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An Analysis on Cost Over Runs in Road Construction Projects: A Case Study of Road Projects in Lusaka District

Pumulo Muchuu[1], Kelvin Chibomba[2]

[1,2]Department of Humanities Information and Communications University Lusaka, Zambia.

Abstract

Cost overruns in construction road contracts projects are a prevalent issue that hampers the successful and timely completion of infrastructure development. This study aims to analyze the factors contributing to cost overruns in road construction projects within Lusaka District, Zambia. By examining various projects and their associated cost overruns, this research identified key contributors, quantified their impact, and proposed mitigation strategies to enhance project cost management. The research employed a case study method approach, incorporating multiple sources of evidence including qualitative and quantitative to understand the scenarios. Interviews and surveys were conducted with project stakeholders, including contractors, project managers, and government officials, to gather primary data regarding project specifics and underlying causes of cost overruns. Additionally, a comprehensive review of project documentation and financial records was performed that provided quantitative insights into the extent of cost overruns. Understanding these factors would aid in the development of strategies to mitigate cost overruns, including improved project planning, risk assessment, stakeholder collaboration, and enhanced cost estimation methodologies.

Data gathered from respondents reflected that 7(7%) of the participants were aged between 21 - 30 years, 60 (60%) were aged between 31 - 40 years, 30 (30%) were aged between 41 - 50 years and 3 (3%) of the respondents were 51 years and above.

The study indicated that 5 (5%) of the participants attained certificate level of education, 15 (15%) of the participants attained Diploma level of education, 70 (70%) of the participants attained Undergraduate degree level of education and 10 (10%) attained Master's level of education.

It was found that 75% of the respondents agreed that the use of CPM in project planning increased the efficiency of completion of the project while 25% of the respondents said that the use of CPM in project planning did not increase the efficiency of completion of the project. Ultimately, this research aims to contribute to the body of knowledge surrounding construction project management, particularly in the context of road infrastructure development, and offer actionable recommendations to optimize cost management and ensure the successful delivery of road projects in Lusaka District and beyond.

Keywords: Cost Over runs, Construction, Critical Path Method, Design change, Project Scope change.

1. INTRODUCTION

1.1 Background to study

The background section discusses the broader context of road construction projects in Lusaka District,

Zambia, emphasizing the significance of studying and addressing cost overruns in these projects. Lusaka District, the capital and largest city of Zambia, is a central hub for commerce, transportation, and governmental activities (Ministry of Local Government, 2021). The district's infrastructure, particularly its road network, is critical to supporting economic development, trade, and connectivity within the region (World Bank, 2017). Over the years, Lusaka has witnessed substantial growth, leading to an increased demand for efficient transportation systems to facilitate urbanization and industrialization.

According to the study by Crossett and Hines (Ahmed, F, 2018), the average on-budget project delivery is 46% over a five-year period (2001 – 2005), and in a follow-up study by Crossett and Schneweis (Ahmed, F, 2018), the average is 47% over a ten-year period (2001 – 2010). The on-time performance is only slightly better at 53% (Ahmed, F, 2018) over the five-year period and 55% over the ten-year period (Ahmed, F, 2018). The cost overruns in a construction project may affect the overall productivity of the project due to its adverse effects, such as cost escalation, poor quality of products, reduced productivity, late completion of work, disruption of work, and termination of contracts (Kaliba, Muya, & Mumba, 2013; Muhammed, T. A. 2015).

Cost overruns occur when the actual expenses of a road construction project exceed the initial budget estimates (Smith et al., 2018). These cost overruns can be attributed to a variety of factors, including inaccurate initial cost estimates, market volatility affecting material prices, project scope changes, unforeseen technical challenges, and ineffective project management practices (Smith, J., 2020).

In the context of Lusaka District, understanding and addressing the issue of cost overruns is of paramount importance. Overruns lead to significant financial strains on government budgets, funding agencies, and private investors involved in these projects. Furthermore, they can cause delays in project completion, impact on the quality of infrastructure, and, consequently, affect the overall socioeconomic development of the region. Currently, there is a gap in comprehensive research specifically focused on cost overruns in road construction projects within Lusaka District. Most studies often generalize findings from broader contexts, which may not adequately capture the unique economic, regulatory, and logistical challenges faced by construction projects in this specific region (Smith, J., 2020).

1.2 Statement of the problem.

Cost overruns in road construction Projects pose a significant challenge to infrastructure development in Lusaka District, Zambia. As the country strives to enhance its transportation network and accommodate urban growth, accurately estimating and managing costs in road construction projects is imperative. However, cost overruns have been persistently observed, impacting the timely completion of projects, and straining financial resources allocated for infrastructure improvements (Smith et al., 2018; Ministry of Works and Supply, 2019). Financial discrepancies at project execution arise due to inaccurate cost estimations, inadequate initial project assessments and incomplete site investigations (Huemann et al., 2017). Delays in project completion due to cost overruns not only impede transportation improvements but also have economic and social ramifications. Economic consequences include budgetary strain on government funds and potential negative impacts on the country's fiscal health (World Bank, 2015). Therefore, strategies encompassing efficient and improved project planning, enhanced risk assessment mechanisms, and stakeholder collaboration to promote accurate cost estimations and timely completion of road construction projects within Lusaka District are necessary (Shen et al., 2020; Chan et al., 2019).

1.3 General Objective

The study aimed at analyzing the causes and implications of cost overruns in road construction projects in Lusaka District.

1.4 Specific objectives

1. To examine the primary causes of cost overruns in road construction projects in the Lusaka district.
2. To evaluate the effects of cost overruns on project timelines and completion in Lusaka district.
3. To establish the Strategies by Project Managers to reduce cost overruns in Lusaka district.
4. To evaluate critical path analysis in cost overruns in road construction projects in Lusaka District.

1.5 Research questions

1. What are the primary causes of cost overruns in road construction projects in Lusaka district?
2. How effective are cost overruns on project timelines and completion in Lusaka district?
3. What are the Strategies by Project Managers to reduce cost overruns in Lusaka district?
4. What is the role of critical path analysis in cost overruns in road construction projects in Lusaka District.

1.6 Theoretical Framework

The theories that have attempted to provide schedules extending the project completion time by a proven minimum amount have overall, so far been unsuccessful for most practical applications. They have been formulated in terms of integer theories (Greathouse, C. R. (2022), dynamic theories (Lofts, 2014), forms of bounded and implicit enumeration (MacFarland and Yates, 2016) and branch and bound (Hastings and Willis, 2022). Their limitations have been manageable project size within 'reasonable' computer solution times (a maximum of around 100 activities x 5 resources) and the fact that the uncertainty inherent in most projects makes the search for a proven minimum extension rarely relevant. However, it would be disappointing to see this area of research curtailed since there are projects that can benefit from such analysis. The following are the theories underpinning this research:

1.6.1 Resource Constraint's theory

Traditional Critical Path Schedules in project management are based only on causal dependencies. However, a project may have limited resources that need to be taken into consideration. These limitations will create more dependencies, often referred to as resource constraints (Heidorn, 2022). Resource constraint implies that one cannot be in two places at the same time. However, depending on the project conditions, these tasks can be performed in a different order. This kind of critical path is called a resource critical path.. A resource-leveled schedule may include delays due to resource bottlenecks (i.e., unavailability of a resource at the required time), and it may cause a previously shorter critical path to lengthen (Nafici, 2001).

1.7 Significance of the study

The study of cost overruns in road construction projects in Lusaka District, or any other region, holds significant importance for several reasons: Budgetary efficiency and Public Funds Allocation; Effective management of road construction costs ensures that public funds are allocated efficiently. Understanding the causes of cost overruns enables better budget planning and allocation of resources, optimizing the use of taxpayer money (Smith et al., 2018). Accountability and Transparency; Investigating cost overruns promotes transparency and accountability in the construction process. It helps in identifying if cost overruns were avoidable and holds stakeholders accountable for responsible project management and execution (Flyvbjerg et al., 2016). Project Success and Timely Completion; Identifying the factors contributing to cost overruns allows for the development of strategies to mitigate them, ultimately ensuring that road construction projects are completed on time and within budget. This contributes to the overall

success and timely delivery of infrastructure projects, which is vital for public convenience and safety (Shen et al., 2020). Economic and Social Development; Efficient Road construction supports economic growth by improving connectivity and transportation networks. By minimizing cost overruns, the project's economic impact can be maximized, positively influencing trade, tourism, and local industries (World Bank, 2017).

Optimized Future Projects: Insights gained from studying cost overruns can be used to improve future road construction projects. Lessons learned can help in refining cost estimation techniques, risk assessment, and project management methodologies, leading to more accurate budgeting and successful project outcomes (Makasa et al., 2016).

Stakeholder Satisfaction and Public Trust; Addressing cost overruns ensures that stakeholders, including the government, investors, and the public, have confidence in the project management process. When projects are completed within budget, it fosters trust in the capabilities of the authorities and the construction industry (Chileshe et al., 2019). Environmental Considerations: Overruns can sometimes lead to additional environmental impacts. Understanding the cost implications helps in evaluating the environmental aspects and incorporating sustainable practices to minimize adverse effects on the environment (Huemann et al., 2017). Legal and Contractual Compliance; Analyzing cost overruns helps in assessing whether the construction contracts and legal frameworks were followed correctly. This is crucial for ensuring that the project adheres to all legal and contractual obligations, minimizing legal disputes (Ramsey et al. 2016).

2.0 LITERATURE REVIEW

This chapter looks at the literature review of the study to analyse the causes and implications of cost overruns in road construction projects in Lusaka District.

2.1 literature on causes of cost overruns

Cost overruns in construction projects are a pervasive issue globally. Various studies highlight factors contributing to cost overruns, including inadequate project planning, inaccurate cost estimations, changes in project scope, and unforeseen risks (Flyvbjerg et al., 2016; Flyvbjerg & Holm, 2016).

According to Flyvbjerg et al. (2016), inadequate project planning and inaccurate cost estimations are significant contributors to cost overruns in road construction projects.

With the development of the national economy of China, construction industry plays a very important role in the whole economy. Shiu A, Li R and Woo C-K (2016) concluded that the normal growth of the construction industry can drive the growth of the nation’s macro-economic and vice versa, through analyzing the relationship between GDP of Hong Kong construction industry. Shaiful Amri Mansur et al., revealed that the construction industry is very important to the growth of the national economy because it has an impact on nearly every aspect of the economy. However, with the development of the construction industry, the projects are becoming more complex and highly monitored by clients. Therefore, construction industry is facing a higher risk of cost overrun (Ansar et al., 2016). Multiple stakeholder Complexity, insufficient risk management during execution of projects and as well purposeful cost underestimation to outbid competitors do contribute to project cost Overruns in China (Rothengatter,2017). Haber, 2016; Muelleretal, 2016 concluded that China employs international practices in infrastructure governance and sustainability to mitigate the effects of cost overruns. Chinese cost overruns in its transport projects average 31% over budget at completion (Ansar et al., 2016). Ansar et al., 2016 further contends that cost overruns in the delivery of infrastructure projects in China leads to

economic fragile posing extreme economic risks equating one third China's enormous USD 28 trillion pile of debt. Resettlement and Land Acquisitions (RLA) Cost overruns accounts for 21% China's total cost overruns in infrastructure delivery which impacts final project costs across sectors while the hydropower consumes 100%, and the railway averages 93% (Rabe et al., 2021: 187). Flyvbjerg studied 153 cases of overrun costs to an amount of CNY 97 billion, averaging cost overruns of 22% across industry sector distributions, and it unveiled that transport projects in China have the highest cost increases with 26 per cent, rail constructions average 28% against the global 34%, road projects overrun costs by 29% versus the 20% in other countries (Flyvbjerg, B., 2018). China accounts 15% cost increases in the energy sector, whereas Hydropower projects overrun costs by 26% relatively below the global average 96% (Ansar et al., 2014: 48; Kostka and Fiedler, 2016). Ansar et al., 2016: 372 affirms that China experiences significant cost over-runs across sectors, a situation like Western countries.

The major causes of Project cost overruns in China happen due to technological challenges and unforeseen risk such as geographical conditions which bring about alterations in the construction design which leads to higher-than-expected costs (ADB, 2018:2,5).

2.2 Literature on effects of cost overruns on project's timelines and completion

Chileshe & Kaming (2012) highlight the economic factors prevalent in Sub-Saharan Africa that significantly impact cost overruns. Economic instability, fluctuating exchange rates, and inadequate funding pose significant challenges to the financial feasibility of construction projects, leading to cost escalation.

Olomolaiye et al. (2018) discussed contractual arrangements and procurement processes as major contributors to cost overruns, and the authors argue that the resultant Cost overruns affect the sponsor's budgets for future projects. Issues such as poorly defined contracts, ambiguous clauses, and ineffective procurement procedures can lead to disputes, claims, and ultimately cost escalation. Marachi et al. (2016) emphasized that the economic impact of time and cost overruns can be severe. Overruns can strain the financial resources of both the project owner and the government, affecting the overall economic development and investment potential of the region.

The complexity of projects, often due to design changes or unforeseen site conditions, is identified as a significant cause of cost overruns. Inadequate initial design, frequent design modifications, and poor coordination can amplify costs and extend project durations (Chileshe & Kaming, 2012). Fluctuating material prices and labor costs as key factors affecting project budgets. Rapidly changing prices for construction materials and challenges in labor availability and wage rates can strain the project's financial resources labor (Chileshe & Kaming, 2012; Olomolaiye et al., 2018). Kaming et al. (1997) emphasized that construction delays have a significant impact on project costs. Not only do delays lead to increased labor and material costs, but they also result in indirect costs such as extended project management, overheads, and potential legal disputes as well as loss of stakeholder confidence.

Johnson (2021) highlighted the significance of accurate initial project assessment, addressing insufficient cost estimation, inadequate risk assessment, and flawed scope definition in Lusaka Road projects. Johnson (2021) conducted a comprehensive analysis that emphasized the critical importance of a meticulous initial project assessment in road construction projects within the Lusaka region.

Anderson (2022) provided insights into the impact of unforeseen site conditions on construction projects, particularly in the context of Lusaka District, and arrived at the following conclusions: Unforeseen conditions led to additional costs for investigating, mitigating, and resolving the issues. This resulted in the need for extra materials, labor, equipment, and consulting services. Addressing unforeseen conditions

caused delays in the construction schedule as additional time was needed for investigations, redesigns, and adjustments to accommodate the new conditions. Project delays: Contractual Disputes; Addressing unforeseen conditions sometimes led to disputes between contractors and project owners regarding responsibility and costs associated with managing the unforeseen issues. Safety Concerns: Unforeseen site conditions posed safety risks for workers and impacted the safety measures and protocols initially planned for the project. Design Modifications: Unforeseen conditions required modifications to the project design, necessitating engineering adjustments and approvals.

2.3 literature on strategies to reduce cost overruns

The scholars stress the importance of a structured process for identifying and assessing both risks and opportunities throughout the project lifecycle. They advocate techniques such as scenario planning and sensitivity analysis to comprehensively evaluate uncertainties that could impact project costs (Hillson & Murray-Webster, 2017). Chapman and Ward argue for an approach that goes beyond traditional risk management by encompassing both risks and opportunities. They emphasize that uncertainties, whether positive or negative, need to be effectively managed to optimize project outcomes, including cost control. Chapman and Ward (2011) underscore integrating uncertainty management into project management processes seamlessly. By embedding uncertainty management within project planning, execution, and monitoring, projects can proactively address potential cost overruns arising from unforeseen events or missed opportunities. Hillson and Murray-Webster delve into the intricacies of risk attitude within project teams and organizations. They emphasize that understanding and managing risk attitudes can significantly influence how risks, including those related to cost overruns, are identified, evaluated, and mitigated (Hillson & Murray-Webster, 2017).

As a result, once a conclusion is drawn regarding a sequence of conceivable outcomes, and after known odds may be attached to predict those outcomes, the presence of risk is established. Hillson and Murray-Webster (2005) highlighted an intriguing tendency discovered while analysing various officially published risk management guidelines. According to the authors, prior to 1997, individuals had a negative sense of risk, and as a result, the risk was synonymous with threat, with the condition being equivalent to hazard, danger. Hillson and Murray-Webster (2005) highlight that risk attitude affects decision-making regarding risk acceptance, avoidance, transfer, or mitigation. By acknowledging and accommodating varying risk attitudes within a project team, better decisions can be made concerning risk responses and ultimately cost management. Hillson and Murray-Webster (2005) advocate for integrating an understanding of risk attitudes into risk management processes. By considering risk attitudes when assessing potential risks and opportunities, project teams can tailor risk responses, enhancing the effectiveness of risk management in cost containment.

Ahmed S.M. et al. (2002), in their study of delays in Florida, North American have recommended streamlining the Buildings Permit Approval Process as much as possible. The issues such as changes in drawings, incomplete and faulty specifications and change orders must be controlled with proper design process management and timely decision making. Abdul-Rahman H. et al (2006), identified the procedures taken by contractor to recover delays. From their survey, recommended procedures were increasing productivity by working overtime hours or working shifts, followed by asking for extension of time. If the problem was shortage of resources, they suggested rescheduling the activities within the available resources, using skilled labour and by using subcontractors. The respondent also agreed that site meetings are essential in solving the problems on the condition that they should not be too frequent.

2.4 literature on critical path methodology analysis

Critical path method (CPM) scheduling allows project implementors focus on the larger picture instead of being slowed down by smaller details. By creating a specific schedule and working with those who will be responsible for completing each individual task along the way, it's easier to determine an accurate timeline and track what needs to be completed for each stage. A critical path chart, also called a diagram, puts all team members on the same path toward completion while clearly outlining who is responsible for what task. Crossett & Hines, (2007) South Carolina, Critical path methodology in project management also becomes a tool of reference for monitoring progress and reporting on each task as it is completed

The increase in usage of CPM schedule for project management is due to the development of certain technologies in mid 1980s that facilitated the growth (Kelleher, 2004; Liberatore, Pollack-Johnson, & Smith, 2001). The popularity of CPM scheduling grew so much that the scheduling in construction industry and use of CPM scheduling became synonymous (Yates, 1993).

]]*9/In response to some shortcomings of the Critical Path Method model, (Kuchta 2002) proposed a fuzzy method to measure the criticality of project activities and the whole project. In another study, (Jassbi 2008) proposed a fuzzy inference system to determine activities' criticality in deterministic networks. (Mota 2009) presented a model for supporting project managers to focus on the main tasks of a project. They used a multiple criteria decision aid (MCDA) approach and considered several points of view in their study.

Professionals and executors of private and public projects in Nigeria and other developing countries have been trapped devotedly to the Gantt chart regardless of its severe shortcoming in effective project management and delivery. The number of abandoned or uncompleted projects that litter the length and breadth of Nigeria is a clear indication of ineffectiveness and the inability to plan, manage, and execute complex projects. These are besides the behavioral problems that hinder the implementation of public project in Nigeria. Nevertheless, the practice and use of Gantt chart is an additive to the general problem (Crossett & Hines, 2007). This major drawback prevents simple bar charts from reacting dynamically when changes are made to the schedule. Modern scheduling software enables critical path analysis to be displayed in a linked bar chart format that overcomes some of the problems associated with simple bar charts. The critical path method (CPM) was developed in the late 1950s by researchers at the E. I. Du Pont de Nemours Company. When first developed, the traditional form of CPM networks was termed an AOA or "activity on arrow" diagram, which allows only Finish-to-Start relationships among the activities. This means that activities cannot be overlapped and that all preceding activities must be completed before a current activity can start. With the introduction of the Precedence Diagram Method (PDM), more flexibility regarding activity relationships has been added while the schedule calculations still utilize CPM analysis. In precedence networks, an activity can be connected from either its start or its finish, which in addition to the traditional Finish-to-Start relationship, allows the use of three additional relationships between project activities: Start-to-Start, Finish-to-Finish, and Start to-Finish (Crossett & Hines, 2007).

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3 RESEARCH METHODOLOGY

This chapter discusses the research design, the sampling methods and sample size adopted by the researcher. Further, it discusses the development of data collection methods, the data collection itself and analysis methods used in the research. The chapter finally confers the soundness, reliability and the generalizability of data.

3.1 Research design

The research design appropriate for this study was a Case Study Research design Creswell, J., W. (2014). For this study, a Case Study technique was used to benefit from the advantages of both qualitative and quantitative data (Creswell, J., W. 2014). The Case study relied on multiple sources of evidence, such as documents reviews, interviewing key stakeholders and observations to present a complete and nuanced understanding of the phenomenon under investigation (David S.,2006).

3.2 Target population

The target population is a group of objects from which samples are taken for measurement. The research site for the study will be restricted to Lusaka district. The study will target construction projects, institutions that are directly connected to road Construction projects that are taking place in Lusaka District. The study population includes project managers, project supervisors and project team members.

3.3 Sampling design

According to Cooper and Schindler (2003) sampling is the process of selecting a predetermined number of subjects from a defined population as a representative of that population. Basically, to say that sampling is the process in which a representative part of the population is picked for the purpose of determining the characteristics and parameters of the entire population. This research will use random sampling techniques.

Table 3.1 Distribution of Questionnaires

No.	Description	Target number of respondents
1	Institutions	05
2	Project managers	20
3	Project supervisors	25
4	Project implementers	50
Total		**100**

The researcher (2024)

3.4 Sample size

The sample size of 110 subjects from the selected road construction projects. The questionnaires were broken down into four (4) of 20 given to the project managers and senior personnel on site at the projects. A set of 25 were given to supervisors, coordinators, and project foremen. A set of 60 were given to the

project implementers or the general workers doing the actual work. The remaining 5 were distributed to regulating institutions, such as ZDA, RDA, EIZ and NCC.

3.5 Data collection methods

3.5.1 Questionnaire Method and Interview

A questionnaire is a set of questions used to conduct a survey, which is the process of gathering, sampling, analyzing, and interpreting data from a group of respondents. The main purpose of a questionnaire is to extract data from the respondents. It's a relatively inexpensive, quick, and efficient way of collecting large amount data even when the researcher is not present to collect those responses firsthand. In this research, questionnaire and interview methods were used to collect data. Different project managers were interviewed, and questionnaires were given out to different groups of people working at road construction sites in Lusaka district. According to (Drost 2020) instrument validity is concerned with the meaningfulness of the research components, meaning that it is concerned with whether the questions are measuring what they are intended to measure. According to (Drost, 2020) reliability is the extent to which measurements are repeatable when different persons perform the measurement, on different occasions and under different conditions. Reliability is basically the consistency of measurement. To ensure the reliability of the questionnaire, the researcher tested the instrument on a project in progress within the area.

3.6 Data analysis

Data that was collected was put into excel and Statistical Package for Social Sciences (SPSS) application for analysis. The data that was collected through open ended questions was analyzed using narrative and thematic approach using STATA software. Analyzing using thematic areas allowed the researcher to identify, analyze and report patterns within the data.

3.7 Triangulation

Triangulation refers to the use of multiple methods or data sources in qualitative research to develop a comprehensive understanding of phenomena (Patton, 2019). Triangulation also has been viewed as a qualitative research strategy to test validity through the convergence of information from different data sources. Denzin (1978) and Patton (1999) identified four types of triangulations: (a) method triangulation, (b) investigator triangulation, (c) theory triangulation, and (d) data source triangulation.

3.8 Limitations of the study

This study was limited to Lusaka District and its findings not to be generalized. The study was constraint by inadequate resources like funds for undertaking in-depth interviews and mobility during data collection. Insufficient information related to specific projects from respondents in the field was another limitation due to confidentiality codes.

3.9 Ethical considerations

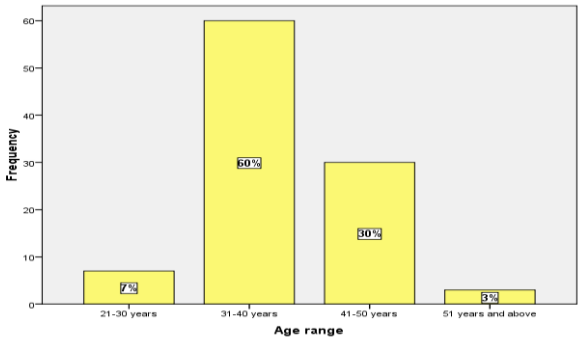
Ethical considerations to ensure quality and integrity of the research, consent by respondents to voluntarily participate, confidentiality and anonymity of the participants were upheld by the researcher. For the sake of this study the researcher ensured that the subjects received full disclosure of the nature of the research, risks, benefits, and opportunities with an extended arm to ask questions (Jackson, 2002). The researcher pledged not to disclose the names of the participants by excluding them on the questionnaires to protect their anonymity and confidentiality.

4.0 Data Presentation

This section covered the general information on the characteristics of the respondents in terms of their age, education, and employment status.

4.1.1 Respondents by age

Chart 4.1: Age distribution



Source: Compiled by Author 2024

4.1.2 Level of Education

Table 4.1: level of education

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Certificate	5	5.0	5.0	5.0
	Diploma	15	15.0	15.0	20.0
	Undergraduate degree	70	70.0	70.0	90.0
	Master's Degree	10	10.0	10.0	100.0
	Total	100	100.0	100.0	

Source: Compiled by Author 2024

Table 4.1 indicates that 5 (5%) of the participants attained certificate level of education, 15 (15%) of the participants attained Diploma level of education, 70 (70%) of the participants attained Undergraduate degree level of education and 10 (10%) attained Master's level of education.

4.1.3: Job title of respondents

Table 4.2 shows that 30 (30%) of the respondents were managers while 70 (70%) were juniors.

Table 4.2: Job title of respondents

Job Title	Frequency	Percent	Valid Percent	Cumulative Percent
Managers	30	30.0	30.0	30.0
Juniors	70	70.0	70.0	100.0
Total	100.0	100.0	100.0	

The researcher (2024)

4.3 Causes of Cost overruns in road construction projects in Lusaka district

4.3.1 Own related causes

Poor coordination scored highest with 30 respondents, delays in payment of progress payments and poor communication at 15% each, 12% poor decision making, 10% delays in approving designs, 9% delays in approving sample materials, 5% delays in approving design changes and 4% delays in revision of designs documents.

4.3.2 Contractor related causes

Poor coordination was identified at 40%, and poor communication ranked at 35%, reworks due to poor workmanship resulting in errors at 12%, financing challenges at 7% and ineffective planning at 6%.

4.3.3 Consultant related causes

Poor communication came first at 35%, 23% inconsistent in design documentation, 19% poor coordination, 15% lack of advanced engineering design software, 5% delays in approving major scope changes, 2% delays in producing design documents, and 1% attributable to unclear design details.

4.3.4 Materials related causes

Fluctuations in materials prices were recognized as the major causer at 60%, late delivery of materials 20%, availability of specific construction materials 14%, late ordering of materials 6%.

4.3.5 Equipment related causes

Lack of high-tech equipment scored 60%, use of outdated equipment and equipment breakdowns 15% each, 10% attributed to shortage of equipment.

4.3.6 Labour related causes

Respondents identified the low productivity of workers as the main cause 90%, conflicts among workers 6%, and 4% work permits.

4.3.7 External related causes

Changes in economic factors such as prices hikes 80% and 20% attributed to political interference.

4.4 Effects of Cost Overruns on road construction projects' timelines and completion.

Cost overruns ranked 35%, 24% influence of different project management practices, allocation of scarce resources and delays in road construction scored 15% each, 10% attributed to contractual disputes 1% identified as due to claims and litigations resulting in abandonment of projects.

4.5 Strategies by project managers to reduce cost overruns in road construction projects in Lusaka district.

Adherence to comprehensive budget comprising potential costs, clearly defined scope with no room for scope creep; analysis of project feasibility before inception, and early identification and evaluation of potential project risks cumulatively scored 60% as each had 15%. Utilizing earned Value management and effective procurement strategies that incorporates vendor relationships scored 8% each, 7% ranked against applying technological methods, 6% flexible terms of agreements and contracts, 3% resources management, and capacity building 1%.

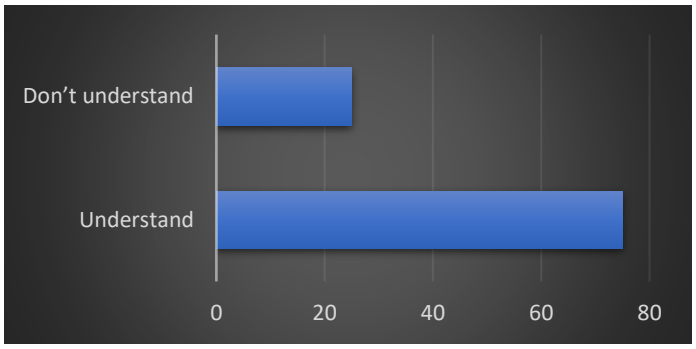
4.6.0 Role of Critical Path Methodology

4.6.1 Knowledge about Critical Path Method (CPM).

From the above chart, 75% of the respondents knew what CPM was while 25% had no clue.

4.6.2 Understanding CPM before implementation.

Chart 4.5 Understanding CPM before implementation



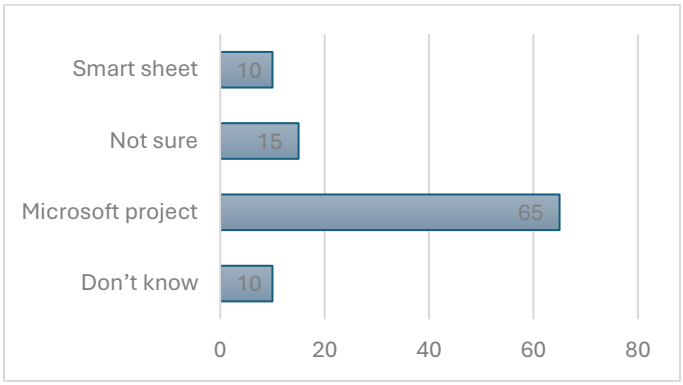
The researcher (2024)

From the above chart, 75% of the respondents understood CPM before implementing while 25% didn't understand.

4.6.3 Project software utilized by organizations to calculate CPM.

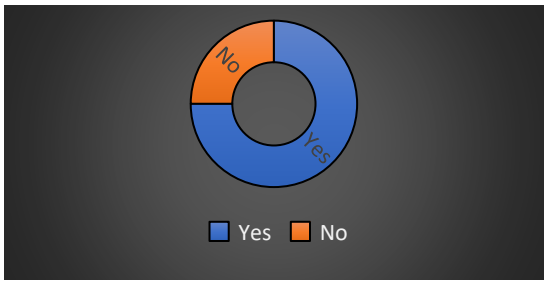
The results show 10% of the respondents used smart sheet, 15% were not sure, 65% used Microsoft project while 10% didn't know.

Chart 4.6 Project software utilized by organizations to calculate CPM.



The researcher (2024)

4.6.4 Whether the use of CPM in project planning increases the efficiency of completion of project.



The researcher (2024)

From the above chart, 75% of the respondents agreed that the use of CPM in project planning increased the efficiency of completion of the project while 25% of the respondents said that the use of CPM in Proj-

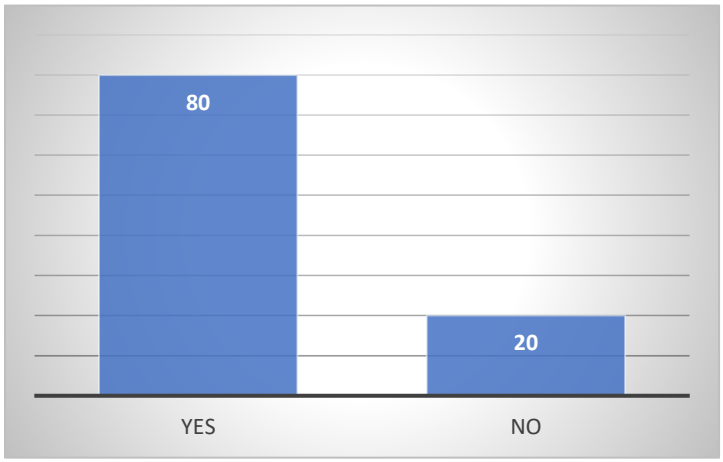
ect planning did not increase the efficiency of completion of the project.

4.6.5 Whether utilizing the CPM software use helps reduce the calculating time for determining the project finishing date.

The study results showed that 75% of the respondents agreed that the CPM software they used helped reduce the calculating time for determining the project finishing date while 25% did not agree.

4.6.6 Comparison of expected results versus actual results.

Chart 4.10 Can one be able to compare expected results versus actual of the project using CP



The researcher (2024)

From the above chart, 80% of the respondents agreed that they were able to compare expected results versus actual of the project using CPM while 20% were unable.

4.5 Discussions

4.5.1 Causes of cost overruns on road construction projects in Lusaka district

The study has revealed the existence of cost overruns on the road construction projects in the Lusaka district as confirmed by 100 respondents to the questionnaire. The respondents were able to categorize the causes of cost overruns into (i) Own related causes, (ii) Contractor related causes, (iii) Consultant related causes, (iv) Material related causes, (v) Equipment related causes, (vi) labour related causes, and (vii) external related causes.

Own related causes ranked results as Poor Coordination with 30 respondents (30%) scored highest on the own related causes of cost overruns in the Lusaka Road construction projects. This was followed by delays in progress payments and poor communication with 15 (15%) respondents each. Contractor related Causes were attributed **to** Poor coordination 40 (40%) respondents were identified as the highest followed by poor Communication at 35% of the respondents. Rework due to errors during construction ranked third at 12% as contractor related causes and financing challenges came fourth. Consultant related causes ranked the responses as Poor communication was recognized to be the major contributor to cost overruns at 35%, followed by mistakes and inconsistencies in design documents at 23%, Poor coordination at 19% of the respondents. Lack of advanced engineering design software of advanced engineering design software at 15%. While the delay in approving major changes in the scope of work came fifth at 5%. Under Materials related causes, the respondents found that the fluctuations in materials prices was noted to be the major primary cause of cost overruns related to construction materials that recorded 60 (60%), late delivery of materials followed at 20 (20%), availability of specified construction materials at 14% was ranked 3rd and late delivery of materials fourth at 6%. In terms of Equipment related causes **t**he respondents

overwhelmingly noted that lack of high-technology mechanical equipment was the main contributor to cost overruns at 60 (60%), use of outdated equipment and equipment breakdowns were at par at 15 (15%) each, and finally shortage of equipment followed at 10 (10%). Labour related causes showed that 90% of the primary causes of overrun costs in the Lusaka district road construction projects were attributable to low productivity level of workers for varying reasons such as low motivation. Conflicts among workers came second at 6% and those related to work permits ranked last at 4% as it affected expatriates as locals do not require work permits.

The above findings are in support of Anderson (2022), the impact of unforeseen site conditions on construction projects, particularly in the context of Lusaka District. Unforeseen conditions lead to additional costs for investigating, mitigating, and resolving the issues, and these required extra materials, labor, equipment, and consulting services. Addressing unforeseen conditions sometimes leads to disputes between contractors and project owners regarding responsibility and costs associated with managing the unforeseen issues. Safety Concerns: Unforeseen site conditions posed safety risks for workers and impacted on the safety measures and protocols initially planned for the project. Design Modifications.

External factors bring about changes in economic factors contribute to primary causes of Cost overruns in the road construction projects at 80 (80%), and while 20% was attributed to political interference. Out of the eleven sampled presumed causes, only these two were identified.

The findings of the study per the above results are in support of Marachi et al., (2016), emphasizing the need for effective policy frameworks and governance structures to address cost overruns in road construction projects. Transparency, accountability, and regulatory reforms were seen as essential strategies to minimize financial discrepancies.The study backs Smith (2020), examining the economic landscape of the Lusaka District, the study shed light on how changes in economic conditions can escalate project costs and disrupt initial budget estimates, ultimately leading to cost overruns. The study supports revelations by Assaf and Al-Hejji (2006:352) and Sambasivan and Soon (2007:522) effects of subsurface and ground conditions were the major external factors that cause schedule overruns on construction projects. The study further backs assertions by Le-Hoai, Lee and Lee (2008:370) causes of schedule overruns related to external factors include the unforeseen site conditions, price fluctuations, bad weather and obstacles from governments. Furthermore, Further, Alwi and Hampson (2003:4) showed that site condition, weather and damage by other participants are the major causes of schedule overruns caused by external factors. Furthermore, Theodore (2009) identified the following causes of schedule overruns cause by external factors: weather effect on construction activities, traffic control and restriction at job site, changes in government regulations and laws, delay in providing services from utilities, delay in performing final inspection and certification.

4.5.2 Effects of cost overruns on project timelines and completion

The results by the respondents suggest that Cost overruns have negative effects on road construction projects timelines and completion ranked 35%, followed by influence of different project management practices that have been ranked 24%, whilst allocation of scarce resources and delays in road construction have been rated 15% each. Contractual disputes came forth with 10% of the respondents and 1% was attributed to claims and litigation leading to project abandonment. These findings are backed by Anderson (2022), Addressing unforeseen conditions caused delays in the construction schedule as additional time was needed for investigations, redesigns, and adjustments to accommodate the new conditions. Unforeseen conditions required modifications to the project design, necessitating engineering adjustments and approvals. The findings are in line with those of Smith (2020) the repercussions of cost overruns on

project timelines, including delayed milestones, extended project durations, and disruptions in project phases for Lusaka Road projects.

The study is also in line with Brown (2019) explored in his study focusing on the role of scope changes and how they contribute to cost overruns in road construction projects in Lusaka District and concluded as follows. Cost Implications: Scope changes often resulted in additional costs, including material costs, labor costs, equipment costs, and indirect costs associated with project delays. Schedule Delays: Alterations in the project scope led to delays in the project timeline, affecting the overall completion date and potentially incurring penalties for exceeding the agreed-upon project duration.

The respondents showed a relatively neutral view regarding the success of road contractors in meeting project deadlines by prioritizing construction delivery and lead time management.

This suggests that respondents are uncertain or moderately agree on the impact of these management practices on timely project completion. Similarly, statements related to the impact of efficient lead time management, clear understanding and implementation of construction delivery strategies, and efficient risk management practices on timely project completion.

This indicates a slightly higher level of agreement among respondents regarding the importance of effective construction delivery practices in ensuring timely project completion (Flyvbjerg, 2013).

The statement "Collaboration and cooperation among project stakeholders are critical for ensuring timely project completion by road contractors in Lusaka district indicating a moderate level of agreement on the significance of collaboration among stakeholders for timely project delivery (Liu et al., 2021; Shen et al., 2018). Overall, the findings suggest that there is a perceived connection between construction delivery and lead time management practices and the timely completion of projects by Road Contractors in Lusaka district. However, the level of agreement varies among different aspects of these management practices. The study has shown that focusing on effective construction delivery practices, lead time management, and fostering collaboration among stakeholders (Jha et al., 2016; Zhang et al., 2020).

4.5.3 Strategies to reduce cost overruns on road construction projects in Lusaka district

Sixty percent (60%) of the respondents believed that adherence to a comprehensive budget that includes all potential costs, having a clearly defined project scope that has no room for scope creep, the analysis of Project Feasibility before inception, and early identification and evaluation of potential project risks can reduce cost overruns. Each of these characteristics was ranked 15%, while utilizing Earned Value Management (EVM) 8%, and adherence to effective Procurement Strategies that incorporates Competitive Bidding for prices for materials and services and Vendor Relationships 8%, applying technological methods was ranked was represented by 7%, flexible terms of agreements and contracts represented by 6%, appropriate resources management was represented by 3%, capacity building and knowledge sharing based on past projects and post project evaluation each was represented by 1%.

The findings suggest that efficient lead time management has the potential to contribute to better project planning, leading to improved work quality by road contractors in Lusaka district. This aligns with the expectancy theory, which proposes that effective lead time management can positively influence decision-making and behaviour towards specific behaviours that lead to desired outcomes. Road contractors who prioritize lead time management may be more focused on planning and coordination, which can result in better-quality work (Kerzner, 2017). Moreover, the study found that timely project completion, as a result of effective lead time management, enhances the quality of work delivered by road contractors in Lusaka district. This finding is in line with the literature on construction management, where efficient lead time management is known to reduce delays and disruptions, ensuring that projects are completed on schedule.

On-time project completion can contribute to better quality work by allowing sufficient time for thorough execution and attention to detail (Kerzner, 2017; Pinto & Slevin, 1987).

The adoption of modern technologies and tools for lead time management also demonstrated a positive impact on work quality in road construction projects in Lusaka district. This finding corresponds with the literature on technology adoption in construction, emphasizing the benefits of using advanced tools to streamline processes, enhance communication, and improve efficiency. These technologies can aid in better planning, resource allocation, and monitoring, leading to better-quality work (Bryde, Broquetas, & Volm, 2013; Chang & Wang, 2010).

To enhance work quality, road contractors in the area should focus on improving lead time management, adopting modern technologies, fostering effective communication, and gaining a clear understanding of construction delivery timelines. By addressing these areas, road contractors can potentially achieve better-quality outcomes in their projects. Nonetheless, further research is necessary to gain deeper insights into the specific mechanisms that lead to improvements in work quality through construction delivery and lead time management practices. Researchers emphasize the importance of effective risk management to mitigate cost overruns. Risk assessment and management techniques, such as Monte Carlo simulation and sensitivity analysis, have been advocated to enhance project cost estimation and control (Chapman & Ward, 2011; Hillson & Murray-Webster, 2017).

4.5.4 the role of cpm analysis in reducing cost overruns on road construction projects

The findings on the research have shown that the critical path method has been underutilized by the construction industry. The study reached a total of 100 participants with a 75% turn out that revealed just how much project managers need to apply CPM in the road construction industry. The levels of perception of CPM generally in the construction industry in Zambia, Lusaka in particular was a very good out of the 100 participants 75 representing a 75 percent understanding of CPM expressed understanding of CPM, and this is a very good sign for the researcher, because it shows most participants in construction are conversant with CPM. Only 25 participants representing a 25 percent turnout of the total participants did not understand what CPM is.

The literature that was reviewed from Okmen (2014), established that the procedures involved in listing all the activities that are to take place in a project has contributed to the negative perception CPM has received. This research therefore submits that the knowledge and use of CPM in the road construction industry will directly impact on the completion time of the projects. The research also shows that despite the very good percentage of people having knowledge of CPM there needs to be a deliberate policy to close the remaining 25 percent so that all people directly involved in a project have the necessary knowledge about CPM. The research also established that most engineers and artisans have enough knowledge about CPM. The research further established that the knowledge of CPM was not the main problem but its use and implementation. The conclusion based on this objective, the research established that the perception or knowledge of CPM is very high and good but the implementers or planners of projects are not doing their part to the fullest.

A question was given to the participants whether to use CPM software in the planning phase especially to determine the duration of the project. Of the 100 participants, 75% agreed that using the software did have a contribution towards the efficient completion of projects and 25% disagreed. The literature that reviewed from Deacon and (2015) in their study on the use of CPM in construction projects in South Africa concluded that construction companies needed to improve on the use of CPM in their planning. A project is said to be a success if it achieves the three constraints of cost, quality and time. The findings of the

research concluded that implementing CPM had a positive influence on the time constraint of project management. Further literature from Metanxas & Deffner (2013) concluded that CPM is based on the fact that the planning and the implementation of a Project is a strategic process, characterised by specific phases, actions and evaluation methods, which are fitted and controlled in specific time horizon.

This research also established that the type of software used for implementation also had a bearing on how to use CPM as observed from the findings, from the type of software used it was observed that more participants are more familiar with and use Microsoft project in their planning, others used Smart sheet, while the rest were not sure this could be attributed to the fact that the project implementers were more concerned with doing the actual work than knowing which type of software is used, a smaller percentage just did not know this was due to the fact that they had no basic construction knowledge.

The variations in the type of software used have to be narrowed down to two or three for the industry for easy monitoring and evaluation of the projects. The research found that after asking participants if the use of CPM software in the determining of the project duration reduced the calculating time. It was found that 75% of all the participants agreed and said yes to the fact that it did reduce the calculating time, and only 25% of the participants said no. This result shows the importance and need for using CPM as a deterministic tool. The researcher observed from the literature reviewed by Mohamed (2015) that the reason of inaccurate time estimation that can only arise when PERT and CPM are not properly used and implemented in the very initial phase of planning. Further literature according to Willett. (2011) in his research report he states that since CPM helps these management tools greatly improve the systematic execution of projects. Although widely used, these tools do not guarantee that neither a project individual tasks nor the overall project will be finished on schedule, but properly used and implemented will make sure a project is finished on time. Research established that using CPM as a planning tool or monitoring tool has always improved and closed projects efficiently.

5.0 General Overview of the study

Finally, the chapter highlights the conclusions and recommendations after considering the research findings. Its main goal is to confirm that the study has adequately addressed the objectives outlined in chapter one.

5.1 Conclusion

The aim of this research was to assess causes of cost over runs in road construction projects in Lusaka district. The specific objectives of the study were to examine the primary causes of Cost overruns, to evaluate the effects of cost overruns on road projects' timelines and completion, to establish strategies by project managers to reduce cost overruns and to assess the efficiency and effectiveness of using Critical Path Methodology. Based on the findings of the study, it can be concluded that there is a perceived connection between primary causes of cost overruns, the effects of cost overruns on road construction projects timelines and completion. The study also revealed the links between strategies by project managers to reduce cost overruns and the role played by Critical Path Method in the management of project timelines to ensure efficient delivery in the district. The study has revealed the prevalence of primary causes of cost overruns in Lusaka district resulting from own related causes, Contractor related causes, consultant related causes, materials related causes, Labour related causes, equipment related causes and external related causes. Poor coordination and Poor communication are significant and commonly affect project timelines and completion. Communication being a two-way channel leads to delayed decision making that negatively impacts the completion timelines. Cost implications such as scope

changes often resulted in additional costs including materials, labour, equipment and indirect associated costs.The research has shown that Critical Path method increased the visibility for it allowed everyone on the project to understand how individual tasks join and how they affect the overall project's duration. The results have shown the importance and need for using CPM as a deterministic tool in large and complex road construction projects.

5.2 Recommendations

Based on the findings and conclusion of this study, there are several areas that warrant further research to deepen the readers' understanding of the prevalence of primary causes of cost overruns, effects of cost overruns on projects' timelines and completion; strategies by project managers to reduce cost overruns and the role played by Critical Path Methodology in the road construction projects in Lusaka district. A deep know-how of the relationship between the primary causes of cost overruns and their effects on the projects' timelines and completion of road construction projects in Lusaka district, and the connection between the strategies utilized by project managers to reduce cost overruns and the role played by the critical path method in estimating timely delivery of the road construction projects in Lusaka district. The researcher therefore makes the following recommendations for further research:

Longitudinal studies: To be conducted for an extended period to provide valuable understanding into long term effects of primary causes of cost over runs in the road construction projects in Lusaka district, the effects of cost overruns on projects' timelines and completion; strategies by project managers to reduce cost overruns and efficiency and effectiveness of the critical Path method in estimating project timelines.

Comparative studies: To compare the performance of road construction projects in Lusaka district with other districts in the country or region that may exhibit similar environmental aspects; the strategies by project managers to reduce cost overruns in the road construction projects within the country or region and effectiveness of critical Path method with other method in the estimation of road construction project timelines. Different implementation strategies of road construction projects by project managers may aid in identifying the best practices and highlight possible areas for improvement. These studies can provide valuable benchmarking data for road construction project sponsors and implementers to gauge their performance against industry peers.

Stakeholder Involvement: Additional research may explore the perspectives of diverse stakeholders engaged in the road construction projects, such as project sponsors, government agencies, subcontractors, consultants and local community as the main stakeholders. Understanding their views and experiences regarding road construction cost overruns and their effects on timelines and completion can give a comprehensive knowledge of the impact on the project outcome.

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