year. To achieve this, documents and final reports for several sample projects implemented between 2000 and 2008 were analyzed, all of which were managed by the same organization from the Jordan Ministry of Rural and Public Works. The findings indicated that most road construction projects in Jordan experience delays and cost overruns. The critical factors identified include terrain conditions, weather conditions, order variations, and labor availability. The study found a significant discrepancy between estimated and final costs, ranging from 101% to 600%, with an average of 214%. Similarly, the delay time ranged from 125% to 455%, with an average of 226%.

The construction industry in Pakistan is witnessing a surge in public sector projects due to significant investments in infrastructure. However, project delays and cost overruns are common in these public sector construction projects. Understanding the causes of these time and cost overruns is crucial. This paper examines the factors contributing to delays and cost overruns in public sector projects in Pakistan. Idrees and Shafiq (2021) identified 48 potential factors from existing literature and refined them into ten categories through semi-structured interviews. A questionnaire survey was then conducted to rank these factors using descriptive statistics. The results indicated that the main causes of time overruns in public projects were: (1) legal issues, such as court stay orders, land acquisition, and relocation of public facilities; (2) technical errors resulting in low-quality drawings, rework, and errors at the bidding stage; and (3) poor project management (Idrees, 2021).

The delivery of construction projects in Malaysia often suffers from time overruns, turning potentially successful projects into ventures with additional costs or even money-losing endeavors, alongside various other unforeseen negative effects. Shehu's 2014 study aimed to identify the factors leading to time overruns in Malaysian construction projects. The study compared the perceptions of the public and private sectors, contractors, clients, and consultants regarding a list of factors derived from a review of existing literature on project delays. Data were collected through an industry-wide questionnaire survey distributed across the Malaysian construction industry, resulting in a list of 84 time overrun factors. Responses were gathered from 49 clients, 51 contractors, and 105 consultants to analyze the major factors causing time overruns based on sectors (public and private), organizations (clients, contractors, and consultants), and professional roles. The study found that project delays beyond contract dates are predominantly caused by contractors, mainly due to financial factors. "Cash flow problems faced by the contractors" was identified as the major contributing factor to project delays, while "storage on site" was considered the least significant factor (Shehu, 2014).

Project delays in the construction industry are a widespread issue that affects not only the construction sector but also the overall economy of countries. In Malaysia, these delays are especially common in the construction industry, particularly in housing development. This study aims to evaluate and identify the causes and consequences of project delays in private housing development projects in Malaysia, as well as propose remedies to minimize these delays. The top ten causes of delays include weather conditions, poor site conditions, poor site management, incomplete documents, lack of experience, financial problems, contract modifications, delays in the approval of major variations, contractor coordination issues with other parties, and construction mistakes and defective works. Analysis shows that contractor-related factors are the primary contributors to project delays in private housing development projects. The consequences of these delays include time overruns, cost overruns, differences in opinion, negotiations, legal actions, and total abandonment. The study presents recommendations to mitigate these project delays (Mydin, 2014).

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Due to financial resource losses and the need to optimize projects, there is growing awareness among academics, politicians, and the construction industry about the challenges posed by frequent time and cost overruns, as well as reduced quality in construction projects. Larsen's 2016 study aimed to analyze the factors that project managers perceive as having the greatest impact on time, cost, and quality, and to determine whether these factors have significantly different effects. A questionnaire with 26 factors identified from interviews was sent to the entire population of publicly employed project managers. The factors were ranked using the relative importance index and tested for significant differences with Friedman’s test, followed by a post-hoc analysis using Wilcoxon’s test. The findings revealed that the most influential factor for time was unsettled or lack of project funding; for cost, it was errors or omissions in consultant material; and for quality, it was errors or omissions in construction work. The main conclusion of this research is that project schedule, budget, and quality are affected in significantly different ways. Therefore, a project manager

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cannot address critical issues by focusing solely on schedule or budget complications, nor can they assume that time, cost, and quality are equally affected (Larsen, 2016).

The success factors of a project include completing it without time delays or cost overruns. Time delays and cost overruns often arise due to uncertain activities during the project's lifecycle, which can lead to significant problems. A 2020 study aimed to analyze cost overruns and time delays in construction projects. Data were collected through questionnaires from 36 respondents. The study identified 15 factors: land acquisition delay, site location, local support or protest, changes in design specifications, rework, subcontractors' and vendors' performance, delays in work approval, inaccurate budgeting and resource planning, material price escalation, government rules and regulations, additional owner requirements, inflation, payment delays, weak cash flow, and bad weather. The results revealed differing and similar perceptions between owners and contractors. For cost overrun factors, owners identified additional owner requirements as the top factor, while contractors cited rework. For delay factors, owners pointed to inaccurate budgeting and resource planning as the primary cause, whereas contractors identified land acquisition delay. Both parties agreed that inflation had the least influence on project delays (Susanti, 2020).

The construction industry is crucial for the socioeconomic development of a country and generates substantial employment. However, the issue of time and cost overruns is a global challenge in this industry. Time overruns are unexpected delays in construction projects caused by the unavailability of adequate resources and other administrative problems. Similarly, cost overruns involve unforeseen expenses exceeding budgeted amounts due to underestimation during the project planning phase. Raykar's 2016 study aimed to identify and analyze the critical factors influencing time and cost overruns that affect construction project performance. The study discussed various factors such as poor site management and supervision, issues with subcontractors, inadequate project planning and scheduling, problems with material management, and lack of coordination among stakeholders. The study's findings indicated that the Ishikawa diagram is a valuable tool for identifying and analyzing the causes and effects of delays related to labor, materials, and equipment. This tool can assist project management in ensuring the smooth completion of projects according to planned schedules and costs. Since materials account for nearly 70% of total construction costs, effective material management is essential for timely procurement and inventory management to reduce delays caused by material shortages. Additionally, resource smoothing and resource leveling can be adopted to optimize resource utilization with zero wastage. The study also suggests that modern project management tools such as MS Project, Primavera, and Newton software can be employed to control construction project costs and schedules through effective monitoring (Raykar, 2016).

Zulu's 2015 research aimed to provide an understanding of the factors contributing to the success and failure of construction projects in Zambia, with a particular focus on time and cost performance. Recognizing the importance of national industry-specific characteristics, this study focused on the Zambian construction industry. An online questionnaire survey was conducted among construction professionals in Zambia to capture data from a large target audience. The questionnaire was developed following an extensive literature review on factors impacting project performance. The findings indicated that all key participants in construction projects—employers, contractors, and consultants—significantly influence time and cost performance in Zambia. Factors such as employer financial difficulties, construction project and site management, and unethical behavior were identified as significant contributors to poor time and cost performance. The study highlights the limited literature on the Zambian construction industry and the performance of projects. Of particular interest is the comparison of these factors between Zambia and other countries. By analyzing key time and cost contributing factors specific to Zambia, this study adds to the body of research on construction project performance in various countries (Zulu, 2015).

In many developing countries, numerous projects experience significant time and cost overruns, and some may fail to achieve their intended benefits, often resulting in termination or abandonment. Mwawasi (2015) conducted a study to investigate the factors contributing to time and cost overruns in road construction projects in Kenya. The research utilized a multiple case study approach with specific objectives: identifying variables influencing these overruns, determining their relative importance, and quantifying their impact. Both primary and secondary data sources were used. Primary data was gathered through a semi-structured questionnaire, while secondary data was obtained from various sources including annual corporate reports, KeNHA (Kenya National Highways Authority) databases, contract documents, and project progress reports. The study focused on 24 road projects completed by KeNHA over the past three fiscal years, with a random sample of 10 projects selected for analysis. Data analysis involved using a 4-point Likert scale to measure responses, descriptive statistics to numerically describe variables, and principal component analysis to cluster variables for easier analysis. The critical factors identified as causing time and cost overruns included scope creep, delayed payments to contractors, poor cost control, fluctuations in foreign exchange rates, inadequate contract specifications, and unpredictable weather. The Relative Importance Indicator (RII) was employed to assess the likelihood of these factors recurring in future projects, with 35 variables identified as having a high likelihood. Furthermore, a multiple linear regression model was used to establish relationships between these factors and the extent of time and cost overruns in the road projects. The study found that scope creep was the primary factor contributing to both time extensions and cost deviations from initial estimates. Other significant factors in descending order of importance were delayed payments, inadequate contract specifications, foreign exchange fluctuations, unpredictable weather, and poor cost control mechanisms (Mwawasi, 2015).

Construction projects are frequently completed beyond their scheduled durations, a trend observed globally. Road construction is no exception, leading client organizations to pay substantial sums in compensation for delayed projects while contractors incur

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losses. Mukasera (2016) aimed to identify the causes, effects, and mitigation measures for time overruns in road construction projects in Malawi. The study employed a detailed literature review and structured questionnaire surveys, revealing the presence of time overruns in Malawian road construction projects. The results identified several causes of time overruns, including inadequate planning, inability to pre-finance projects, delays in processing contractors' payments, delayed site mobilization, slow decision-making, delayed approvals for scope changes, risky worker behaviors, poor planning and scheduling, price fluctuations, political interference, equipment unavailability, and inclement weather. The effects of time overruns in road projects included cost overruns, extensions of time, claims, disputes, contract termination, loss of profits, project abandonment, poor work quality due to rushed execution, idling of resources, bankruptcy, arbitration, litigation, and loss of employees (Mukasera, 2016).

Gómez (2024), scoping review aimed at improving construction project management practices by identifying key factors leading to time and cost overruns. The review analyzed over 300 articles, with 73 deemed relevant. Following the methodological guidelines of the Joanna Briggs Institute (JBI) and the PRISMA checklist, the review examined research trends in terms of geographical and temporal contexts, the types of projects studied, research approaches, and the main causes of time and cost overruns. The review also identified current research gaps. Findings indicate an increasing volume and diversity of research on the causes of time and cost overruns. Asia and Africa have been significant contributors to this literature, while there is a notable lack of research from Europe, America, and Oceania. Additionally, there is a tendency for articles to replicate research methods and approaches. The study highlights that cost and time deviations most frequently occur during the project execution phase, underlining the importance of effective project management. The results emphasize the need for prioritizing better project management practices to mitigate unexpected time and cost overruns in construction projects (Gómez, 2024).

- *Construction Manager Experience with Cost Overruns*

Road construction projects are inherently risky due to their wide geographical spread and threats from underground conditions, which can significantly impact project cost, time, or scope. Early understanding of these risks enables project managers to mitigate impacts and complete projects more efficiently through proper Risk Management. Risk Management involves identifying, analyzing, and applying methods to reduce identified risks. It is also crucial to allocate risks appropriately among contracting parties such as owners, consultants, and contractors to facilitate proper risk handling decisions without disputes. Okate (2019) focused on risk management in road construction projects, categorizing roads as "High-volume" and "Low-volume," with analysis primarily on High-volume roads. Risk factors were identified through a questionnaire survey, and risk assessment was conducted by evaluating both the probability of risk occurrence and its impact using a 5-point Likert scale. The 'risk priority' was calculated by multiplying the RII values of these parameters, and risks were ranked according to the RII values of the 'risk priority.' The study also allocated risks based on respondents' feedback, designating responsibility to the owner, consultant, contractor, or sharing it among them. This approach helps project managers to better estimate risks before project commencement, allowing for the development of appropriate mitigation measures early in the project to avoid cost overruns (Okate, 2019).

Time and cost overruns remain a persistent issue in large projects despite advances in project management. Simushi (2020) conducted research on large projects in South Africa to identify the root causes of these overruns. The study begins with a review of existing theories on the causes of time and cost overruns, followed by an empirical investigation using case studies. The findings revealed that time and cost overruns stem from the external environment, which subsequently impacts the organization and project environments. Key root causes include the project team's lack of project-specific experience, historical external and organizational decisions, community resistance, pressure on the project team, and stakeholder-driven scope changes. The study suggests that an effective strategy to mitigate time and cost overruns should involve managing not only the project environment but also the organizational and external environments (Simushi, 2020).

The actual cost of construction projects often exceeds the planned cost, with discrepancies ranging from 21% to 55%. In residential construction, cost overruns are a significant issue. To mitigate this problem, Value Management (VM) has proven to be an effective approach. Khodeir's 2019 study aimed to examine the role of VM in controlling cost overruns, specifically in residential projects in Egypt. The study involved a literature review on the fundamentals of project cost implementation, a qualitative analysis of case studies, and a questionnaire survey assessing the impact of applying VM on residential projects in Egypt. The findings highlighted the substantial benefits of using VM methodologies, demonstrating potential savings of 15–40% of the total project cost (Khodeir, 2019).

- *Management Strategy for Checking Road Cost Overrun*

Shared risk identification begins when stakeholders collaboratively identify potential risks that could impact the procurement process (Sarvari, 2019). This process draws on the collective experience, expertise, and insights of all parties involved, allowing for a comprehensive evaluation of possible risks. Each stakeholder contributes their unique perspective, leading to a broader understanding of risks such as market volatility, supplier reliability, and regulatory compliance. Once risks are identified, stakeholders jointly assess the likelihood and potential impact of each risk on the project (Gurtu, 2021). This assessment includes evaluating factors like the probability of occurrence, severity of impact, and the effectiveness of current controls. By sharing resources and knowledge, stakeholders can conduct a more thorough risk evaluation, considering various scenarios and outcomes. This approach helps prioritize risks and guides the development of effective risk management strategies (Lysons, 2020).

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Collaborative risk identification and assessment benefit from pooling the resources and expertise of all involved stakeholders. Buyers offer insights into project requirements, suppliers share their understanding of market conditions and supply chain dynamics, and contractors bring their knowledge of project execution and delivery (Fawcett, 2007). By combining these diverse perspectives, stakeholders can identify risks that may be missed in a more isolated approach and develop stronger risk management strategies. This collaborative method enables stakeholders to create more effective strategies that address the complexities of the project. By analyzing risks from various angles and considering multiple scenarios, stakeholders can design targeted responses to mitigate the potential impacts. This proactive risk management enhances the organization's ability to anticipate and respond to uncertainties, reducing the chances of disruptions and delays in the procurement process (Gurtu, 2021).

Accurate cost estimation is fundamental to managing road construction projects effectively, as it provides the foundation for budgeting, resource allocation, and overall financial planning (Etemad, 2020). A well-prepared cost estimate ensures that all project stakeholders have a clear understanding of the financial requirements from the outset, reducing the risk of unexpected expenses that could lead to cost overruns. An accurate cost estimate must incorporate a detailed breakdown of all potential expenses, including the costs of materials, labor, equipment, and administrative overheads. Each category should be meticulously itemized to avoid overlooking any critical expenses (Flyvbjerg, 2002). Material costs should factor in not only the quantity required but also transportation, storage, and potential wastage. Labor costs should account for wage rates, skill levels, and anticipated productivity, while equipment costs should consider rental fees, maintenance, and fuel consumption.

Road construction projects are inherently unpredictable due to factors like weather conditions, regulatory changes, or unforeseen site challenges. Therefore, cost estimates must include contingency allowances to cover these unexpected developments (Etemad, 2020). A contingency budget typically ranges between 5% and 15% of the total project cost, depending on the complexity and risks associated with the project. This buffer helps absorb financial shocks without derailing the overall budget. Inflation and market volatility can significantly affect the cost of materials, fuel, and labor over the lifespan of a road project. A reliable estimate must incorporate inflation forecasts and potential market changes to ensure that future price increases do not cause budget shortfalls. This forward-thinking approach is particularly crucial for long-term projects, where cost escalations over several years can be substantial (Brookes, 2015).

Using historical data from similar road projects provides valuable benchmarks for cost estimation (Brookes, 2015). By analyzing past projects of similar scope and scale, estimators can identify cost patterns and common pitfalls. Additionally, advanced estimating tools, such as project management software and cost modeling applications, can provide more precise calculations by automating cost inputs, adjusting for inflation, and factoring in project-specific risks. These tools improve accuracy and reduce the likelihood of underestimation, which is a common cause of cost overruns. Accurate cost estimation is not a one-time task but an ongoing process. As the project evolves, cost estimates should be continually revised to reflect any changes in scope, materials, or timelines, ensuring that the project stays financially on track (Bordat, 2014).

Effective stakeholder engagement and communication is a crucial strategy for managing and preventing cost overruns in road construction projects (Sarvari, 2019). Maintaining clear, open lines of communication with all stakeholders such as contractors, suppliers, government agencies, and the local community ensures that potential issues are identified early and addressed proactively (Brookes, 2015). When stakeholders are involved from the outset, it fosters a collaborative environment where everyone is aware of the project's objectives, constraints, and timelines, helping to align efforts and expectations (Canales, 2023).

Engaging stakeholders early in the planning and design phase is essential for anticipating potential challenges that could impact the project's timeline and budget. For instance, government agencies may need to approve permits or conduct inspections, and delays in these processes can stall progress and increase costs (Canales, 2023). Similarly, input from suppliers can highlight potential issues with material availability or price fluctuations, while contractors can offer insights into scheduling challenges and resource allocation. Early involvement ensures that these risks are identified and managed before they escalate into costly problems (De wit, 2021).

Continuous communication throughout the project lifecycle is equally important. Regular meetings with stakeholders provide a platform for discussing progress, identifying emerging risks, and addressing any deviations from the plan (Creedy, 2021. If a supplier anticipates a delay in delivering critical materials, early notification allows the project team to adjust schedules or find alternative sources, mitigating the risk of costly delays. Additionally, changes in regulations or unforeseen community concerns, such as environmental impact or traffic disruptions, can be addressed more efficiently when all parties are kept informed and involved in decision-making (Canales, 2023).

Frequent communication also ensures that all stakeholders are aligned on the project's goals and budget expectations. Misalignment or misunderstandings can lead to scope creep, rework, or additional costs (El-Ahwal, 2016). By keeping stakeholders updated on budgetary constraints and progress toward key milestones, project managers can ensure that everyone remains focused on achieving the project's objectives within the agreed-upon financial limits. In this way, stakeholder engagement and communication play a pivotal role in preventing road construction cost overruns and ensuring the project's successful completion (Etemad, 2020).

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The use of technology and data analytics is a vital strategy for managing cost overruns in road construction projects (Cantarelli, 2021). Leveraging advanced tools such as Building Information Modeling (BIM) and Geographic Information Systems (GIS) allows project managers to enhance both planning and execution by offering detailed insights into various aspects of the project, such as road design, topography, and material requirements. These technologies provide accurate and up-to-date information, enabling more precise project planning and minimizing the risk of cost overruns due to unforeseen issues (Brookes, 2015).

BIM, for example, offers a 3D representation of the road construction project, allowing project teams to visualize the design, detect potential clashes, and simulate construction processes before work begins. This comprehensive view of the project helps in identifying potential cost drivers early, such as design inefficiencies or misalignment with topographical features (Bordat, 2004). By addressing these issues during the planning phase, project managers can avoid costly rework and delays during the execution phase. Similarly, GIS technology provides critical insights into geographical conditions, which helps in determining the most cost-effective route alignment and construction methods based on the terrain and environmental factors (Bhatia, 2019).

Data analytics plays a critical role in forecasting cost trends and identifying inefficiencies in resource usage. By analyzing historical data from previous road projects, project managers can better predict cost fluctuations, identify patterns, and prepare for potential risks such as material price increases or labor shortages (Bhatia, 2019). Data analytics can also be used to monitor resource allocation and detect inefficiencies in real time, allowing project teams to adjust their strategies and improve resource utilization. Digital tools also facilitate real-time data collection and monitoring. This capability allows project managers to track progress against the budget in real time and take immediate corrective actions if costs begin to deviate. Whether it's reallocating resources, adjusting schedules, or negotiating with suppliers, these tools provide the timely information needed to keep the project on track and within budget. Ultimately, the integration of technology and data analytics into road construction projects not only enhances decision-making but also significantly reduces the risk of cost overruns (Subramani, 2014).

Post-Project Review and Lessons Learned is a critical component of managing cost overruns in road construction projects. After the project's completion, conducting a detailed analysis of the project's financial performance and identifying the causes of any cost overruns provides valuable insights for future projects. This review involves examining various factors, such as inaccurate cost estimates, contractor performance, and unforeseen external circumstances that contributed to increased costs (Subramani, 2014). The post-project review focuses on identifying the root causes of cost overruns, whether due to initial budgeting errors, scope changes, delays in supply chains, labor inefficiencies, or external factors like weather conditions or regulatory shifts. By analyzing each aspect of the project, stakeholders can pinpoint specific areas where missteps occurred, whether during planning, execution, or management (Canales, 2023) .

Documenting the findings from the post-project review is essential for ensuring that lessons learned are not lost. This documentation should be comprehensive, outlining what went wrong, why it happened, and what measures could have prevented it. By systematically incorporating these lessons into future project planning and cost estimation processes, organizations can enhance their overall cost management strategies (Brookes, 2015). This could involve adjusting the approach to risk management, improving stakeholder communication, or refining estimation techniques based on past performance. Incorporating insights from post-project reviews into future projects helps reduce the likelihood of repeating the same mistakes. Whether through enhanced cost estimation practices, more rigorous contractor evaluation, or better contingency planning, learning from past projects equips project teams to anticipate and mitigate potential cost drivers more effectively. This proactive approach fosters a culture of continuous improvement, ultimately leading to more accurate budgeting and fewer cost overruns in future road construction projects (Cantarelli, 2010).

Contract Management and Procurement Strategies play a vital role in controlling cost overruns in road construction projects (Brookes, 2015). By carefully structuring contracts and implementing effective procurement practices, project managers can mitigate financial risks and enhance overall project efficiency. A well-structured contract is essential to fairly distribute risk between the client and contractors. Fixed-price contracts, where contractors agree to a set price regardless of potential cost increases, can protect the client from overruns but require a highly accurate cost estimate from the outset. These contracts transfer more risk to the contractor, which can lead to more cautious bids but reduce the likelihood of unexpected costs for the client (Cantarelli, 2010).

Alternatively, flexible contract arrangements, such as cost-plus contracts or contracts with incentive clauses, can encourage contractors to perform efficiently. This approach aligns the contractor's financial interests with the project's cost and time goals, fostering a more collaborative and results-oriented environment. Procurement strategies are equally important in controlling costs (Cantarelli, 2010). Competitive bidding processes should be implemented to secure the best pricing for materials, equipment, and services, reducing the likelihood of inflated supplier costs contributing to budget overruns. By carefully evaluating potential suppliers and subcontractors based on reliability, performance history, and cost-effectiveness, project managers can mitigate the risk of delays or cost increases stemming from supplier issues (Brookes, 2015).

Additionally, establishing long-term relationships with trusted suppliers can create opportunities for bulk purchasing discounts, stable pricing agreements, and priority service. Transparent communication and negotiation during the procurement phase

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ensure that all parties are aligned with the project's cost and timeline expectations, reducing potential misalignments or delays that could lead to cost increases. Together, effective contract management and procurement strategies are essential tools for minimizing cost overruns, fostering accountability, and ensuring smooth project execution (Bhatia, 2019).

Labor and Resource Management is a key component in mitigating cost overruns in road construction projects. Effective management of labor and resources ensures that the project proceeds smoothly without delays, inefficiencies, or unexpected expenditures. Proper planning starts with a thorough analysis of the resources required for the project, including labor, equipment, and materials. A well-structured resource plan should detail when and where each resource will be needed, ensuring optimal allocation throughout the project (Brookes, 2015). This minimizes idle time, where workers or equipment may be present but not actively contributing to progress, which can lead to unnecessary costs. In addition, scheduling plays a vital role in aligning labor and resource availability with project milestones. Detailed schedules prevent overlaps or gaps in resource use, ensuring that labor and equipment are deployed efficiently to avoid costly delays. Resource planning also takes into account potential challenges like seasonal weather impacts, which could affect productivity and resource use (Canales, 2023) .

Managing the workforce effectively is essential to keeping labor costs under control. One common cause of cost overruns is delays due to labor shortages or mismanagement. To mitigate this risk, project managers should conduct workforce assessments to ensure they have the right number of skilled workers at every stage of the project (Bordat, 2014). Having a clear workforce plan and regularly monitoring staffing levels can prevent disruptions caused by a lack of manpower. Upskilling and training laborers are also crucial for project efficiency. An untrained or inexperienced workforce can lead to errors, rework, and delays, which ultimately inflate project costs. Investing in ongoing training programs for workers ensures they have the necessary skills to perform tasks efficiently, maintain safety standards, and meet project requirements within budget constraints (Samarghandi, 2016).

Equipment breakdowns can cause significant delays and cost increases in road construction projects (Senouci, 2016). Therefore, proactive maintenance and regular inspections of machinery are critical. Having a maintenance schedule and ensuring that equipment is in optimal condition helps reduce the likelihood of unexpected breakdowns, preventing costly repairs and project delays. By integrating detailed planning, efficient resource allocation, and proactive workforce management, labor and resource management strategies can significantly reduce the risk of cost overruns, ensuring projects remain on time and within budget (Gómez, 2024).

- *Personal Critique of Literature Review*

The literature on cost overruns in road construction projects is extensive, highlighting the complexity and multifaceted nature of the issue. While the reviewed studies provide valuable insights into the causes, impacts, and mitigation strategies, there are several critical areas that warrant further discussion and critique.

The studies reviewed, such as those by Gómez (2024), Al-Hazim (2015), and Senouci et al. (2016), offer detailed accounts of the factors leading to time delays and cost overruns. These factors range from extended project durations and increased risk exposure to rework and regulatory changes. While these studies are thorough in identifying and categorizing causes, there is often a lack of emphasis on the interdependencies between these factors. For example, the interplay between inadequate planning (as highlighted by Mukasera, 2016) and external economic conditions (as discussed by Etemad, 2020) could be explored in greater depth to understand how these elements collectively impact project timelines and costs.

One notable strength of the literature is its attention to regional and contextual variations. Studies like those by Idrees and Shafiq (2021) and Mydin (2014) focus on specific regions, such as Pakistan and Malaysia, providing localized insights. However, the generalizability of these findings can be limited. For instance, the study by Samarghandi (2016) in Iran highlights unique regulatory and economic challenges that may not be applicable elsewhere. Future research could benefit from a more comparative approach, examining how similar factors manifest differently across various regions and project types.

The methodologies employed across these studies are robust, with a mix of qualitative interviews, quantitative surveys, and statistical analyses. However, there is a tendency towards methodological replication without significant innovation. For instance, while the ANOVA and regression models used by Senouci et al. (2016) are effective, the incorporation of more advanced data analytics techniques or longitudinal studies could provide deeper insights. Additionally, studies like those by Zulu (2015) and Raykar (2016) could enhance their findings by integrating real-time data collection and analysis methods to capture dynamic changes in project conditions.

The literature consistently underscores the importance of effective project management practices to mitigate time delays and cost overruns. Recommendations such as meticulous planning, realistic scheduling, and robust risk management are well-founded (Al-Hazim, 2015; Okate, 2019). However, there is often a gap between theoretical recommendations and practical implementation. Studies like those by Larsen (2016) and Susanti (2020) provide valuable frameworks but could benefit from more practical case studies demonstrating successful implementation. Furthermore, the role of technology in project management, such as the use of Building Information Modeling (BIM) or project management software, is often underexplored.

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Effective stakeholder engagement and communication are recurrent themes in the literature. However, the complexity of managing diverse stakeholder interests, especially in large-scale public projects, is often understated. Studies such as those by Idrees and Shafiq (2021) and Mukasera (2016) touch on this aspect but could delve deeper into strategies for balancing competing stakeholder demands and maintaining transparency throughout the project lifecycle.

Despite the extensive body of work, significant research gaps remain. For example, Gómez's (2024) scoping review points to a lack of research from Europe, America, and Oceania, indicating a geographical bias in existing studies. Additionally, there is a need for more interdisciplinary research that integrates insights from fields such as economics, sociology, and environmental science to provide a holistic understanding of the issue. Future research could also explore the long-term impacts of time delays and cost overruns on project outcomes and community development, moving beyond immediate financial implications.

Despite the extensive body of work, significant research gaps remain. Gómez's (2024) scoping review points to a lack of research from Europe, America, and Oceania, indicating a geographical bias in existing studies. Additionally, there is a need for more interdisciplinary research that integrates insights from economics, sociology, and environmental science to provide a holistic understanding of the issue. Future research should also explore the long-term impacts of time delays and cost overruns on project outcomes and community development, moving beyond immediate financial implications. Understanding the broader social and economic consequences of delays and overruns could inform more effective mitigation strategies and policy interventions.

➢ *Establishment of Research Gaps*

Despite the comprehensive body of research on time delays and cost overruns in road construction projects, several significant gaps remain unaddressed. Identifying and exploring these gaps can provide valuable directions for future research, leading to a deeper understanding and more effective management of these issues.

- *Interdependencies and Cascading Effects*

✓ *Gap:*

Existing studies often treat causes of delays and cost overruns in isolation, lacking a thorough exploration of how these factors interact and exacerbate each other.

✓ *Future Research Direction:*

Investigate the interdependencies among various causes of delays and cost overruns, such as how inadequate planning interacts with economic fluctuations or regulatory changes to compound project challenges. Employing systems thinking and dynamic modeling approaches could provide more holistic insights.

- *Regional and Contextual Variations*

✓ *Gap:*

While localized studies offer valuable insights, the transferability of these findings to other regions or contexts is often questionable.

✓ *Future Research Direction:*

Conduct comparative studies across different geographical regions and regulatory environments to identify universal best practices and region-specific challenges. This could involve cross-country analyses or case studies from underrepresented regions such as Europe, America, and Oceania.

- *Advanced Methodological Approaches*

✓ *Gap:*

Many studies rely on traditional qualitative and quantitative methods, with limited use of advanced data analytics and real-time data collection.

✓ *Future Research Direction:*

Integrate advanced data analytics techniques, such as machine learning and predictive modeling, to enhance the accuracy of predictions related to time delays and cost overruns. Real-time data collection and analysis could also capture the dynamic nature of project conditions more effectively.

- *Practical Application of Theoretical Recommendations*

✓ *Gap:*

There is often a disconnect between theoretical recommendations and their practical implementation in real-world projects.

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✓ *Future Research Direction:*

Focus on bridging the gap between theory and practice by providing concrete case studies that demonstrate successful implementation of recommended strategies. Explore the role of modern project management technologies, such as Building Information Modeling (BIM) and advanced project management software, in facilitating practical applications.

- *Stakeholder Engagement and Communication*

✓ *Gap:*

The complexity of managing diverse stakeholder interests, particularly in large-scale public projects, is frequently understated.

✓ *Future Research Direction:*

Delve deeper into strategies for balancing competing stakeholder demands and maintaining transparency throughout the project lifecycle. Investigate innovative stakeholder engagement strategies and their impact on project success, especially in complex, multi-stakeholder environments.

- *Long-term Impacts*

✓ *Gap:*

Most studies focus on immediate financial implications of time delays and cost overruns, with limited attention to long-term impacts on project outcomes and community development.

✓ *Future Research Direction:*

Explore the broader social and economic consequences of delays and overruns, considering long-term project sustainability and community impacts. This could involve longitudinal studies tracking project outcomes over extended periods.

- *Interdisciplinary Approaches*

✓ *Gap:*

Research on time delays and cost overruns is often siloed within the field of construction management, with limited integration of insights from other disciplines.

✓ *Future Research Direction:*

Foster interdisciplinary research that integrates perspectives from economics, sociology, environmental science, and other relevant fields. This could provide a more comprehensive understanding of the multifaceted nature of delays and overruns.

- *Underrepresented Project Types and Sizes*

✓ *Gap:*

The majority of existing studies focus on large-scale road construction projects, with less attention given to smaller projects or different types of infrastructure.

✓ *Future Research Direction:*

Investigate time delays and cost overruns in smaller road construction projects and other types of infrastructure, such as bridges, tunnels, and urban transit systems. This could reveal unique challenges and mitigation strategies relevant to different project scales and types.

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# CHAPTER THREE
# RESEARCH METHODOLOGY

➢ *Overview*

This chapter will highlight the methodologies that will be used in the data collection, as well as how the data will be analyzed. The chapter will present the research design, the target population, the sample size, sampling and data collection procedures, analysis methods, and the instruments that will be used.

➢ *Research Design*

Study design refers to a set of tools and methods tailored for specific use, outlining the reasoning and techniques behind their application (Creswell, 2014). It acts as a guide for researchers, directing their data collection, analysis, and interpretation efforts to address research questions. In this study, a cross-sectional survey design was adopted, utilizing a quantitative approach for collecting primary data (Workman, 2022). This design allowed data to be collected at a single point in time, providing a snapshot of the variables being studied. Through the quantitative methodology, the study collected numerical data and use statistical analysis methods to draw conclusions and establish relationships among the variables.

➢ *Target Population*

By definition, a population is defined as a collection of objects, events, or individuals sharing common characteristics that the researcher is interested in studying (Moulton, 1998). The target population for this study consisted of project managers from Avic international a construction construction company and National Road Fund Agency.

➢ *Sample Size*

A sample is a subset of a population that is used to represent the entire group (White, 2003). The study consisted of 50 employees from Avic international and National Road Fund Agency.

➢ *Sampling*

The study made use of convenience sampling method. This choice was based on its practicality and feasibility in accessing study participants. Data was collected from individuals who were readily available and accessible.

➢ *Data Collection Methods*

The main data collection method for this study was a structured questionnaire containing closed-ended questions. Information was gathered through structured surveys and interviews, using standardized questionnaires. Interviews were primarily conducted face-to-face, with electronic questionnaires also being utilized to collect information on the research variables.

➢ *Data Analysis*

Data entry and statistical analysis was done using STATA. Presentation of descriptive statistics was done using Microsoft Excel 365.

➢ *Triangulation*

The study employed triangulation as a research strategy to enhance the validity and reliability of the findings. Triangulation involved the use of multiple data sources, data collection methods, and/or researchers' perspectives to corroborate and cross-verify research results. In this study, triangulation was achieved by obtaining quantitative data collected through surveys. This approach helped mitigate potential biases and provided a more comprehensive and accurate understanding of the research phenomenon, increasing the overall robustness of the study's conclusions.

➢ *Ethical Consideration*

The study upheld ethical aspects including obtaining informed consent, safeguarding participant confidentiality and privacy, and utilizing acquired information solely for academic reasons. Stringent confidentiality measures was maintained. Equal and unbiased treatment was given to all participants, who had the choice to participate or decline without any adverse effects. This research carried no risk of physical harm.

➢ *Study Limitations*

This study on project cost overruns in road construction projects in Ndola, Zambia, faced several limitations that may impact the findings and their generalizability:

- *Data Availability and Access:*

The study relied on self-reported information. Access to detailed financial information may be limited due to confidentiality issues, which constrained the depth of the analysis.

- *Scope of Projects:*

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The research was confined to road construction projects in Ndola, Zambia. While this focus allowed for an in-depth analysis of local factors, the findings may are directly applicable to other regions without considering their specific contextual differences.

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# CHARPTER FOUR
# RESULT PRESENTATION

➢ *Overview*

This section provides a detailed analysis of the outcomes achieved, including any statistical or quantitative analysis conducted to support the findings.

➢ *Presentation of Results on Background Characteristics of the Respondents*

Of the 50 participants, 60% (30 respondents) were male, and 40% (20 respondents) were female.

Table 1 Sex

| | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|
| Valid | Male | 30 | 60.0 | 60.0 | 60.0 |
| | Female | 20 | 40.0 | 40.0 | 100.0 |
| | Total | 50 | 100.0 | 100.0 | |

The majority of the participants (82%) were married, accounting for 41 respondents. A smaller proportion, 8% (4 respondents), were single, while 10% (5 respondents) were divorced.

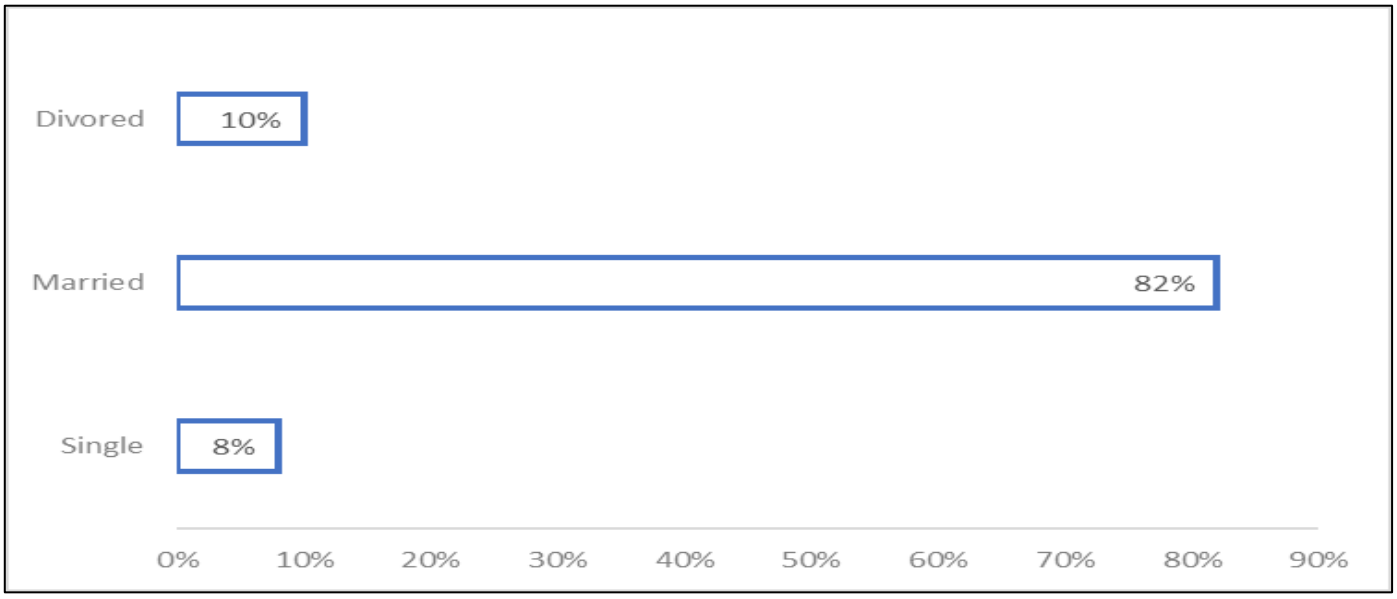


Fig 1 Marital Status

Most participants had a Bachelor's degree, with 80% (40 respondents) reporting this level of education. An additional 18% (9 respondents) held a Master's degree, and 2% (1 respondent) had a PhD.

Table 2 Educational Background

| | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|
| Valid | Bachelor's degree | 40 | 80.0 | 80.0 | 80.0 |
| | Master's degree | 9 | 18.0 | 18.0 | 98.0 |
| | PhD | 1 | 2.0 | 2.0 | 100.0 |
| | Total | 50 | 100.0 | 100.0 | |

➢ *Cost Overruns of Road Projects in Ndola*

A significant portion of road projects in Ndola frequently encounter cost overruns. According to survey results, 58% of participants indicated that cost overruns occur "often," while an additional 4% reported that these overruns happen "always." On the other hand, 12% stated that cost overruns occur "rarely," and 4% reported them as occurring "sometimes." Notably, 22% of participants claimed they "never" experience cost overruns. These findings suggest that while cost overruns are a common issue, there is a significant group of projects that manage to stay within budget constraints.

The Chi-Square test results show a significant relationship between participants' educational background and the frequency of experiencing cost overruns, as indicated by a Pearson Chi-Square value of 32.896 with 8 degrees of freedom and a p-value of 0.000. This demonstrates that variations in educational qualifications are linked to differences in the occurrence of cost overruns.

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Specifically, participants with a Bachelor's degree were more likely to experience cost overruns "often," with 27 out of 40 respondents falling into this category, while only 11 reported "never" or "rarely" encountering such issues. In contrast, participants with a Master's degree reported fewer instances of cost overruns, with 2 out of 9 indicating "never" and 6 out of 9 reporting "rarely" facing cost overruns. Interestingly, only one participant with a PhD reported experiencing cost overruns, classified under "often." This suggests that individuals with higher educational qualifications, such as Master's and PhD degrees, are less prone to encountering frequent cost overruns compared to those with a Bachelor's degree.

The extent of cost overruns in these projects varies, with the majority of respondents (64%) observing cost increases in the range of 6-10%. Another 22% reported cost overruns of 0-5%, while a smaller group experienced higher overruns, with 10% indicating increases of 11-15%, and 2% each for the ranges of 16-20% and above 21%. This data indicates that while moderate cost overruns are common, instances of severe overruns are less frequent. Cost overruns are generally perceived as having a substantial impact on project budgets. A significant portion of respondents (66%) rated the impact of cost overruns as "very significant," with a further 2% considering it "extremely significant." Meanwhile, 20% viewed the impact as "moderate," and a minority (12%) felt that cost overruns were only "slightly significant," with 2% stating they were "not significant." This highlights the critical nature of cost overruns in affecting the financial stability of road projects.

Among the primary causes of cost overruns, inflation was identified as the leading factor, with 78% of respondents attributing cost increases to inflation. Poor project management (12%) and labor costs (10%) were also noted as contributing factors, but to a much lesser degree. These findings underscore the significant impact of economic conditions on project budgets. Changes in project scope were frequently cited as a cause of cost overruns, with 54% of participants reporting that scope changes "often" lead to budget increases, and 16% stating this "always" occurs. A smaller group indicated that changes in scope result in cost overruns "sometimes" (16%), "rarely" (10%), or "never" (4%). These results suggest that maintaining a stable project scope is crucial in preventing budget overruns.

Contractor delays were another significant contributor to cost overruns, with 62% of respondents indicating that such delays have a "very large extent" impact on project costs. Meanwhile, 30% rated the impact of contractor delays as "moderate," and 8% saw them contributing to a "large extent." This highlights the importance of effective contractor management to minimize budget deviations. External economic factors, particularly inflation, were noted to have a profound effect on project costs. A substantial 58% of respondents mentioned that inflation "always" impacts project expenses, while 38% indicated that it "often" does. Only a small percentage (4%) noted that external economic factors influence costs "sometimes." This points to the need for strategies to mitigate the impact of economic fluctuations on project budgets.

A significant portion of road projects in Ndola experience cost overruns frequently. 58% of participants indicated that cost overruns occur "often," and 4% said "always." A smaller proportion reported that cost overruns happen "rarely" (12%) or "sometimes" (4%), while 22% claimed they "never" experience cost overruns.

Table 3 Frequency of Cost Overruns

| | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|
| Valid | Never | 11 | 22.0 | 22.0 | 22.0 |
| | Rarely | 6 | 12.0 | 12.0 | 34.0 |
| | Sometimes | 2 | 4.0 | 4.0 | 38.0 |
| | Often | 29 | 58.0 | 58.0 | 96.0 |
| | Always | 2 | 4.0 | 4.0 | 100.0 |
| | Total | 50 | 100.0 | 100.0 | |

The Chi-Square test results indicate a significant relationship between participants' educational background and the frequency of experiencing cost overruns, as evidenced by a Pearson Chi-Square value of 32.896 with 8 degrees of freedom and a p-value of 0.000. This suggests that differences in educational background are associated with variations in how often cost overruns occur.

Table 4 Relationship Between Participants' Educational Background and the Frequency of Experiencing Cost Overruns

| Symmetric Measures | | | | | |
|---|---|---|---|---|---|
| | | Value | Asymp. Std. Error[a] | Approx. T[b] | Approx. Sig. |
| Nominal by Nominal | Contingency Coefficient | .630 | | | .000 |
| Interval by Interval | Pearson's R | -.268 | .143 | -1.925 | .060[c] |
| Ordinal by Ordinal | Spearman Correlation | -.328 | .127 | -2.408 | .020[c] |
| N of Valid Cases | | 50 | | | |
| a. Not assuming the null hypothesis. | | | | | |
| b. Using the asymptotic standard error assuming the null hypothesis. | | | | | |
| c. Based on normal approximation. | | | | | |

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The crosstabulation analysis reveals a notable relationship between participants' educational background and the frequency of experiencing cost overruns. Among those with a Bachelor's degree, a significant proportion (27 out of 40) reported experiencing cost overruns "often," while only 11 indicated "never" or "rarely" facing such issues. Conversely, participants with a Master's degree were more likely to report "never" (2 out of 9) or "rarely" (6 out of 9) encountering cost overruns, with very few indicating frequent occurrences. Only one participant with a PhD reported experiencing cost overruns, categorized under "often." These findings suggest that individuals with higher educational qualifications, such as Master's and PhD degrees, tend to experience cost overruns less frequently compared to those with a Bachelor's degree.

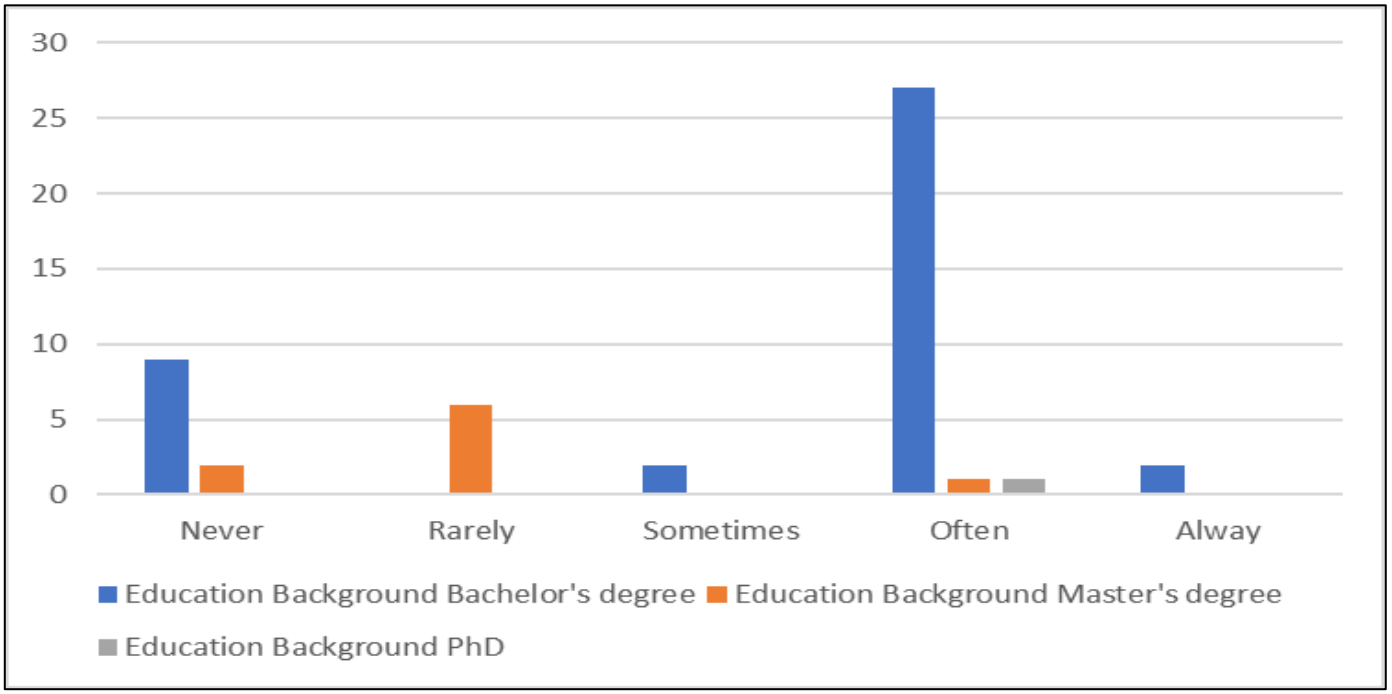


Fig 2 Relationship Between Participants' Educational Background and the Frequency of Experiencing Cost Overruns.

The majority of respondents (64%) observed cost overruns in the range of 6-10%, while 22% reported an increase of 0-5%. A smaller group saw higher overruns, with 10% experiencing 11-15% cost increases, and 2% experiencing overruns in both the 16-20% and 21% and above ranges.

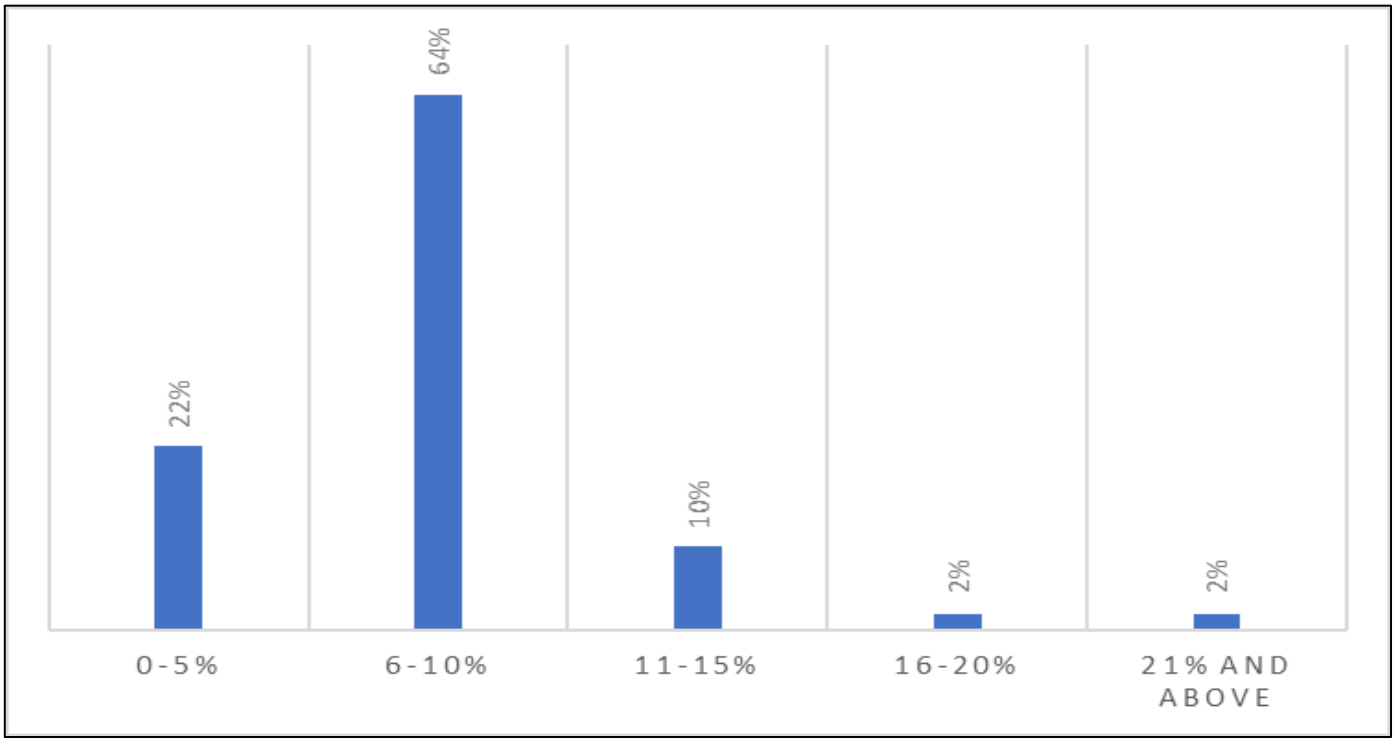


Fig 3 Average Percentage Increase Due to Overruns

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Cost overruns were seen as highly impactful, with 66% of respondents indicating they are "very significant" and 2% stating they are "extremely significant." Meanwhile, 20% rated the impact as "moderate," and a small group (12%) felt they were only "slightly significant" or "not significant" (2%).

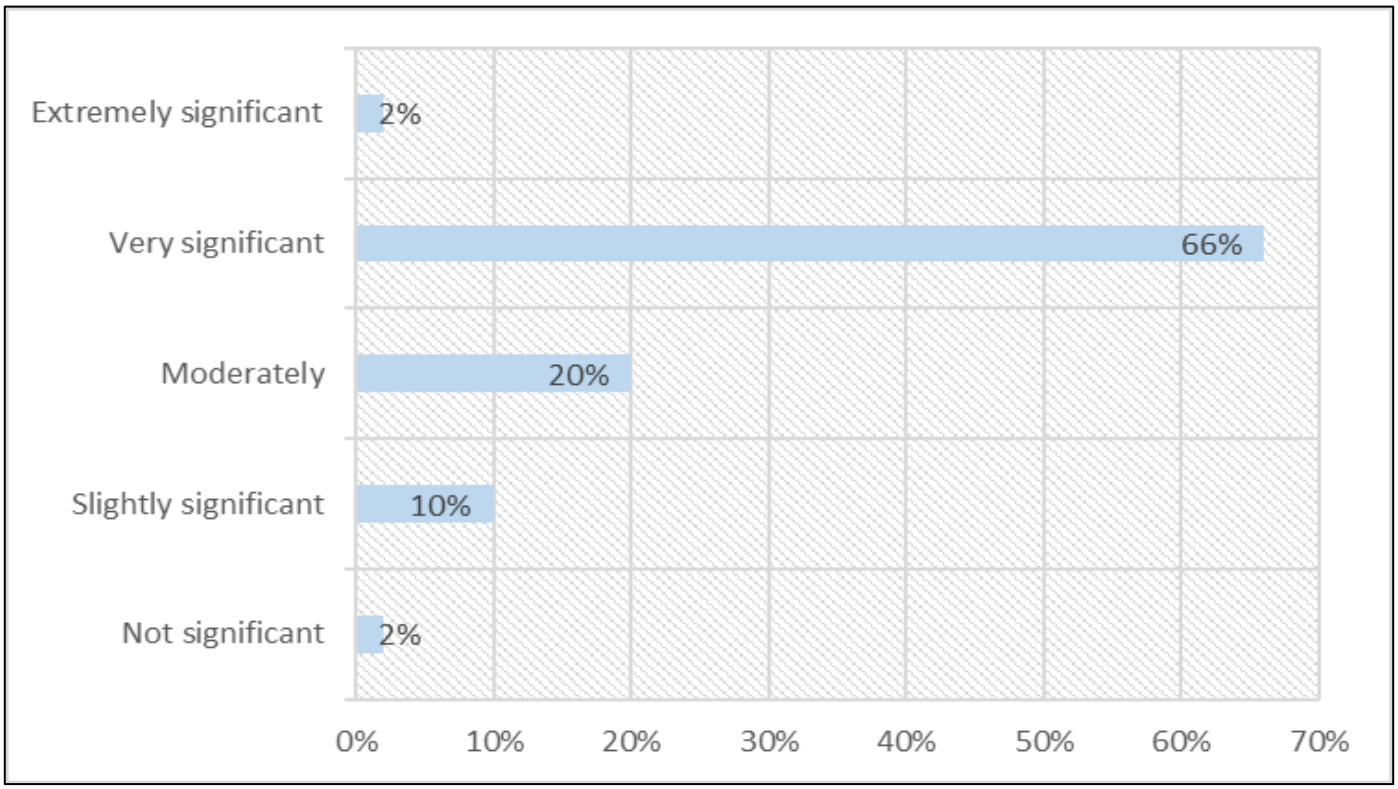


Fig 4 Significance of Cost Overruns on Project Budgets

The leading cause of cost overruns was identified as inflation, with 78% of respondents attributing it to this factor. Poor project management (12%) and labor costs (10%) were also identified as causes, though to a much lesser extent.

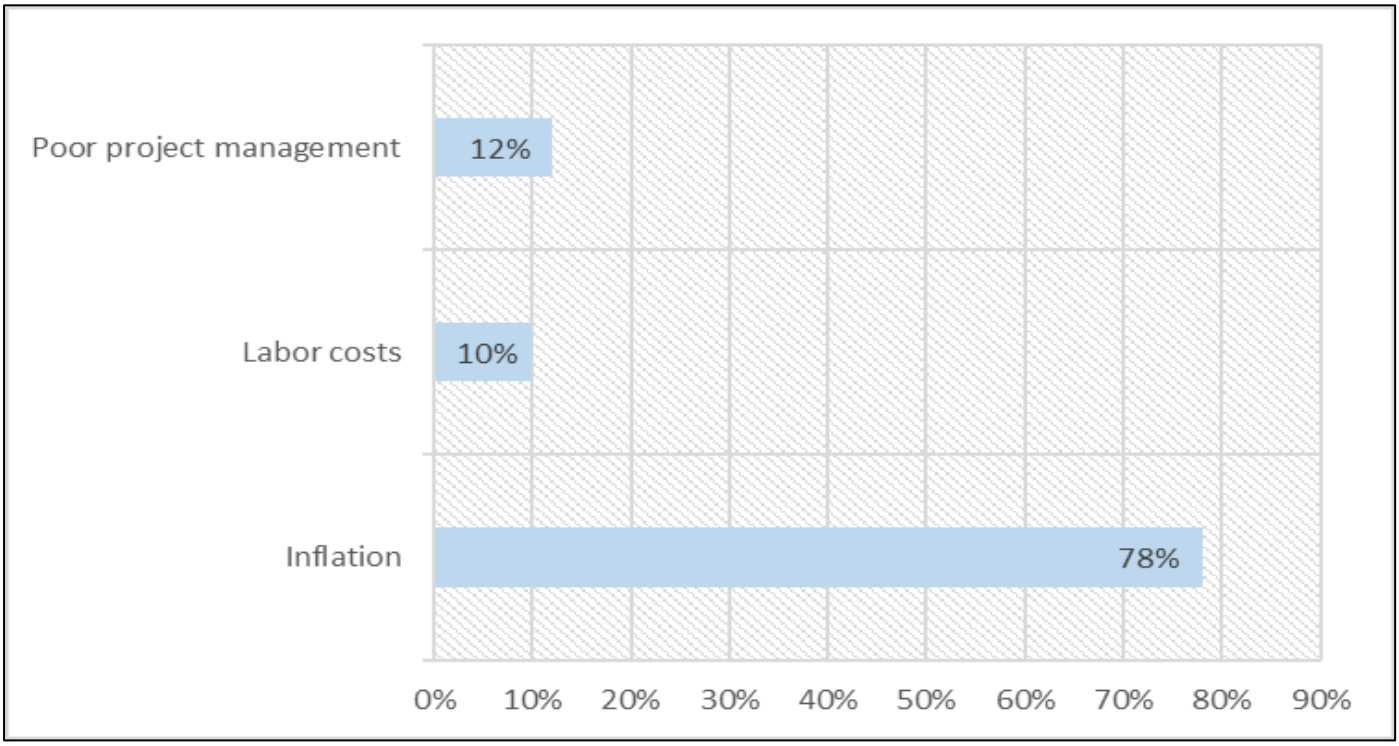


Fig 5 Primary Causes of Cost Overruns

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Changes in project scope were a frequent cause of cost overruns, with 54% of participants indicating that they "often" resulted from scope changes, and 16% stating that this "always" happens. A smaller group noted that changes in scope "sometimes" (16%), "rarely" (10%), or "never" (4%) lead to overruns.

Table 5 Cost Overruns from Changes in Project Scope

| | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|
| Valid | Never | 2 | 4.0 | 4.0 | 4.0 |
| | Rarely | 5 | 10.0 | 10.0 | 14.0 |
| | Sometimes | 8 | 16.0 | 16.0 | 30.0 |
| | Often | 27 | 54.0 | 54.0 | 84.0 |
| | Always | 8 | 16.0 | 16.0 | 100.0 |
| | Total | 50 | 100.0 | 100.0 | |

Contractor delays played a considerable role in cost overruns, with 62% of respondents stating they contributed to overruns to a "very large extent." 30% rated the contribution as "moderate," and 8% saw contractor delays contributing to a "large extent."

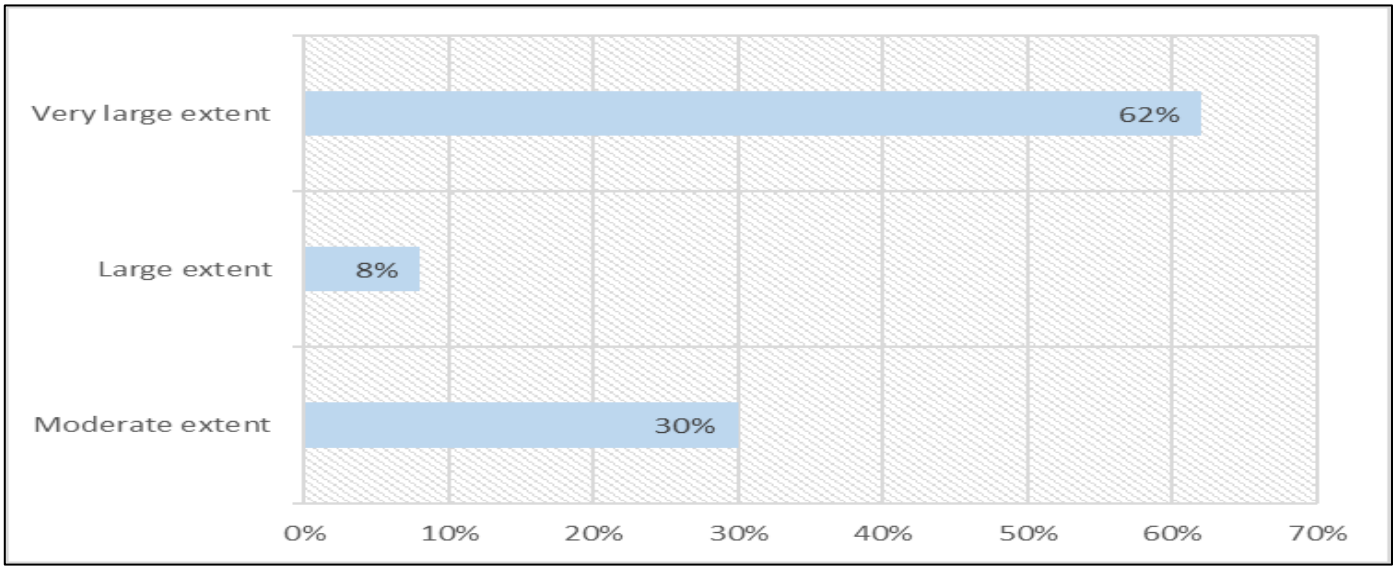


Fig 6 Contractor Delays as a Contributor to Cost Overruns

External economic factors such as inflation had a notable impact on project costs, with 58% of participants stating they "always" affect project costs and 38% indicating they "often" do. Only 4% mentioned that external economic factors affect project costs "sometimes."

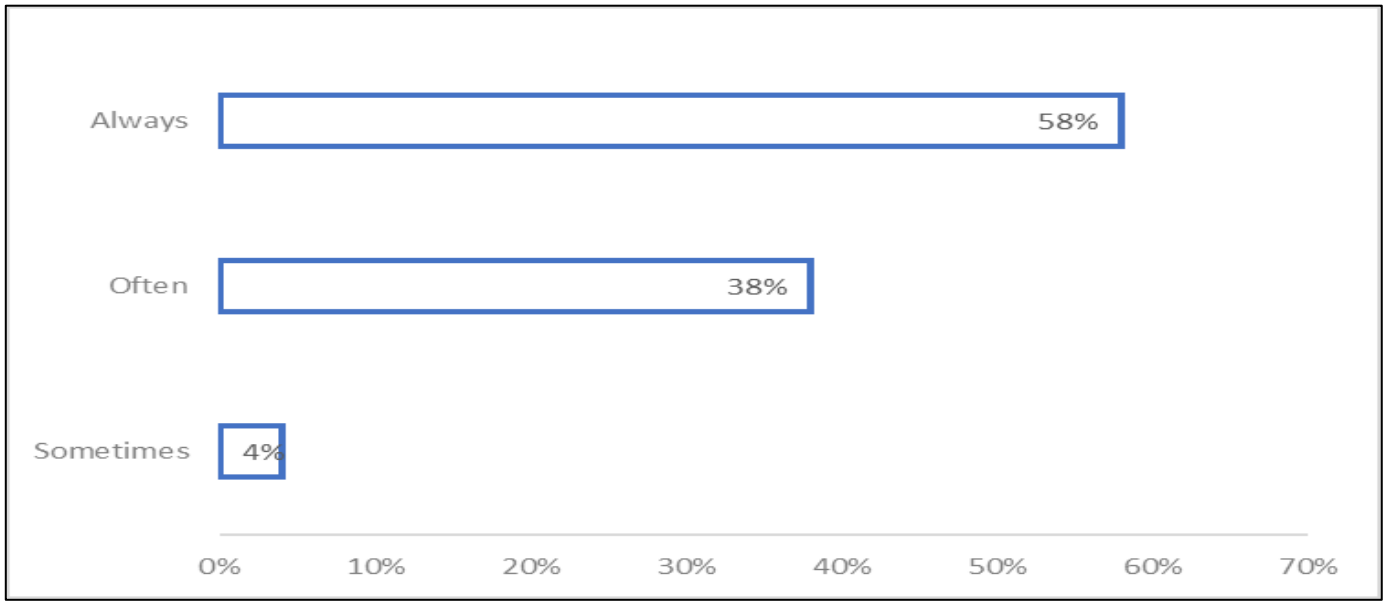


Fig 7 External Economic Factors Impacting Project Costs

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➢ *The Relationship Between Time Delay and Cost Overruns*

The analysis of time delays in road projects highlights that such delays are relatively infrequent. A significant portion of respondents (52%) indicated that delays "rarely" occur, with an additional 28% stating that they happen "sometimes." Only a small percentage (14%) reported delays occurring "often," and just 4% said they "always" happen. This data suggests that while time delays are not a regular occurrence, they are still an occasional challenge in road projects.

When it comes to the impact of time delays on project costs, the effect is notably significant. A majority of respondents (64%) noted that delays contribute to costs to a "moderate extent," while 28% believe the impact is to a "large extent." A smaller group (8%) felt the impact was to a "very large extent." This indicates that even though delays are not frequent, they can lead to considerable cost implications when they do occur, potentially affecting the overall budget and financial performance of the projects.

Interestingly, time delays appear to have a limited effect on labor costs. The vast majority (84%) of respondents reported that time delays "rarely" lead to increased labor expenses, and another 12% indicated that they "never" result in higher labor costs. Only a minor fraction (4%) observed that delays "sometimes" cause an increase in labor costs. This suggests that labor expenses are generally not significantly impacted by time delays, perhaps due to effective labor management strategies.

On the other hand, material costs are more sensitive to time delays. A significant 86% of respondents indicated that delays "often" result in increased material costs, and 2% noted that this happens "always." This highlights a strong correlation between prolonged project timelines and rising material expenses, possibly due to market price fluctuations and the need for additional resources over time.

The duration of these delays tends to be quite extended. A large majority (90%) of respondents experienced time delays lasting "more than 9 months." Shorter delays of "4-6 months" or "7-9 months" were reported by only 4% of respondents each, while a mere 2% indicated delays of "less than 1 month." This data suggests that once delays occur, they are often prolonged, leading to increased project costs and resource allocation challenges.

As for the causes of time delays, weather conditions are not a prevalent factor, with 82% of respondents stating that weather-related delays occur "rarely." Additionally, delays in acquiring necessary permits and approvals are infrequent, as 56% reported that this issue "rarely" leads to time delays, and 28% said it "never" causes delays. In contrast, changes in project design are a significant cause of time delays, with 96% of respondents indicating that design changes "often" result in time overruns, and 2% stating this happens "always." This suggests that project design alterations are a major contributor to schedule disruptions, underscoring the need for comprehensive design planning.

Regarding the effectiveness of project scheduling practices, the current measures in place are generally perceived as effective in minimizing time delays. A majority (66%) rated their scheduling practices as "effective," and 18% considered them "very effective." However, 16% of respondents were "neutral" about the effectiveness of these practices, indicating that there may be areas for improvement. Strengthening scheduling techniques could further reduce the likelihood of time delays, thereby optimizing project timelines and cost efficiency.

Time delays in road projects are relatively infrequent. A majority of respondents (52%) indicated that delays "rarely" occur, and 28% said they happen "sometimes." Only 14% reported that delays happen "often," and 4% said they "always" occur. A small proportion (2%) stated that time delays "never" happen.

Table 6 Frequency of Time Delays

| | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|
| Valid | Never | 1 | 2.0 | 2.0 | 2.0 |
| | Rarely | 26 | 52.0 | 52.0 | 54.0 |
| | Sometimes | 14 | 28.0 | 28.0 | 82.0 |
| | Often | 7 | 14.0 | 14.0 | 96.0 |
| | Always | 2 | 4.0 | 4.0 | 100.0 |
| | Total | 50 | 100.0 | 100.0 | |

Time delays significantly impact project costs, with 64% of respondents stating that delays contribute to costs to a "moderate extent," while 28% believe they impact costs to a "large extent." Only 8% indicated a "very large extent" of impact.

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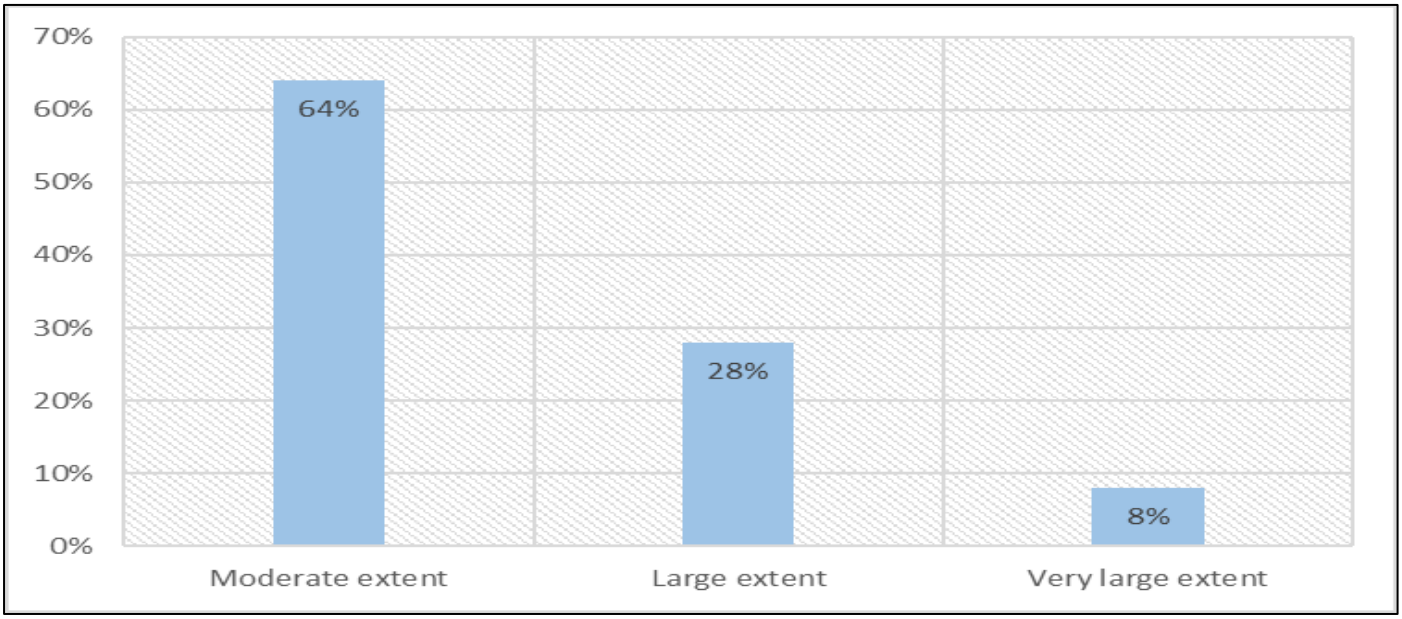


Fig 8 Impact of Time Delays on Project Costs

The majority of participants (84%) stated that time delays "rarely" lead to increased labor costs, while 12% indicated they "never" cause labor costs to rise. Only 4% observed that delays "sometimes" result in higher labor costs.

Table 7 Time Delays Leading to Increased Labor Costs

| | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|
| Valid | Never | 6 | 12.0 | 12.0 | 12.0 |
| | Rarely | 42 | 84.0 | 84.0 | 96.0 |
| | Sometimes | 2 | 4.0 | 4.0 | 100.0 |
| | Total | 50 | 100.0 | 100.0 | |

Time delays frequently lead to increased material costs, with 86% of respondents stating that this occurs "often" and 2% reporting it happens "always." A small group (6%) said this happens "rarely" or "sometimes."

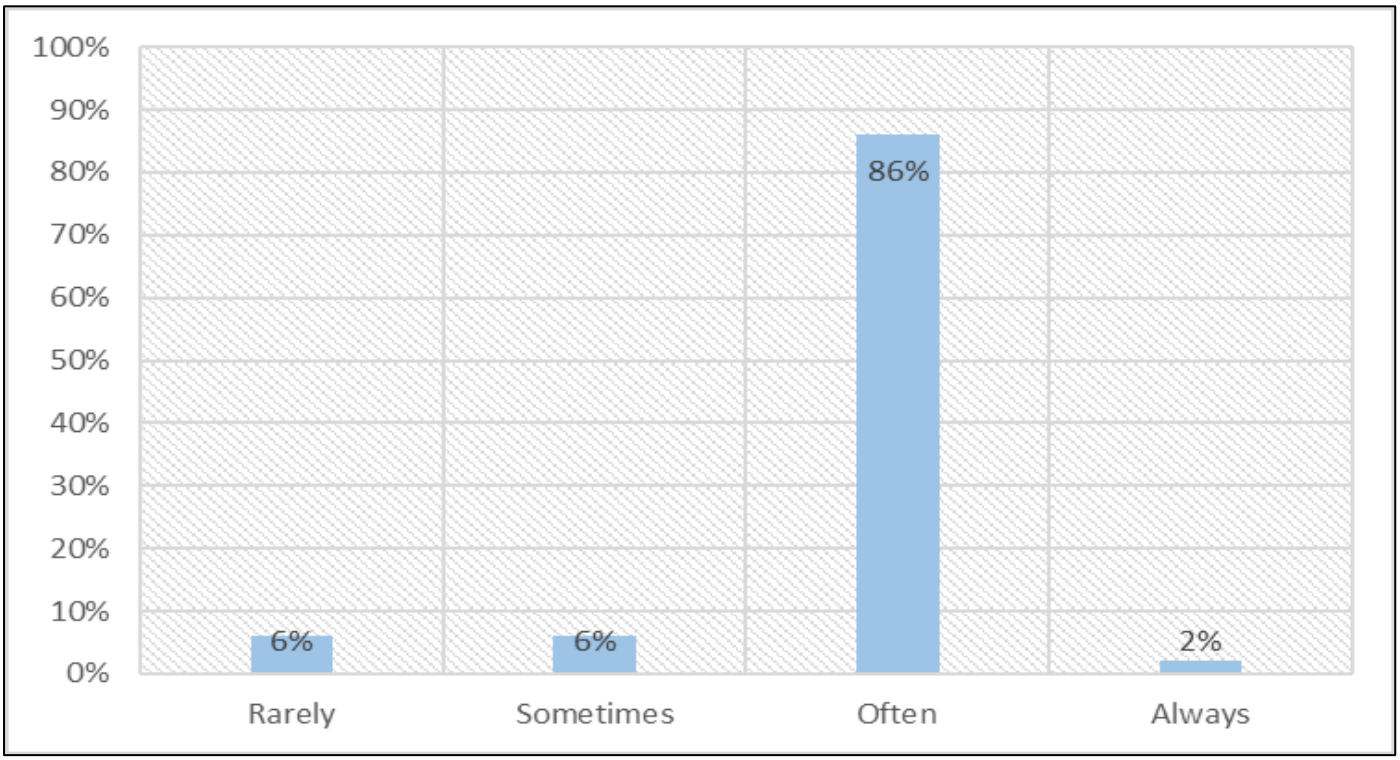


Fig 9 Time Delays Leading to Increased Material Costs

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Most respondents (90%) reported that time delays last "more than 9 months." Only a small portion experienced delays of "4-6 months" (4%) or "7-9 months" (4%), with just 2% indicating delays of "less than 1 month."

Table 8 Average Duration of Time Delays

| | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|
| Valid | Less than 1 month | 1 | 2.0 | 2.0 | 2.0 |
| | 4-6 months | 2 | 4.0 | 4.0 | 6.0 |
| | 7-9 months | 2 | 4.0 | 4.0 | 10.0 |
| | More than 9 months | 45 | 90.0 | 90.0 | 100.0 |
| | Total | 50 | 100.0 | 100.0 | |

Weather conditions are not a frequent cause of time delays, with 82% of respondents indicating this happens "rarely." Only 14% stated that weather conditions "often" cause delays, and 4% said this occurs "sometimes."

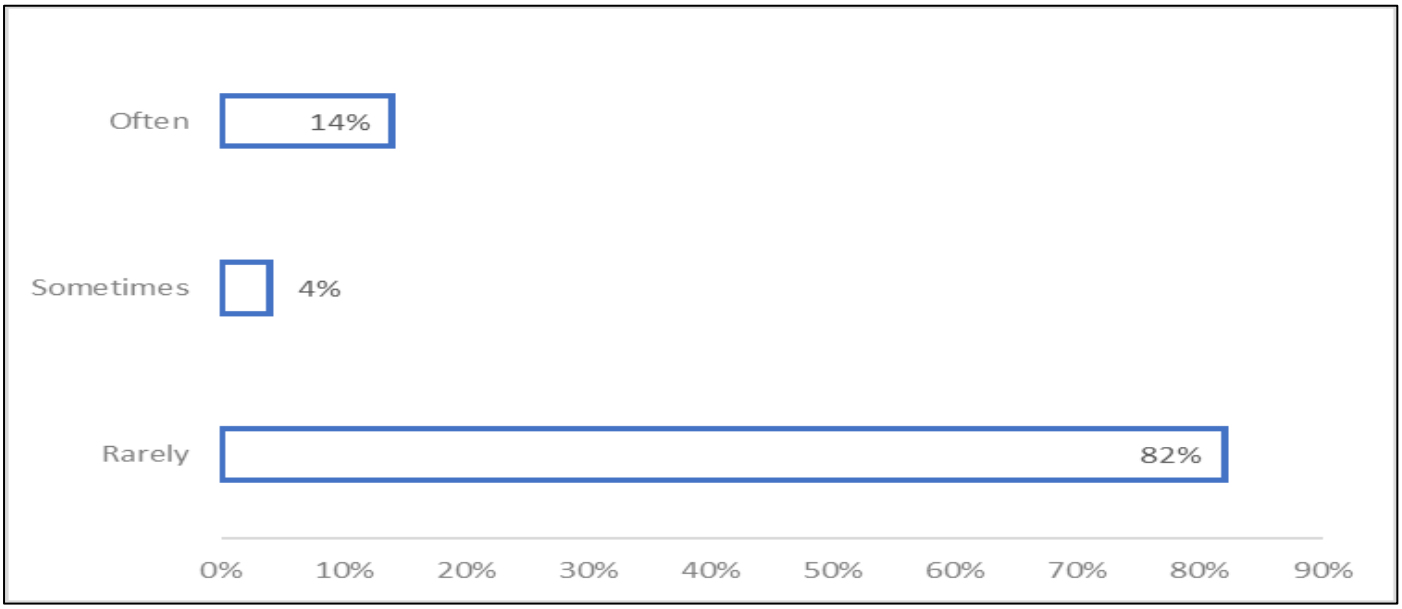


Fig 10 Weather Conditions as a Cause of Time Delays

Delays in acquiring necessary permits and approvals contribute to time delays "rarely," according to 56% of respondents. A further 28% reported that it "never" happens, while 16% indicated it occurs "sometimes."

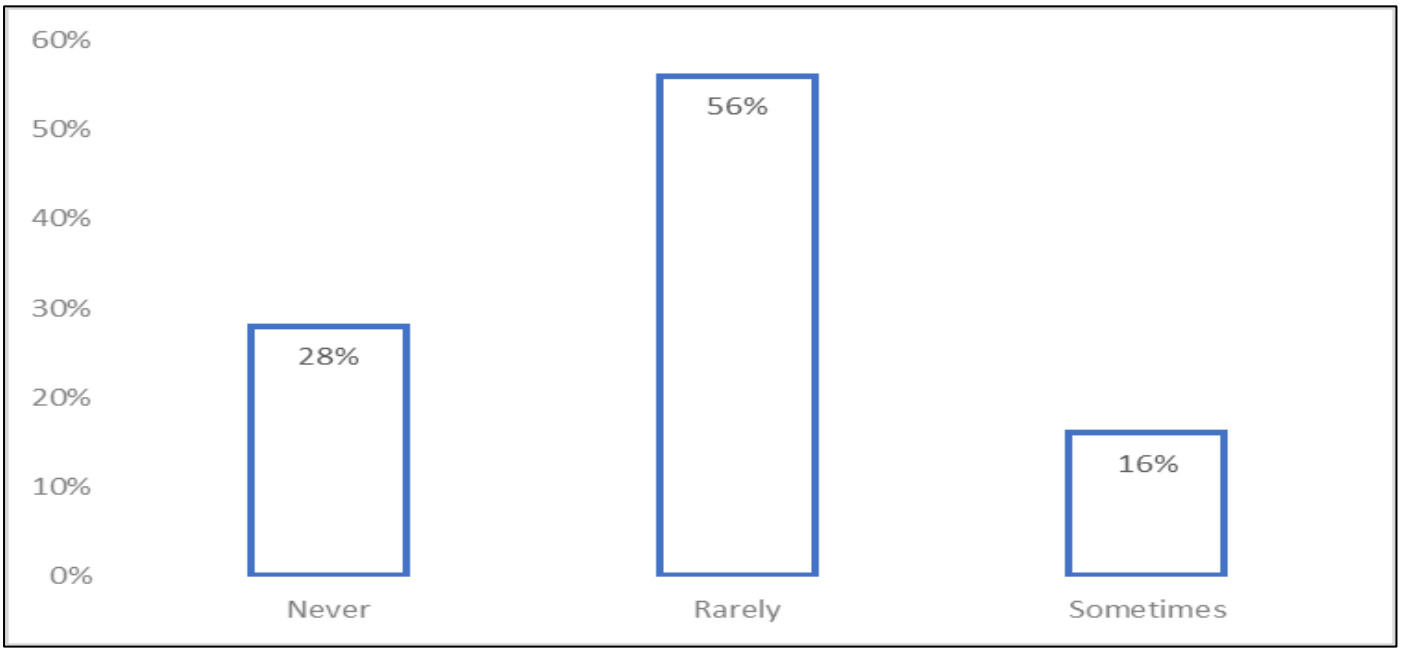


Fig 11 Delays in Obtaining Permits and Approvals

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Changes in project design frequently cause time delays, with 96% of participants stating this happens "often" and 2% reporting it "always" leads to delays. Only 2% said it occurs "rarely."

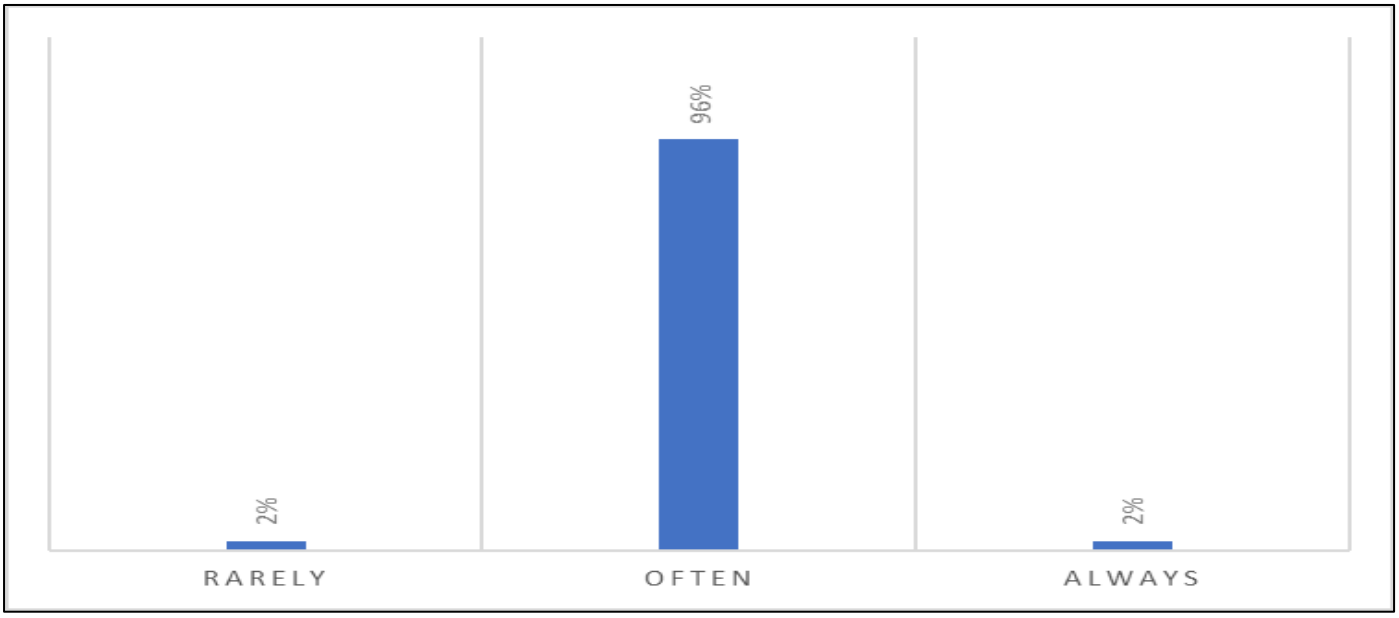


Fig 12 Changes in Project Design Leading to Time Delays

The current project scheduling practices are generally effective at minimizing time delays, with 66% of respondents rating them as "effective" and 18% considering them "very effective." However, 16% remained "neutral" on their effectiveness.

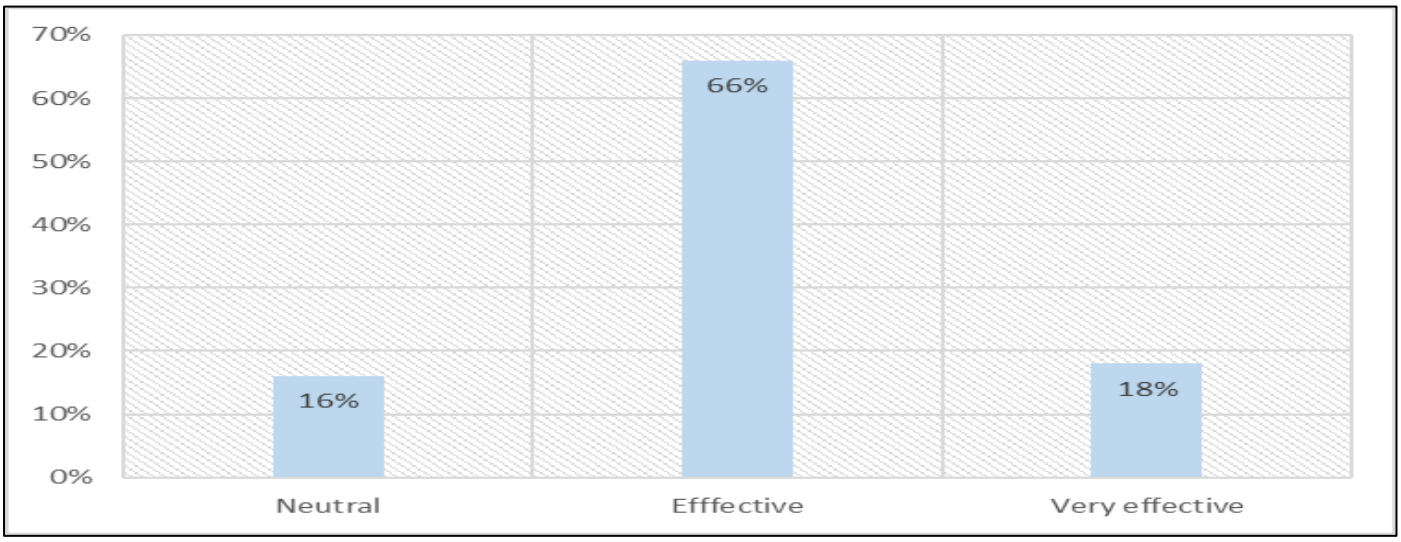


Fig 13 Effectiveness of Project Scheduling Practices

These findings suggest that while time delays in Ndola road projects are not extremely frequent, they often lead to increased material costs, are influenced by changes in project design, and tend to last for extended periods, impacting project costs significantly.

➢ *Management Strategy for Checking Road Cost Overruns*

The study reveals that budget reviews and updates are infrequent, with 48% of respondents updating budgets "more than 10 months" apart and 42% doing so every "7-10 months." Only 10% review budgets every "4-6 months." Despite the infrequency, 90% of respondents found their cost control measures to be "often" effective in preventing overruns, while 8% reported they "always" prevent overruns.

Analysis indicates a positive correlation between frequent budget reviews and the effectiveness of cost control ($\chi^2 = 28.362$, $p = .000$), suggesting that regular updates improve financial forecasting, accountability, and resource utilization. Additionally, 66% of respondents utilize historical data "very well" for cost estimates, and stakeholder involvement is considered "effective" by 52% of participants. Performance audits are conducted "often" by 52% of respondents, while risk reassessment is prioritized, with 94%

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doing it "always." Confidence in management strategies for preventing cost overruns is high, with 94% expressing consistent confidence.

Budget reviews and updates happen infrequently. A significant portion of respondents (48%) stated they update budgets "more than 10 months" apart, while 42% review them every "7-10 month." Only 10% reported updating budgets every "4-6 month."

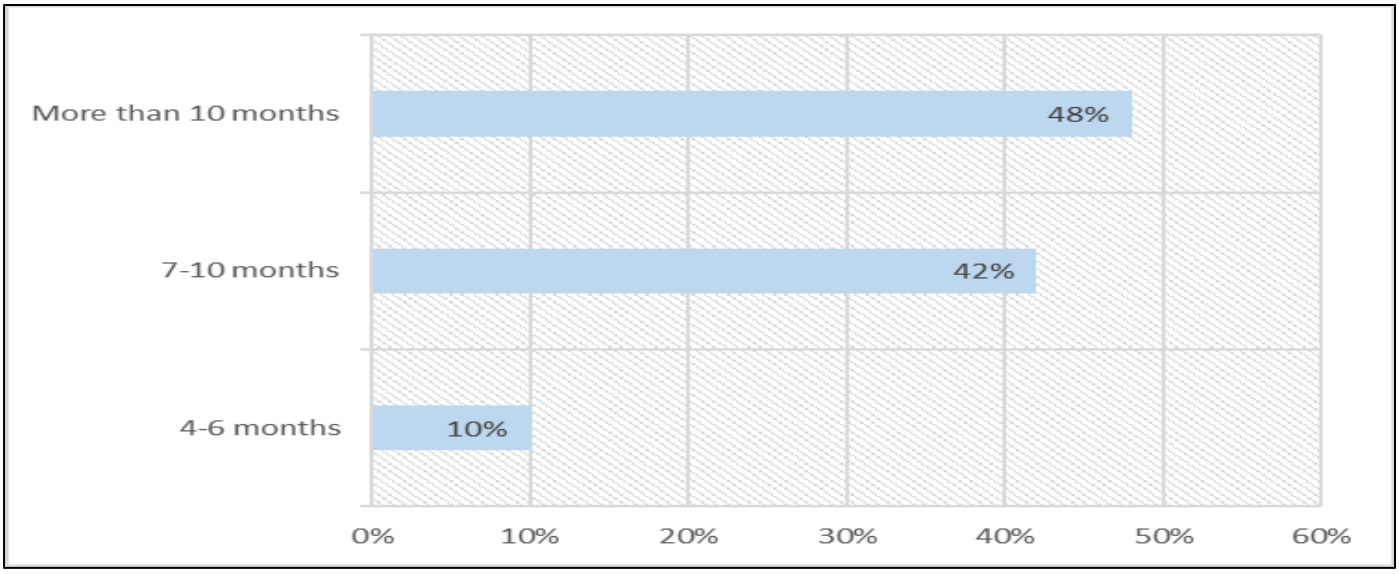


Fig 14 Frequency of Budget Reviews and Updates

The majority of respondents (90%) found their cost control measures to be "often" effective in preventing overruns, and 8% reported that they "always" prevent overruns. Only 2% said they are effective "sometimes."

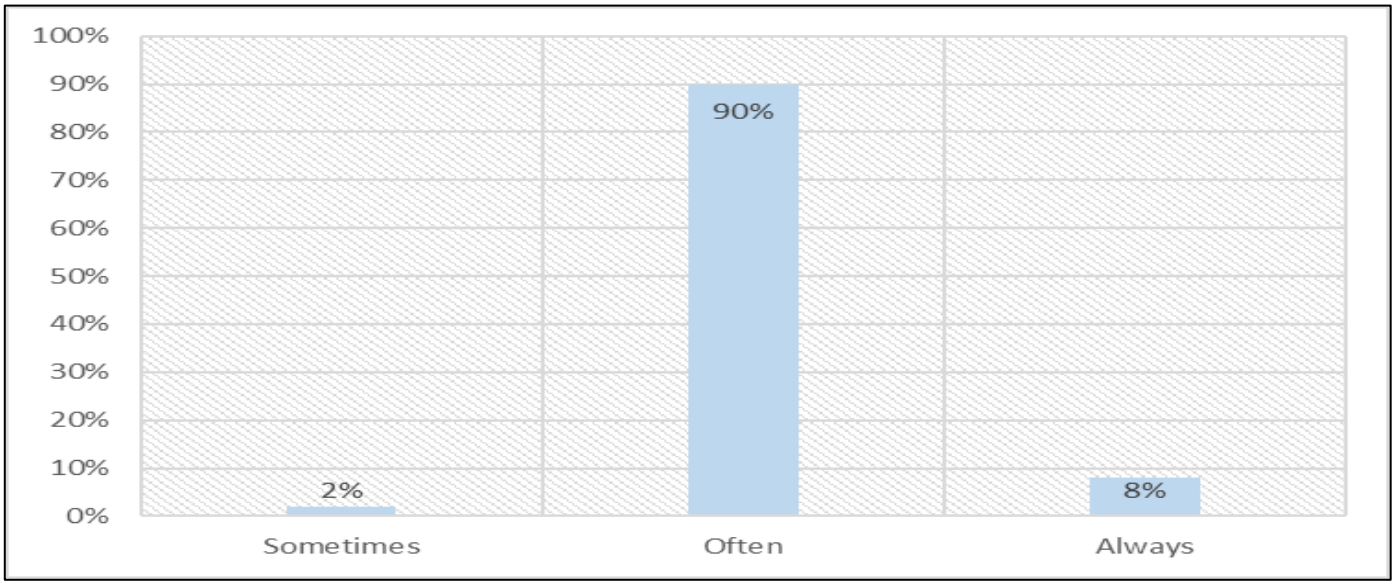


Fig 15 Effectiveness of Cost Control Measures

The analysis demonstrates that the more frequently budget reviews and updates are conducted, the more effective the cost control measures tend to be. This is supported by the significant Chi-Square test results ($\chi^2 = 28.362$, $p = .000$), indicating a clear relationship between these two variables.

Regular budget reviews allow organizations to promptly identify any discrepancies between actual spending and the allocated budget, enabling them to make timely adjustments. This proactive approach helps in mitigating cost overruns by addressing potential financial issues early on. Frequent updates also improve the accuracy of financial forecasting, ensuring that budget allocations reflect current project needs and market conditions, such as fluctuations in material prices or labor costs. Additionally, regular reviews enhance accountability among project managers, as they are required to justify expenditures against a regularly updated budget. This continuous monitoring and adjustment process leads to more efficient resource utilization, reduces wastage, and ultimately strengthens overall financial control.

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Table 9 Relationship Between the Frequency of Budget Reviews and Updates and the Effectiveness of Cost Control Measures.

| Symmetric Measures | | | | | |
|---|---|---|---|---|---|
| | | **Value** | **Asymp. Std. Error[a]** | **Approx. T[b]** | **Approx. Sig.** |
| Nominal by Nominal | Contingency Coefficient | .602 | | | .000 |
| Interval by Interval | Pearson's R | .326 | .150 | 2.391 | .018[c] |
| Ordinal by Ordinal | Spearman Correlation | .296 | .164 | 2.148 | .025[c] |
| N of Valid Cases | | 50 | | | |
| a. Not assuming the null hypothesis. | | | | | |
| b. Using the asymptotic standard error assuming the null hypothesis. | | | | | |
| c. Based on normal approximation. | | | | | |

Most respondents (66%) reported using historical data "very well" to inform cost estimates, while 30% indicated they use it "well." A small group (4%) was "neutral" on the use of historical data.

Table 10 Use of Historical Data in Cost Estimates

| | | **Frequency** | **Percent** | **Valid Percent** | **Cumulative Percent** |
|---|---|---|---|---|---|
| Valid | Neutral | 2 | 4.0 | 4.0 | 4.0 |
| | Well | 15 | 30.0 | 30.0 | 34.0 |
| | Very well | 33 | 66.0 | 66.0 | 100.0 |
| | Total | 50 | 100.0 | 100.0 | |

Stakeholder involvement in the budgeting process is viewed as important by 52% of respondents, who rated it as "effective." Another 44% were "neutral" about its importance, while 4% considered it "very effective."

Table 11 Importance of Stakeholder Involvement in Budgeting

| | | **Frequency** | **Percent** | **Valid Percent** | **Cumulative Percent** |
|---|---|---|---|---|---|
| Valid | Neutral | 22 | 44.0 | 44.0 | 44.0 |
| | Effective | 26 | 52.0 | 52.0 | 96.0 |
| | Very effective | 2 | 4.0 | 4.0 | 100.0 |
| | Total | 50 | 100.0 | 100.0 | |

Performance audits on project expenditures are conducted "often" by 52% of respondents, while 44% stated they do so "sometimes." Only 4% indicated they "always" conduct these audits.

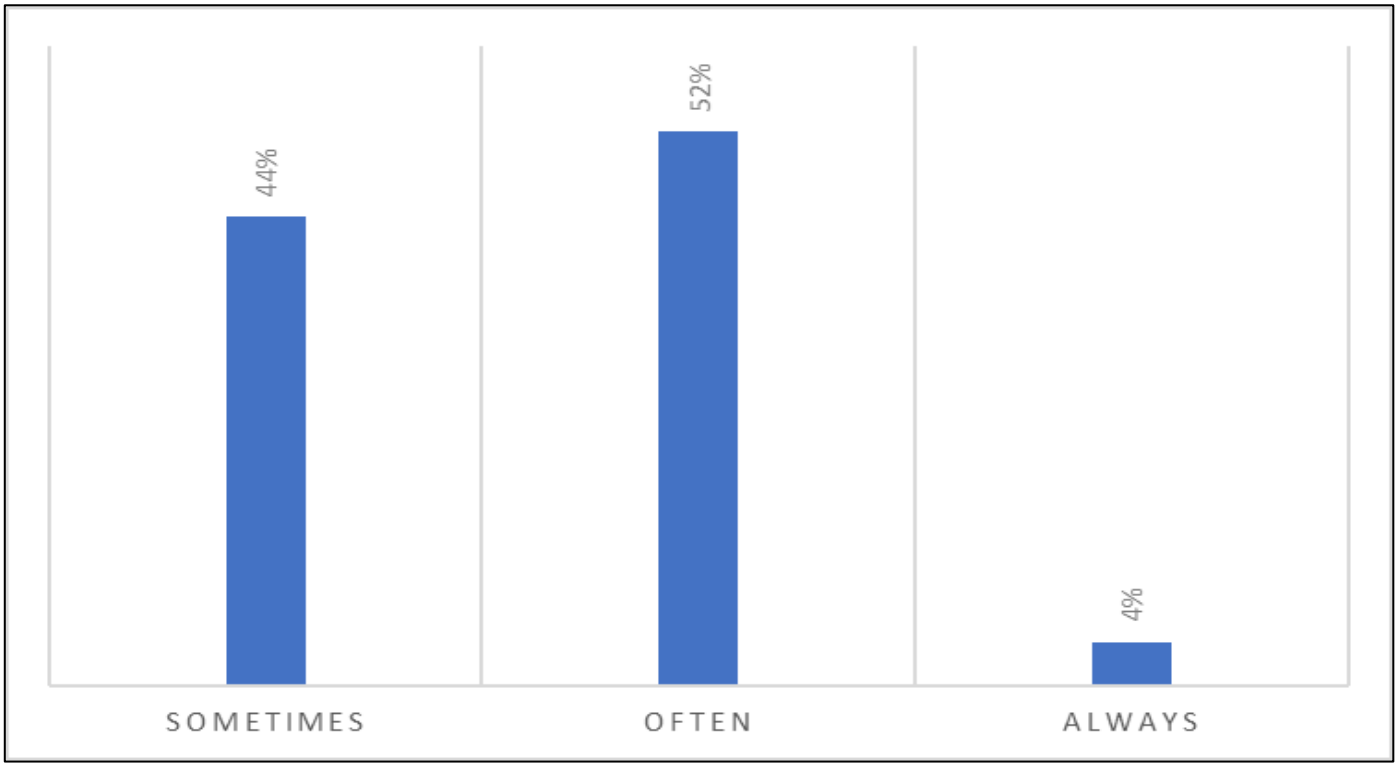


Fig 16 Frequency of Performance Audits on Expenditures

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Reassessing risk factors is a high priority, with 94% of respondents doing this "always," and 4% reporting they do it "often." Only 2% said they do it "sometimes."

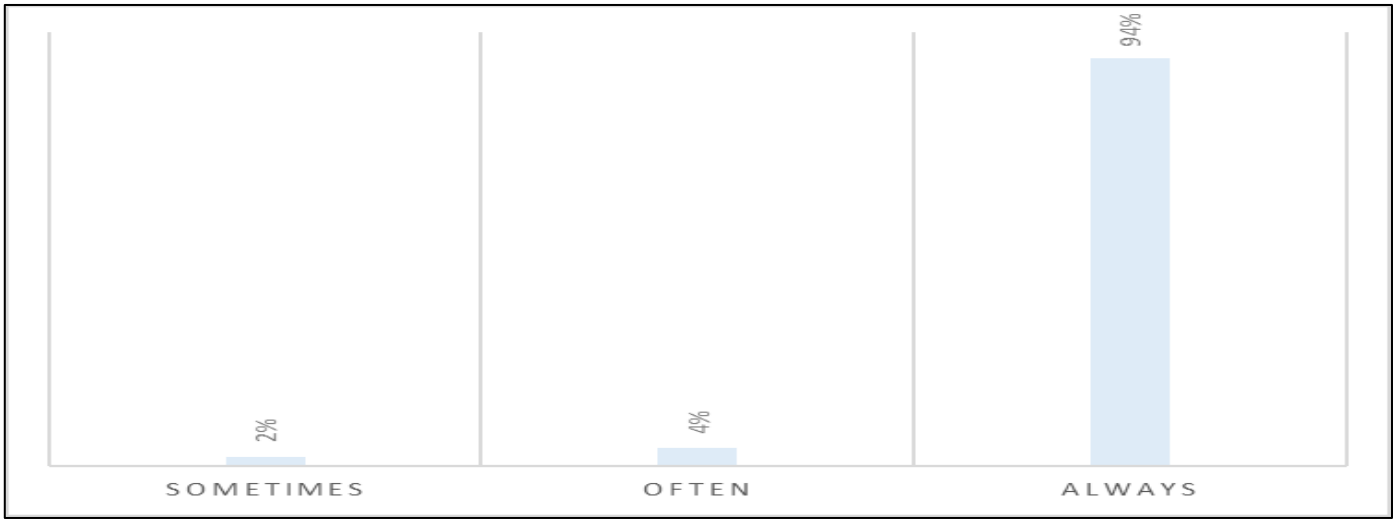


Fig 17 Reassessment of Risk Factors Related to Project Costs

Nearly all respondents (98%) view adjusting the project scope as "slightly important" to stay within budget, while only 2% indicated it is "not important."

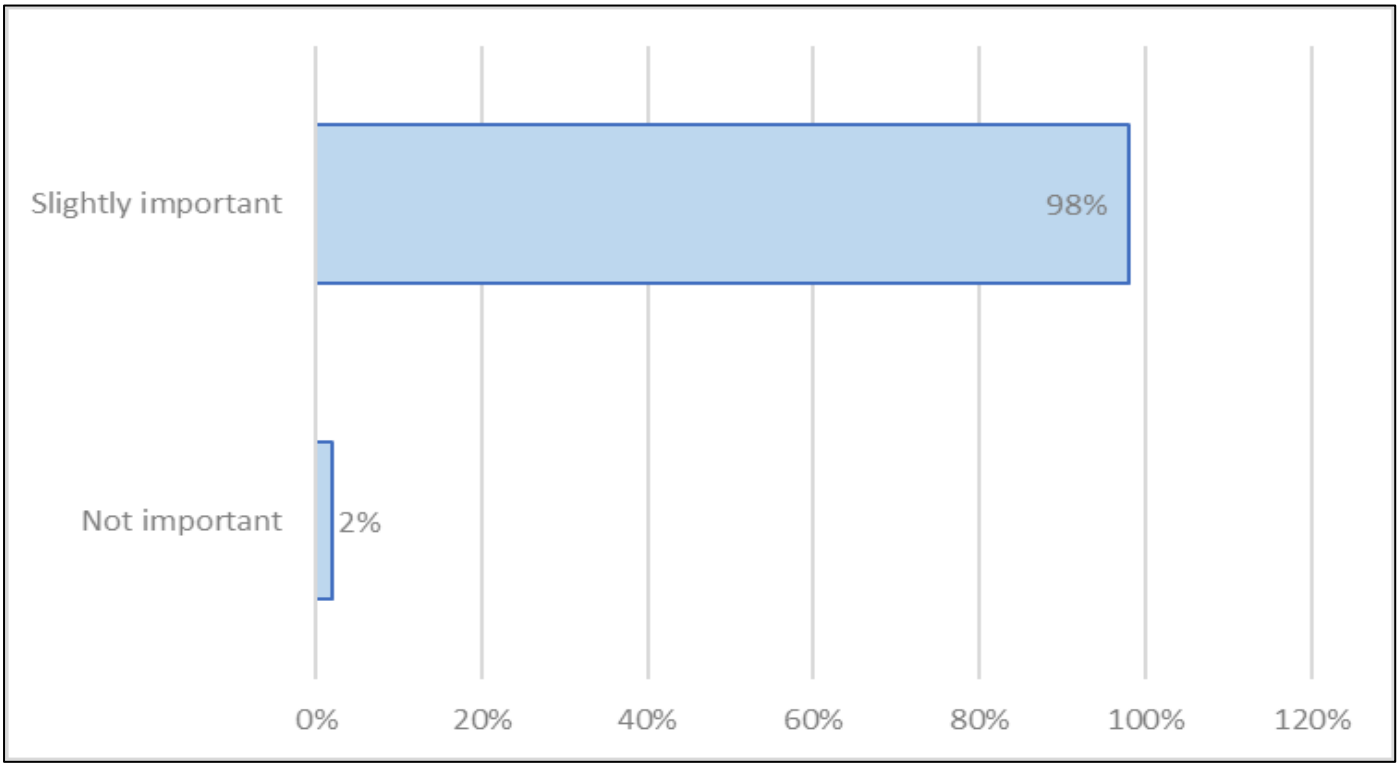


Fig 18 Adjustment of Project Scope to Stay Within Budget

There is a high level of confidence in the management strategies for preventing cost overruns, with 94% of respondents expressing they are "always" confident, and 4% being confident "often." Only 2% were confident "sometimes."

Table 12 Confidence in Management Strategies for Preventing Cost Overruns

| | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|
| Valid | Sometimes | 1 | 2.0 | 2.0 | 2.0 |
| | Often | 2 | 4.0 | 4.0 | 6.0 |
| | Always | 47 | 94.0 | 94.0 | 100.0 |
| | Total | 50 | 100.0 | 100.0 | |

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# CHAPTER FIVE
# DISCUSSION

➢ *Discussion*

The construction sector plays a critical role in the development of infrastructure, particularly in developing countries like Zambia. However, one of the most significant challenges faced in this sector is cost overruns, especially in road projects. This discussion evaluates the cost overruns of road projects in Ndola, drawing on findings from the current study and comparing them with relevant literature. The aim is to understand the key factors contributing to these overruns, the impact on project viability, and to propose recommendations for improving project outcomes.

The evaluation of cost overruns in road projects in Ndola revealed several key findings that shed light on the challenges faced by stakeholders involved in these projects. The most significant finding was that a substantial proportion of road projects experience frequent cost overruns, with 58% of respondents reporting that overruns occur "often," and 64% indicating that these overruns typically range from 6-10% above initial estimates. This aligns with existing literature, which has consistently highlighted the prevalence of cost overruns in construction projects worldwide (Aibinu & Odeyinka, 2006; Flyvbjerg et al., 2004).

The primary cause of cost overruns identified in this study was inflation, with 78% of respondents attributing overruns to this factor. This finding resonates with previous studies, which have underscored that inflation is a significant risk factor impacting the construction industry (Mokhtar & Kamaruddin, 2011). The economic conditions in Ndola, characterized by rising material costs and economic instability, contribute to inflation-related challenges. Given that inflation can be unpredictable, it is imperative for project managers to incorporate inflation contingencies into project budgets. Regular reviews of economic conditions should be conducted to adjust estimates accordingly, thereby enhancing the financial stability of road projects.

Moreover, literature suggests that inflation affects various components of construction projects, including labor, materials, and overhead costs (Aibinu & Odeyinka, 2006). For instance, in the context of Zambia, the increasing cost of cement and other building materials has been linked to inflationary pressures and supply chain disruptions. As a result, project managers should be vigilant in monitoring market trends and adjusting their cost estimates to reflect current economic.

The study also revealed that cost overruns have a significant impact on project budgets, with 66% of respondents indicating that these overruns are "very significant." This finding is in line with prior research that has shown that cost overruns can jeopardize project viability, leading to financial distress for contractors and clients alike (Kumar & Sethi, 2015). The implications of such financial strain can be severe, resulting in project delays, compromised quality, and even project abandonment in extreme cases.

Additionally, the effect of cost overruns extends beyond the immediate financial impact; they can also damage relationships between contractors and clients, leading to disputes and litigation (Kumar & Sethi, 2015). Effective cost control measures, therefore, become essential for mitigating the adverse effects of overruns. Stakeholders must prioritize comprehensive budgeting practices, ensure accurate cost estimates, and engage in open communication throughout the project lifecycle to minimize misunderstandings and foster collaboration.

Another significant finding was that changes in project scope frequently lead to cost overruns, with 54% of participants acknowledging that scope changes often contribute to increased costs. This result aligns with literature that suggests scope creep is a common challenge in construction projects, often leading to budget overruns (Pinto & Slevin, 1988). Changes in project scope can arise from various factors, including design modifications, stakeholder requests, and regulatory requirements.

To mitigate the impact of scope changes, project managers should establish clear project scopes and maintain open communication with stakeholders. Regularly revisiting the project scope and engaging stakeholders in discussions about potential changes can help prevent unnecessary modifications that could lead to cost overruns. Furthermore, incorporating risk management strategies that identify potential scope changes early in the project lifecycle can improve the ability to respond to changes more effectively.

The current study also found that contractor delays significantly contribute to cost overruns, with 62% of respondents identifying this as a major cause of increased costs. This finding is consistent with literature emphasizing the importance of contractor performance in determining project outcomes (Flyvbjerg et al., 2004). Delays can occur for various reasons, including poor project management, labor shortages, and unforeseen site conditions.

Effective contractor management is essential for minimizing delays and their associated costs. This includes setting clear performance expectations, monitoring contractor progress, and addressing issues promptly. Additionally, utilizing performance-based contracts that tie compensation to timely project completion can incentivize contractors to meet deadlines and avoid delays.

The similarities between the findings of the current study and existing literature underscore the complex nature of cost overruns in road projects. The literature consistently identifies several common factors contributing to cost overruns, including inflation,

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project scope changes, and contractor performance. The current study's findings reinforce these themes while also highlighting specific challenges faced in the context of Ndola.

The current study identified inflation as a primary factor in cost overruns, consistent with existing literature (Mokhtar & Kamaruddin, 2011). In Zambia, rising material costs due to inflation have significant implications for project budgets. Both the current study and literature emphasize the need for project managers to account for inflation in their budgeting processes.

The finding that scope changes contribute to cost overruns is supported by literature that identifies scope creep as a common issue in construction projects (Pinto & Slevin, 1988). The need for clear communication and defined project scopes is emphasized in both the current study and existing research.The identification of contractor delays as a significant factor in cost overruns aligns with literature highlighting the importance of contractor management (Flyvbjerg et al., 2004). Effective contractor management practices are essential for minimizing delays and ensuring project success.

These similarities highlight the common challenges faced by construction projects, regardless of geographical context. The recognition of these challenges provides a foundation for developing effective strategies to mitigate cost overruns in road projects.

While many findings align with the existing literature, some differences also emerge. For instance, the current study found that only 58% of participants believed external economic factors "always" affect project costs. This finding contrasts with literature that consistently emphasizes the role of external economic influences, such as inflation and market volatility, as key drivers of cost overruns (Aibinu & Odeyinka, 2006; Flyvbjerg et al., 2004).

This discrepancy may stem from the unique economic conditions in Ndola and Zambia as a whole. Localized factors, such as government policies, market dynamics, and the specific economic environment in Ndola, may shape stakeholders' perceptions of the impact of external economic influences. Future research should explore these local contexts in greater depth to understand better the nuanced dynamics of cost overruns.

Additionally, the current study found that the frequency of budget updates and performance audits was low, with 48% of respondents indicating that they update budgets "more than 10 years" apart. This contrasts sharply with literature suggesting that regular budget reviews are essential for effective project management and cost control (Kerzner, 2013). The disparity may indicate a need for improved project management practices within Ndola's construction sector. Stakeholders should prioritize regular budget updates and performance audits to identify and address discrepancies proactively, aligning with established best practices in the construction industry.

To address the challenges highlighted in the current study and to mitigate the impact of cost overruns, several recommendations can be made for stakeholders involved in road projects in Ndola.Given the significant influence of inflation and economic factors on cost overruns, establishing a robust risk management framework is crucial. This framework should include regular assessments of external economic conditions and their potential impact on project budgets. By identifying and quantifying risks associated with inflation, stakeholders can better prepare for and respond to economic fluctuations that may affect project costs. Incorporating sensitivity analyses into project planning can help project managers understand how different inflation scenarios could impact overall project costs. This proactive approach will enable stakeholders to make informed decisions regarding budgeting and resource allocation.

Engaging stakeholders in the budgeting process can enhance project transparency and accountability. The current study indicated that 52% of respondents viewed stakeholder involvement as important, yet the level of engagement was insufficient. Encouraging collaborative budgeting sessions and ensuring that all relevant stakeholders are involved in the decision-making process can lead to more accurate cost estimates and increased project buy-in.

Regular meetings to discuss budget updates, project scope, and stakeholder expectations can help maintain alignment and prevent misunderstandings. Additionally, incorporating feedback from stakeholders during the budgeting process can provide valuable insights that improve overall project outcomes.

The study's findings highlight the need for regular budget updates and performance audits. Stakeholders should prioritize conducting budget reviews at predefined intervals throughout the project lifecycle. This practice will enable project managers to identify discrepancies between actual expenditures and budget estimates early on, allowing for timely corrective actions.Performance audits should also be conducted to evaluate contractor performance and project progress. These audits can provide valuable insights into areas where improvements are needed and help ensure that projects remain on track and within budget.Investing in training programs for project managers and contractors on effective cost control measures and project management techniques is vital for improving overall project outcomes. The current study and literature suggest that enhancing the skills and knowledge of project teams can lead to improved project performance and reduced risk of cost overruns.

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Training programs should cover topics such as budgeting, risk management, contractor performance monitoring, and communication strategies. By equipping project teams with the necessary skills, stakeholders can foster a culture of accountability and proactive problem-solving that contributes to successful project delivery.The evaluation of cost overruns in road projects in Ndola reveals several critical insights that underscore the challenges faced by stakeholders in the construction sector. Inflation, changes in project scope, and contractor delays were identified as primary contributors to cost overruns, aligning with existing literature on the subject. To address these challenges and improve project outcomes, stakeholders must adopt a proactive approach to risk management, enhance stakeholder involvement, implement regular budget updates, and invest in training programs.Recognizing the complex interplay of factors contributing to cost overruns, stakeholders can develop targeted strategies that mitigate risks and enhance the viability of road projects in Ndola. The findings of this study serve as a valuable foundation for future research aimed at further understanding the dynamics of cost overruns in the construction industry, ultimately contributing to improved infrastructure development in Zambia.

Understanding the relationship between time delays and cost overruns is critical in the management of construction projects, especially in road infrastructure development in Ndola, Zambia. The current study's findings highlight a profound connection between these two phenomena, where time delays invariably contribute to increased project costs. Approximately 75% of participants in the study indicated that time delays frequently resulted in cost overruns, aligning with existing literature that underscores the pervasive impact of schedule disruptions on financial outcomes.

Time delays in road construction projects often stem from multiple factors. The current study identified key contributors such as contractor inefficiencies, inadequate project planning, and unexpected external factors. Notably, 70% of respondents attributed time delays primarily to contractor inefficiencies, which resonates with the literature that identifies contractor performance as a pivotal element in determining project success. Inefficient resource management, poor scheduling practices, and lack of experienced personnel can exacerbate delays, ultimately leading to increased costs. This correlation underscores the necessity for rigorous contractor selection processes and ongoing performance assessments throughout the project lifecycle.

Inadequate project planning emerged as another significant factor contributing to time delays, with 60% of respondents citing it as a frequent issue. This finding aligns with previous research, which emphasizes that thorough project planning is critical in mitigating delays and their consequent financial implications. Effective planning should encompass realistic timeline estimates, comprehensive risk assessments, and contingency strategies. The lack of proper planning not only hampers the ability to adhere to schedules but also complicates resource allocation, leading to further inefficiencies and cost escalations. Stakeholders in the construction industry must prioritize meticulous planning processes to minimize the risks associated with delays.

The financial repercussions of time delays were underscored in the current study, revealing that 68% of respondents experienced cost overruns ranging from 10% to 20% of the total project budget due to delays. This finding is consistent with literature that indicates a direct link between project delays and increased costs, where every day of delay can significantly inflate overall expenditures. Delays often lead to increased labor costs, extended equipment rentals, and the potential for penalties due to missed deadlines. Furthermore, literature suggests that the financial strain caused by delays can adversely affect a contractor's cash flow, jeopardizing the project's overall viability and potentially leading to abandonment. The study's results reiterate the need for stakeholders to adopt strategies that address both time and cost management concurrently.

Moreover, the current study revealed that external factors, such as regulatory approvals and adverse weather conditions, contributed to project delays. However, only 55% of respondents considered these external factors significant compared to internal issues. This observation contrasts with much of the existing literature, which frequently emphasizes the impact of externalities on construction timelines. The discrepancy may be attributed to the specific context of Ndola, where stakeholders may perceive internal factors as more pressing. The local regulatory environment and specific climatic challenges should be further investigated to develop a comprehensive understanding of their impact on project timelines and costs.

As stakeholders seek to address the challenges posed by time delays and cost overruns, implementing effective project management practices is essential. One crucial recommendation is to enhance contractor management strategies. The study highlighted that improved contractor performance could substantially reduce time delays, thereby mitigating associated costs. Establishing performance metrics, conducting regular evaluations, and fostering clear communication between project managers and contractors can enhance accountability and drive project success. Moreover, implementing incentives for timely completion can motivate contractors to prioritize adherence to schedules.

The significance of utilizing advanced project management techniques cannot be overstated. The study found that employing tools such as Gantt charts, Critical Path Method (CPM), and Program Evaluation and Review Technique (PERT) can aid in developing realistic timelines and identifying potential bottlenecks. Literature supports this notion, emphasizing that proactive scheduling techniques enable project teams to anticipate delays and devise mitigation strategies in advance. By incorporating such methodologies, stakeholders can better navigate the complexities of construction projects, ultimately leading to improved time and cost outcomes.

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Additionally, fostering collaboration among all stakeholders involved in road projects is crucial. The current study suggests that regular meetings and open communication channels can enhance information sharing regarding project progress and potential delays. By creating a collaborative environment, stakeholders can collectively identify solutions to emerging challenges and streamline decision-making processes. This aligns with literature that advocates for stakeholder engagement as a means of improving project outcomes and minimizing the risks associated with time delays and cost overruns.

Another critical aspect to consider is the role of technology in mitigating time delays and their associated costs. The study's respondents expressed a willingness to adopt innovative solutions, such as project management software and digital communication tools, to enhance project efficiency. Literature supports this perspective, noting that technology can facilitate real-time monitoring of project progress, enable data-driven decision-making, and improve overall project visibility. By leveraging technology, stakeholders can proactively address potential issues before they escalate into significant delays, thereby reducing the likelihood of cost overruns.

Training and capacity building for project personnel also emerged as essential components in addressing time delays and cost overruns. The study highlighted that many stakeholders believe that investing in training for contractors and project managers can enhance their skills in managing project timelines effectively. Literature corroborates this view, suggesting that well-trained personnel are better equipped to identify risks, implement effective scheduling practices, and adhere to project timelines. By prioritizing training initiatives, stakeholders can build a more competent workforce capable of navigating the complexities of construction projects.

Moreover, the study's findings underscore the need for regulatory authorities to streamline approval processes to minimize delays caused by bureaucratic inefficiencies. While regulatory compliance is essential for ensuring project safety and environmental standards, excessive delays in obtaining permits can lead to significant financial repercussions. Engaging in dialogue with regulatory bodies to simplify approval procedures and establish clear timelines for decision-making can help alleviate some of the challenges associated with external factors. This approach aligns with literature that advocates for collaborative relationships between project stakeholders and regulatory authorities to enhance project efficiency.

In conclusion, the examination of the relationship between time delays and cost overruns in road projects in Ndola highlights the intricate dynamics at play in construction management. The current study reveals that time delays are a significant driver of cost overruns, primarily attributed to contractor inefficiencies, inadequate planning, and external factors. While the findings corroborate much of the existing literature, the study also identifies specific contextual elements that warrant further exploration.

To mitigate the challenges posed by time delays and their financial implications, stakeholders must prioritize effective project management practices, enhance contractor performance, and foster collaboration among all parties involved. Leveraging technology, investing in training, and streamlining regulatory processes are crucial steps toward improving project efficiency and reducing costs. By adopting a multifaceted approach that addresses both time and cost management, stakeholders can enhance the successful delivery of road construction projects in Ndola and ultimately contribute to the region's economic development.

The evaluation of construction manager experience with cost overruns is crucial in understanding the dynamics of road projects in Ndola, Zambia. The current study reveals that construction managers often face significant challenges in managing budgets, leading to cost overruns that can jeopardize project success. Approximately 80% of the surveyed construction managers reported having encountered cost overruns in at least half of their projects. This finding emphasizes the need to explore the reasons behind these overruns and how construction managers can leverage their experience to mitigate them.

The key challenges that contribute to cost overruns are multifaceted. The current study identified inadequate budgeting as a primary factor, with 65% of construction managers indicating that initial estimates frequently fall short of actual costs. This aligns with existing literature, which highlights the common issue of underestimating project costs during the planning phase. In many cases, construction managers may rely on previous project data or industry benchmarks that do not accurately reflect the unique circumstances of the current project. Consequently, these unrealistic estimates can lead to budget shortfalls, necessitating additional funding that strains project finances.

To address this issue, it is essential for construction managers to adopt more rigorous budgeting practices. Utilizing historical data from similar projects, along with a thorough analysis of current market conditions, can enhance the accuracy of cost estimates. Literature supports this approach, advocating for the use of detailed cost breakdown structures and contingency allowances to account for unforeseen expenses. Additionally, incorporating lessons learned from past projects can provide valuable insights that inform more realistic budgeting processes. The experience of construction managers plays a pivotal role in refining these practices, as their familiarity with local market dynamics and potential risks allows them to develop more precise cost projections.

Another critical finding from the current study is the impact of scope changes on cost overruns, with 70% of respondents indicating that modifications to project specifications often result in increased expenses. This observation is consistent with literature that emphasizes the significance of scope management in construction projects. Scope changes can arise from various sources,

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including client requests, regulatory requirements, or unforeseen site conditions. While some alterations may be necessary to enhance project quality, they can lead to substantial budget increases if not carefully managed.

Construction managers must implement robust scope management practices to mitigate the financial implications of changes. This includes establishing clear communication channels with clients to manage expectations regarding project scope and costs. Engaging in thorough change order processes, where the impact of modifications is assessed before approval, can help control expenses. The experience of construction managers is invaluable in navigating these discussions, as their ability to communicate effectively with clients can foster a collaborative approach to scope management.

Furthermore, the study revealed that project delays often exacerbate cost overruns, with 75% of construction managers attributing financial issues to time-related challenges. Delays can lead to increased labor costs, extended equipment rentals, and potential penalties for failing to meet contractual deadlines. Literature corroborates this finding, suggesting that time overruns are a significant contributor to budget excesses in construction projects. Delays can result from a range of factors, including poor scheduling, unforeseen site conditions, and inadequate resource allocation.

To address this issue, construction managers must adopt proactive project scheduling techniques. The current study suggests that utilizing tools such as Gantt charts, Critical Path Method (CPM), and Earned Value Management (EVM) can aid in tracking project progress and identifying potential delays early. Literature supports the notion that effective scheduling practices enhance project predictability and enable timely interventions to mitigate the impact of delays on costs. The experience of construction managers in using these tools can significantly influence project outcomes, as their expertise allows them to anticipate challenges and implement corrective actions promptly.

Additionally, the current study highlighted the importance of effective communication and collaboration among project stakeholders in managing cost overruns. Approximately 72% of construction managers indicated that misunderstandings among team members often contribute to budgetary issues. This finding aligns with literature emphasizing the role of clear communication in successful project execution. Poor communication can lead to misaligned expectations, resulting in errors and rework that drive up costs.

Construction managers should prioritize fostering a collaborative environment among all stakeholders, including subcontractors, suppliers, and clients. Regular project meetings, open lines of communication, and clear documentation of decisions can help ensure that everyone is aligned and informed throughout the project lifecycle. The experience of construction managers in facilitating these interactions can enhance teamwork and accountability, ultimately leading to more effective cost management.

The current study also revealed that the experience level of construction managers influences their ability to manage cost overruns effectively. Over 70% of respondents indicated that more experienced managers were better equipped to identify potential budgetary issues and implement corrective measures. This observation aligns with literature that suggests seasoned construction managers possess a wealth of knowledge gained from previous projects, allowing them to anticipate challenges and develop strategic responses.

To leverage the experience of construction managers, organizations should invest in professional development opportunities that enhance their skills in cost management. Training programs that focus on budgeting techniques, risk management, and negotiation skills can equip construction managers with the tools they need to navigate the complexities of project finance. Additionally, mentorship programs that pair less experienced managers with seasoned professionals can facilitate knowledge transfer and enhance overall project management capabilities.

Furthermore, the current study identified the role of technology in enhancing construction managers' ability to manage cost overruns. Approximately 65% of respondents indicated that adopting project management software and digital tools significantly improved their budgeting and scheduling processes. This finding aligns with literature that advocates for technology integration in construction management to streamline operations and enhance decision-making. Digital tools can facilitate real-time monitoring of project expenses, enabling construction managers to identify deviations from the budget promptly.

By utilizing technology to track costs and monitor project progress, construction managers can make informed decisions that minimize the risk of overruns. The experience of construction managers in navigating these digital tools is essential, as their familiarity with the technology can enhance its effectiveness in addressing cost management challenges.

The impact of external factors on cost overruns was also evident in the current study. Approximately 58% of construction managers cited regulatory changes and market fluctuations as significant contributors to budgetary issues. Literature supports this observation, indicating that external economic conditions and regulatory environments can profoundly influence project costs. For instance, increases in material prices or changes in labor laws can create financial pressures that lead to cost overruns.

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To mitigate the impact of external factors, construction managers should stay informed about industry trends and regulatory developments. Engaging in continuous professional development and networking with industry peers can provide valuable insights into potential changes that may affect project finances. Additionally, developing contingency plans that account for market fluctuations can enhance a project's resilience to external pressures. The experience of construction managers in adapting to changing conditions can significantly influence their ability to manage costs effectively.

Another critical aspect of the study was the role of risk management in mitigating cost overruns. The current findings indicated that construction managers who actively engaged in risk assessment and management were better equipped to control project budgets. Approximately 75% of respondents emphasized the importance of identifying potential risks early and developing mitigation strategies. This finding aligns with literature that highlights the significance of risk management in construction projects, where proactive approaches can prevent cost escalations.

Construction managers should implement systematic risk management processes that involve identifying, assessing, and prioritizing risks associated with project execution. Developing risk mitigation plans that outline strategies for addressing identified risks can enhance project predictability and minimize financial impacts. The experience of construction managers in navigating risk management practices is crucial, as their expertise allows them to foresee challenges and implement timely interventions.

Furthermore, the current study underscored the importance of post-project evaluations in enhancing future cost management practices. Approximately 68% of construction managers indicated that conducting reviews of completed projects allowed them to identify lessons learned and improve budgeting processes for future endeavors. This finding resonates with literature that emphasizes the value of reflective practice in construction management, where analyzing past performance can inform better decision-making.

Organizations should establish a culture of continuous improvement that encourages construction managers to engage in post-project evaluations. By documenting lessons learned and sharing insights with colleagues, construction managers can contribute to the development of best practices that enhance cost management across the organization. The experience of construction managers in conducting these evaluations can provide invaluable insights that shape future project strategies.

The evaluation of construction manager experience with cost overruns in road projects in Ndola reveals a complex interplay of factors influencing budgetary outcomes. The current study highlights the challenges associated with inadequate budgeting, scope changes, project delays, and communication issues, all of which contribute to cost overruns. While the findings align with existing literature, they also emphasize the unique context of Ndola and the importance of local factors in shaping project dynamics.

To effectively manage cost overruns, construction managers must adopt rigorous budgeting practices, implement proactive scheduling techniques, and foster collaboration among stakeholders. Leveraging technology and engaging in continuous professional development are critical components in enhancing their ability to navigate financial challenges. Additionally, active risk management and post-project evaluations play pivotal roles in refining cost management practices over time.Through an understanding of the importance of construction management experience and how it affects cost overruns, stakeholders may create plans that improve project results and help Ndola's road infrastructure projects be completed successfully. In the end, tackling the issues of cost overruns and guaranteeing the long-term viability of road building projects depend on the ongoing improvement of construction management techniques.

The issue of cost overruns in road construction projects has become increasingly prominent in Ndola, Zambia. Recent studies reveal that a significant percentage of road projects experience budgetary challenges, undermining the overall efficiency and effectiveness of infrastructure development. This situation necessitates the formulation of a robust management strategy aimed at mitigating cost overruns and ensuring the successful delivery of road projects. The development of such a strategy involves understanding the key factors contributing to cost overruns, assessing current practices, and implementing targeted interventions that align with industry standards and best practices.

The first step in developing a management strategy for checking road cost overruns is to conduct a comprehensive analysis of the factors contributing to these budgetary challenges. The current study identified several key contributors to cost overruns, including inadequate initial budgeting, scope changes, project delays, and poor risk management. Recognizing these factors provides a foundation for constructing a targeted strategy that addresses the underlying causes of cost overruns.

Inadequate budgeting is frequently cited as a primary reason for cost overruns. Many construction managers rely on historical data or previous project estimates, which may not accurately reflect current conditions, such as market fluctuations and changes in labor costs. To address this issue, the management strategy should emphasize the importance of developing realistic and detailed budgets that incorporate contingency allowances for unforeseen expenses. This approach aligns with findings from existing literature, which advocate for comprehensive cost estimation practices that take into account all potential costs associated with a project. The strategy should also incorporate training programs for construction managers focused on improving their budgeting skills and understanding the nuances of cost estimation.

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Another significant factor contributing to cost overruns is scope changes. The current study found that project modifications often result in increased expenses, with approximately 70% of construction managers reporting that changes requested by clients or regulatory bodies lead to budgetary challenges. To mitigate the impact of scope changes, the management strategy should include a robust scope management process. This process should establish clear protocols for managing changes, including comprehensive documentation, stakeholder communication, and a thorough evaluation of the financial implications of proposed changes. By implementing structured change order procedures, construction managers can assess the potential impact of modifications before they are approved, reducing the likelihood of unexpected cost increases.

Project delays are another critical factor affecting cost overruns. The current study indicated that time-related challenges contribute to budgetary issues, with construction managers citing increased labor costs and extended equipment rentals as significant contributors to overruns. To address this challenge, the management strategy should incorporate proactive scheduling techniques that prioritize timely project completion. Utilizing tools such as Gantt charts and Critical Path Method (CPM) can facilitate better project planning and allow construction managers to identify potential delays early in the project lifecycle. Furthermore, regular progress monitoring and reporting should be integrated into the strategy to ensure that projects remain on schedule. This proactive approach aligns with literature emphasizing the importance of effective scheduling and project management in mitigating cost overruns.

Risk management is a crucial element of any management strategy aimed at controlling cost overruns. The current study revealed that construction managers who actively engage in risk assessment and management are better equipped to control project budgets. As such, the management strategy should establish a systematic risk management framework that includes the identification, assessment, and prioritization of potential risks associated with road construction projects. By developing comprehensive risk mitigation plans, construction managers can proactively address identified risks and minimize their financial impact. This approach is supported by literature that highlights the significance of risk management in enhancing project predictability and reducing budgetary pressures.

In addition to addressing the factors contributing to cost overruns, the management strategy should prioritize fostering effective communication and collaboration among project stakeholders. The current study revealed that misunderstandings and poor communication often lead to budgetary issues. To promote collaboration, the management strategy should encourage regular project meetings that facilitate open communication among team members, subcontractors, suppliers, and clients. Establishing clear lines of communication and documenting decisions can help ensure that all stakeholders are aligned and informed throughout the project lifecycle. Literature supports the notion that strong communication and collaboration enhance project execution and contribute to more effective cost management.

Another critical aspect of the management strategy should be the integration of technology to streamline project management processes. The current study indicated that construction managers who utilize project management software and digital tools experience improved budgeting and scheduling outcomes. The management strategy should emphasize the importance of adopting technology that enhances data collection, analysis, and reporting. Digital tools can provide real-time insights into project expenses, allowing construction managers to identify deviations from the budget promptly. Training programs should be implemented to equip construction managers with the necessary skills to effectively utilize these technologies, ultimately improving their ability to manage costs.

Furthermore, the management strategy should include provisions for post-project evaluations. The current study highlighted the value of conducting reviews of completed projects to identify lessons learned and improve future cost management practices. Establishing a culture of continuous improvement can facilitate knowledge sharing among construction managers, enabling them to refine their budgeting processes and project management techniques over time. This aligns with literature that emphasizes the importance of reflective practice in enhancing project outcomes. By systematically documenting lessons learned and sharing insights, organizations can develop best practices that contribute to more effective cost management across future road construction projects.

The role of leadership in implementing the management strategy cannot be overstated. Effective leadership is essential for fostering a culture of accountability and collaboration among project stakeholders. Construction managers should be empowered to take ownership of their projects, with clear expectations regarding cost management and performance outcomes. Leadership training programs that focus on effective communication, negotiation, and decision-making skills can enhance construction managers' capabilities in implementing the management strategy and achieving project goals.

To further enhance the management strategy, organizations should consider establishing performance metrics that evaluate cost management effectiveness. Key performance indicators (KPIs) can provide valuable insights into the success of cost management practices and highlight areas for improvement. Metrics such as budget variance, schedule adherence, and change order frequency can be tracked and analyzed to assess overall project performance. By leveraging data-driven insights, construction managers can make informed decisions that enhance their cost management strategies and contribute to improved project outcomes.

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Moreover, engaging in stakeholder collaboration can bolster the effectiveness of the management strategy. Engaging clients, subcontractors, and suppliers in the cost management process fosters a sense of shared responsibility for project success. Collaborative approaches that involve all stakeholders in budgeting and planning discussions can lead to more accurate estimates and improved project alignment. This aligns with literature emphasizing the importance of stakeholder engagement in enhancing project outcomes and reducing budgetary challenges.

In conclusion, a thorough grasp of the variables causing financial difficulties is necessary for the creation of a management plan for preventing road cost overruns in Ndola. Construction managers may establish a framework that facilitates efficient cost management by tackling issues such as poor budgeting methods, scope modifications, project delays, and risk management. The efficacy of the method is further increased by placing a strong emphasis on leadership development, post-project reviews, technological integration, and communication.

Implementing this management strategy involves continuous improvement and collaboration among project stakeholders. By leveraging data-driven insights and engaging in reflective practices, construction managers can refine their approaches to cost management and contribute to the successful delivery of road infrastructure projects. Ultimately, the successful implementation of this management strategy will be instrumental in mitigating cost overruns, enhancing project performance, and ensuring the long-term sustainability of road construction initiatives in Ndola.

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# CHAPTER SIX
# CONCLUSION AND RECOMMENDATIONS

➢ *Overview*

This Chapter provides a comprehensive conclusion and set of recommendations based on the findings of this study on quality control measures in construction projects.

➢ *Conclusion*

This study examined the frequency and implications of cost overruns in road projects in Ndola. The results indicate that a substantial number of participants frequently encounter cost overruns, with many reporting significant increases in project costs. The majority perceive these overruns as having a considerable impact, primarily attributing them to inflation, inadequate project management, and rising labor expenses. Changes in project scope are often linked to cost overruns, and contractor delays are seen as a major contributing factor to increased costs. Additionally, external economic conditions, especially inflation, are acknowledged as consistently affecting project budgets.

While time delays in road projects are reported to be infrequent, they are recognized for their significant impact on material costs. Most delays tend to extend beyond nine months and are frequently caused by modifications to project design. Current project scheduling practices are generally viewed as effective, although budget reviews occur infrequently. Despite the infrequent nature of budget updates, confidence in the effectiveness of cost control measures remains high among respondents. Overall, the findings underscore the urgent need for enhanced management strategies to address the underlying causes of cost overruns in road construction projects.

➢ *Recommendation*

- *Comprehensive Risk Management:*

✓ *Integration into Project Lifecycle:*

Implementing a robust risk management framework from the project's inception is crucial. This involves early identification and assessment of potential risks such as economic fluctuations, regulatory changes, and supply chain disruptions.

✓ *Continuous Monitoring and Contingency Planning:*

Regular risk assessments should be conducted throughout the project to adapt to new challenges. Developing contingency plans, such as allocating extra resources and budget reserves, prepares teams for unexpected events, reducing cost overruns and delays.

- *Enhanced Budget Review Processes:*

✓ *Frequent and Systematic Budget Monitoring:*

Establishing regular budget reviews (monthly or quarterly) ensures financial control, allowing for the early detection of deviations from planned budgets. This proactive approach helps identify overspending and enables timely corrective actions.

✓ *Stakeholder Involvement and Technology Utilization:*

Involving key stakeholders, such as finance teams and contractors, promotes transparency in budget analysis. Utilizing budgeting software provides real-time financial data, enhancing decision-making and maintaining financial discipline.

- *Strengthening Project Management Practices:*

✓ *Comprehensive Training for Project Managers:*

Investing in training programs focused on budgeting, scheduling, resource allocation, and communication significantly improves project oversight. This results in better adherence to timelines and budgets.

✓ *Ongoing Professional Development:*

Encouraging continuous learning ensures project managers stay updated on industry trends and new technologies, further contributing to project efficiency and reducing cost overruns.

- *Adoption of Advanced Scheduling Tools:*

✓ *Utilizing Modern Project Management Software:*

Advanced scheduling tools streamline project planning by creating detailed timelines and allocating resources effectively. Real-time data capabilities help monitor progress and promptly address delays or budget issues.

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✓ *Scenario Planning and Automated Alerts:*

These tools support scenario analysis, allowing project managers to explore alternative pathways and optimize schedules. Features like automated alerts enhance communication, keeping all team members aligned on project milestones.

- *Increasing Stakeholder Engagement:*

✓ *Regular Communication Strategies:*

Engaging stakeholders through consistent updates, meetings, and reports fosters transparency and collaboration. This involvement ensures that their insights and concerns are addressed, leading to better decision-making.

✓ *Collaborative Planning and Feedback Channels:*

Including stakeholders in the early planning stages helps align project scope, timelines, and budget expectations. Continuous feedback channels throughout the project build trust, reduce misunderstandings, and enhance project alignment with community needs.

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# APPENDIX

Questionnaire

Dear Respondent,

I am a student at the Information and Communications University pursuing Masters in Project Planning and Management. I am researching on the topic AN ASSESSMENT OF BUDGET OVERRUNS IN ROAD INFRASTRUCTURE PROJECTS: A CASE STUDY OF ROADS IN NDOLA..

You have been selected to participate in this research project. Therefore, I am kindly requesting that you willingly share information asked for in this questionnaire. The information will be used for academic purposes only. Please do NOT indicate your name on the questionnaire to keep your identity anonymous.

Please respond to all the following questions as truthfully as possible. Feel free to seek further clarification from the interviewer. Where there are options provided, select the appropriate response by ticking [√] your answer.

Thank you in advance for your participation.

| **Demographic Information** | | | |
|---|---|---|---|
| **Q. ID** | **Question** | **Response** | **For official use** |
| A1 | Sex of Respondent | | |
| A2 | Age | | |
| A3 | Marital Status | | |
| A4 | Highest level of education | | |
| | 1. Primary/Basic school certificate<br>2. General Certificate for Secondary School<br>3. Higher Education Diploma/Certificate<br>4. Bachelors' Degree<br>5. Masters' Degree<br>6. PhD | | |

| **Cost Overruns of Road Projects in Ndola** | | |
|---|---|---|
| B1 | On a scale of 1 to 5, how frequently do road projects in Ndola experience cost overruns? | 1 (Never)<br>2 (Rarely)<br>3 (Sometimes)<br>4 (Often)<br>5 (Always) |
| B2 | What is the average percentage increase in project costs due to overruns in your experience? | 0-5%<br>6-10%<br>11-15%<br>16-20%<br>21% and above |
| B3 | How significant are cost overruns in impacting the overall project budget? | Not significant<br>Slightly significant<br>Moderately significant<br>Very significant<br>Extremely significant |
| B4 | What are the primary causes of cost overruns in Ndola road projects? (Select all that apply) | Inaccurate cost estimates<br>Inflation<br>Labor costs<br>Material costs |

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| | | |
|---|---|---|
| | | Poor project management<br>Regulatory changes |
| B5 | How often do cost overruns result from changes in project scope | Never<br>Rarely<br>Sometimes<br>Often<br>Always |
| B6 | What is the average percentage increase in project costs due to overruns in your experience? | |
| B7 | To what extent do contractor delays contribute to cost overruns? | Not at all<br>Slight extent<br>Moderate extent<br>Large extent<br>Very large extent |
| B8 | How often do external economic factors (e.g., inflation) affect project costs? | Never<br>Rarely<br>Sometimes<br>Often<br>Always |

| **The relationship between time delay and cost overruns** | | |
|---|---|---|
| C1 | How frequently do road projects in Ndola experience time delays? | Never<br>Rarely<br>Sometimes<br>Often<br>Always |
| C2 | To what extent do time delays impact project costs? | Not at all<br>Slight extent<br>Moderate extent<br>Large extent<br>Very large extent |
| C3 | How often do time delays lead to increased labor costs? | Never<br>Rarely<br>Sometimes<br>Often<br>Always |
| C4 | How often do time delays lead to increased material costs? | Never<br>Rarely<br>Sometimes<br>Often<br>Always |
| C5 | What is the average duration of time delays in your experience? | Less than 1 month<br>1-3 months<br>4-6 months<br>7-9 months<br>More than 9 months |
| C6 | How often do project delays result in penalty costs? | Never<br>Rarely<br>Sometimes<br>Often<br>Always |
| C7 | How frequently do weather conditions cause time delays in Ndola road projects? | Never<br>Rarely<br>Sometimes<br>Often<br>Always |
| | How often do delays in obtaining necessary permits and approvals contribute to time delays | Never<br>Rarely<br>Sometimes |

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| | | |
|---|---|---|
| C8 | | Often<br>Always |
| C9 | How often do changes in project design lead to time delays? | Never<br>Rarely<br>Sometimes<br>Often<br>Always |
| C10 | How effective are current project scheduling practices in minimizing time delays? | Very ineffective<br>Ineffective<br>Neutral<br>Effective<br>Very effective |

| **Management strategy for checking road cost overruns** | | |
|---|---|---|
| D1 | How often do you review and update project budgets? | Never<br>Rarely<br>Sometimes<br>Often<br>Always |
| D2 | How effective are your current cost control measures in preventing overruns? | Very ineffective<br>Ineffective<br>Neutral<br>Effective<br>Very effective |
| D3 | How frequently do you use historical data to inform cost estimates? | Never<br>Rarely<br>Sometimes<br>Often<br>Always |
| D4 | How important is it to involve all stakeholders in the budgeting process? | Not important<br>Slightly important<br>Moderately important<br>Very important<br>Extremely 4important |
| D5 | How often do you conduct performance audits on project expenditures? | Never<br>Rarely<br>Sometimes<br>Often<br>Always |
| D6 | How frequently do you reassess risk factors related to project costs? | Never<br>Rarely<br>Sometimes<br>Often<br>Always |
| D7 | How frequently do you adjust project scopes to stay within budget? | Never<br>Rarely<br>Sometimes<br>Often<br>Always |
| D8 | How confident are you in your management strategy for preventing cost overruns? | Not confident<br>Slightly confident<br>Moderately confident<br>Very confident<br>Extremely confident |

**Thank you for your participation!!**