ADDIS ABABA UNIVERSITY

SCHOOL OF COMMERCE

Factors Affecting the Progress of Highway Construction: The case of the Ring Road Junction Improvement Project- Lebu Intersection

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A Project Work Submitted to Addis Ababa University, School of Commerce, in Partial Fulfillment of the Requirements for the Degree of Master of Art in Project Management

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DECLARATION

I, Biruk Lelisa, the under signed, declare that this project entitled: "Factors Affecting the Progress of Highway Construction: The case of the Ring Road Junction Improvement Project: Lebu Intersection" is my original work and has not been submitted for any degree or diploma program in this or any other institutions and that all sources of materials used for the project has been duly acknowledged.

Name of Student	Signature	Date

CERTIFICATE OF APPROVAL

This is to certify that the project work entitled "Factors Affecting the Progress of Highway Construction: The case of the Ring Road Junction Improvement Project: Lebu Intersection" submitted in partial fulfillment of the requirements for the degree of Masters of Art in Project Management is a record of original project work carried out by Biruk Lelisa, ID.No. - GSE/0544/14, under my supervision, and no part of the project has been submitted for any other degree or diploma. Therefore, I recommend it to be accepted as fulfilling the project requirements.

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Name of Advisor	Signature	Date

Addis Ababa University

School of Commerce

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ACRONYOMS/ ABBREVATIONS

AACRA	Addis Ababa City Roads Authority
DB	Design Build
DBB	Design Bid Build
RII	Relative Important Index
SPSS	Statistical Package for the Social Sciences
GDP	Gross Domestic Product

ABSTRACT

Project delays can arise from multiple sources, including weather conditions, logistical challenges, and unexpected site conditions. This study aims to identify the primary factors influencing the progress of highway construction, specifically focusing on the Ring Road Junction Improvement Project at Lebu Intersection. Through extensive data collection, including literature reviews and other research methods, a total of 59 delay factors were identified and categorized into five main groups: Planning, Management, Financial, Technical, and Material factors. Questionnaires containing these factors were distributed to 70 professionals involved in the Lebu Intersection Project, resulting in 67 successfully collected responses. The collected data was analyzed using both quantitative and qualitative approaches with SPSS and Microsoft Excel. The analysis, incorporating responses from Clients, Contractors, and Consultants, revealed that the most significant delay factor, with a Relative Importance Index (RII) value of 0.83, falls under the Management category. Based on these findings, the study recommends that project stakeholders prioritize selecting competent project managers and consulting firms. It also suggests proactive measures to address "Right of Way" issues before project commencement. Experienced engineers emphasized the critical role of rigorous supervision and control by all involved parties to enhance project performance and mitigate delays. Ultimately, understanding and mitigating these factors are essential for achieving successful outcomes in highway construction projects like the Ring Road Junction Improvement Project at Lebu Intersection.

Keywords: *Project delay factors, Lebu Intersection project, Relative importance index, Highway Construction*

CHAPTER ONE

1. INTRODUCTION

1.1. BACKGROUND OF THE STUDY

Highway infrastructure plays a pivotal role in facilitating economic development and enhancing connectivity within and between regions (World Bank, 2019). As nations strive to meet the evolving demands of transportation, the efficient construction of highways emerges as a critical concern. The successful completion of highway projects hinges upon a multitude of factors, ranging from logistical challenges to environmental considerations and regulatory frameworks. Understanding and effectively managing these factors are paramount for ensuring the timely and cost-effective completion of highway construction projects.

Projects are assumed to be delayed when they are not completed or they do not commence based on the contact set dates. The main issue of projects not being completed on time and based on the initially mentioned budget is observed worldwide and worsening, as highlighted by Ahmed et al. (2002). According to Ashley, et al. (2008), the trend of cost overrun is common worldwide and is more severe in developing countries. This problem is collectively mentioned by factors like inadequate planning, unforeseen changes in project scope, and ineffective risk management strategies (Turner & Zolin, 2012). The matter of project completion emerges as a universal concern impacting all stakeholders involved in construction projects. Hence, it becomes imperative for project management, as a growing profession, to tackle every aspect influencing project completion. The concept of contracts was devised to partly shift the risks inherent in project execution primarily to the contractor responsible for its implementation. The ability of the contractor is limited in regards to claiming extra money, which is limited to situations where the client has either ordered the variation work or has caused the delay by employing different factors (McNair et al., 2011). Effective project management practices, including comprehensive risk assessment, stakeholder engagement, and backup planning, are necessary to reduce or eradicate delays and over budgeting which will ensure project success. (Kerzner, 2017).

Construction industries in developing countries were involved in studies that identified performance problems of wide variety. Poor performance of projects in countries that

are developing was reviewed and reported by George Ofori (1994). Identification of unsatisfactory result causes in Nigeria was accounted by Aniekwu and Okpala (1988), and difficulties in Tanzania and Ghana was accounted by the National Construction Council in Tanzania (1993) and Abedi and Haxnmond (1997) respectively. Multidimensional causes of low-quality performance of major projects have been stated in numerous literatures in which few were discovered to take twice as much time as stated in the initial contract document. Services given by public transport in Ethiopia depend on quality road structures. Since the separation of Eritrea from Ethiopia in 1993, Ethiopia's international trade occurs through ports of Djibouti (Admasu Shiferaw, 2012).

The industry of construction is immensely involved in any economy and affects or is affected by the nations' gross domestic product (GDP) (Cox et al., 1998, as cited in Madi, 2003). However, the construction industry's share of GDP in developed countries exceeds that of developing countries (Cox et al., 1998, as cited in Madi, 2003).

This project work endeavors to explore the multifaceted landscape of factors influencing the progress of highway construction. By exploring the intricate interplay between various stakeholders, technologies, environmental impacts, and regulatory frameworks, and synthesizing existing literature, and conducting empirical research, this project work aims to identify key determinants of success and potential areas providing insights that can inform decision-making processes and enhance the efficiency of highway infrastructure development. It is specifically aimed to review Ethiopia's current asphalt road construction practices, considering the causes and results of delays in road construction, and propose recommendations, particularly focusing on Addis Ababa Asphalt Road Construction Projects. It is expected that the discoveries of the project work will provide recommendations based on the assumption of the analysis to address the identified issues and reduce the difficulty of timely commencement of road projects in the future.

1.2. STATEMENT OF THE PROBLEM

Projects involve coordinated activities with specified start and end dates, aiming to achieve specific objectives within constraints like time, cost, and resources (Lockyer & Gordon, 1996). Delays are common across projects, including construction, impacting various indications of performance including time, cost, quality, and client contentment.

In road construction, delays are prevalent, posing significant challenges, especially in developing countries like Ethiopia, affecting industries, socio-economics, and cultural aspects.

Several factors contribute to road project delays, including client issues, material shortages, infrastructure inadequacies, funding gaps, and managerial shortcomings. Identifying these primary factors is crucial for comprehensive resolution. According to Johnson and Brown (2020), delays in road infrastructure often result from inadequate planning, unexpected site conditions, and poor stakeholder communication.

This study focuses on understanding the challenges and solutions in the Lebu Intersection Road construction project, aiming to identify root causes and propose solutions.

1.3. RESEARCH QUESTIONS

- How does inadequate managerial oversight affect the progress of road construction projects?
- What impact does deficient project planning have on the timely completion of road projects?
- How does financial management influence the timely completion of road projects?
- What role does technical expertise play in the completion of road projects?
- How does the availability of project materials impact the completion of road construction projects?

1.4. OBJECTIVE OF THE STUDY

1.4.1. General Objective

The general objective of this project work is to comprehensively distinguish the major factors influencing the advancement of highway construction, specifically on the Ring Road Junction Improvement Project at Lebu Intersection.

1.4.2. Specific Objective

1. To assess the principal managerial factors influencing the successful completion of asphalt road construction projects.

2. To understand the intricacies of planning and execution processes involved in road projects, shedding light on their impact on project completion.

3. To explore the correlation between technical variables and the timely completion of road construction endeavors.

4. To examine the interplay between financial considerations and the successful culmination of road construction projects.

5. To investigate how material factors contribute to or hinder the completion of road construction projects, establishing a clear understanding of their significance.

1.5. SIGNIFICANCE OF THE STUDY

Ethiopia relies heavily on its road infrastructure to facilitate public transport services. In order to enhance this crucial sector, there is a pressing need to identify and implement strategies aimed at reducing unnecessary costs and time losses, thus bolstering the overall efficiency of the construction industry.

By pinpointing the managerial factors that contribute to project delays, stakeholders can devise optimal methods to mitigate these delays and enhance the time and cost execution of construction projects. Consequently, this study serves to heighten the awareness of key stakeholders, including contractors, consultants, and project owners, regarding the underlying causes of inefficiencies in Asphalt Road Construction Projects and their ramifications.

Moreover, the implementation of appropriate mitigation measures can ensure timely project completion within budgetary constraints. Therefore, the findings of this study will significantly contribute to curbing additional costs and time overruns associated with the occurrence of these factors in construction projects.

1.6. SCOPE OF THE STUDY

Within the expansive realm of the construction industry, encompassing projects ranging from highways and roads to bridges and buildings, this study adopts a delimited approach. It is specifically focused on conceptual, locational, and participatory parameters. Conceptually, the study focuses on the factors that affect the progress of highway construction, with a particular emphasis on the Lebu Intersection Project.

In terms of participants, the project was conducted within the confines of Lebu Intersections, with involvement from clients, consultants, and contractors engaged in road construction projects within this locale. Geographically, the study's scope is confined to a singular project site, situated in Addis Ababa, Ethiopia. The survey specifically targeted clients, contractors, and consultants working on the Lebu Intersection project, thereby excluding responses from other locations.

By delimiting its focus to a specific conceptual framework, location, and participant pool, this study aims to provide targeted insights into the factors affecting the progress of highway projects within the context of Lebu Intersection Project, contributing valuable knowledge to the construction industry.

1.7. LIMITATION OF THE STUDY

The issue of defects in asphalt road construction is of significant magnitude, and the complexity of the case project underscores the need for more comprehensive studies than what has been presented here. However, this project work was not without its limitations. The reluctance of certain stakeholders to divulge information during interviews and desk studies, coupled with the scarcity of written literature specific to the Ethiopian context, alongside constraints in time and financial resources allocated to complete this project work, have significantly constrained the range of this study.

These encountered limitations underscore a pervasive issue within the sector: an overarching attitude of irresponsibility towards finding effective solutions to address the uncontrolled delays in road construction projects. Despite challenges faced during the data collection process, including a lack of enthusiasm from some parties to provide comprehensive information, the researcher tried to gather data to the fullest extent possible. Moreover, efforts were made to utilize available literature relevant to the subject matter and to allocate sufficient time to the research process.

Despite the limitations, it is believed that this diagnostic approach to studying construction defects in road projects will serve as a valuable contribution towards mitigating such defects across the country's road infrastructure. By highlighting the challenges faced and the efforts made to overcome them, this study lays the groundwork for future actions aimed at improving the quality and efficiency of road construction projects in Ethiopia.

1.8. ORGANIZATION OF THE STUDY

The study is structured into five chapters. The first chapter serves as the introduction to the study, that encompasses the background, research problem, objectives, research questions, significance, scope, limitations, and definitions of key terms. Moving forward to the second chapter, the literature review dives into a comprehensive analysis of relevant literature, encompassing theoretical, empirical, and conceptual frameworks essential to the project topic. In the third chapter, the project methodology is outlined, detailing aspects such as the target population, research approach, sample size, sampling method design, variable measurement, instrumentation, reliability and validity measures, data analysis methods, and ethical considerations. In the fourth chapter, the focus shifts to presenting and discussing the study's findings, including the response rate, demographic profile of respondents, synthesis of project objectives, and an in-depth discussion of the findings. Finally, the fifth and final chapter concludes the study, providing a detailed summary of the findings, drawing conclusions based on the results, and offering recommendations for future project or practical applications based on the insights gained throughout the study.

By adhering to this organizational structure, the study ensures a coherent and systematic presentation of the project process, findings, and implications, facilitating a comprehensive understanding of the topic under investigation.

1.9. DEFINITION OF TERMS

A project is a one-time undertaking with a clear start and end date, a designated budget, and a need for multiple resources, many of which may be limited and must be shared among various stakeholders (PMI, 2017).

Project Management includes the use of knowledge, skills, tools, and techniques to plan, execute, monitor, control, and close project successfully. (Kerzner,2017)

Project Time Management refers to the process of effectively planning, scheduling, and controlling the allocation of time to the project activities to ensure timely project completion (PMBOK Guide,2017).

Project Planning is the initial phase of project management that involves defining project objectives, determining scope, identifying tasks and activities, estimation

resources, establishing timeline, and creating strategies to achieve project goals (Wysocki et al.,2014).

Project Budget refers to the financial allocation and estimation of costs required to execute a project within a specified timeframe (Meredith & Mantel,2018).

Cost overrun refers to the situation in which the actual costs of a project exceed the initially estimated or budgeted costs (Meredith & Mantel,2018).

Project Delay refers to the situation in which a project's completion extends beyond initially planned or expected timeframe (Gido & Clements,2014)

CHAPTER TWO

2. LITERATURE REVIEW

2.1. INTRODUCTION

This chapter is a compilation of literature that was reviewed during the course of this project. It is divided into three sections: the first section is a Conceptual Review, the second section is an Empirical Review, and the final section is a Conceptual Framework. The first section includes a Historical Perspective of Highway Construction, Key Factors Influencing Highway Construction Progress, and Types of Delays in Highway Construction Projects. The second section involves an exploration of various studies on project delay factors and a list of the main causes mentioned in those studies. The final section presents the conceptual framework of the study.

2.2. CONCEPTUAL REVIEW

Highway construction projects are vital for the development and maintenance of transportation infrastructure, essential for economic growth and quality of life (Smith, 2020). As one of the fundamental infrastructural endeavors, the construction of highways demands meticulous planning, resource allocation, and execution. However, these projects are often plagued by delays, resulting in cost overruns, schedule extensions, and negative impacts on stakeholders. Understanding the factors affecting highway construction progress is crucial in mitigating these delays and ensuring successful project completion.

This project aims to analyze the key reasons for delays in highway construction projects, including planning, management, material, financial, and technical factors. By identifying and addressing these factors, project managers can develop strategies to minimize delays and improve project efficiency. By synthesizing insights from a diverse range of scholarly projects, industry reports, and case studies, this review aims to provide a comprehensive understanding of the challenges and opportunities inherent in highway construction endeavors. Through the exploration of the factors mentioned above, this review seeks to clarify the complex interplay of forces shaping the trajectory of highway.

To achieve this objective, the literature review is organized into several sections. Following this introduction, the historical perspective of highway construction in

Ethiopia provides a contextual framework for understanding the evolution of construction techniques and project management practices. Subsequently, the review dives into an in-depth analysis of the various factors influencing highway construction progress, including planning, management, material, financial, and technical factors. Additionally, the literature review involved sources such as relevant magazines and journals, institutional project publications and reports, and financial text books, among others. It comprises the conceptual framework, theoretical review, and empirical review.

Through a comprehensive exploration of the factors affecting highway construction progress, this literature review aims to contribute to the ongoing discourse surrounding infrastructure development and project management practices.

2.2.1. Historical Perspective of Highway Construction

Highway construction in Ethiopia boasts a rich historical legacy, dating back centuries and evolving alongside advancements in transportation technology and urbanization. The Aksumite Empire, flourishing from the 4th to 7th centuries AD, constructed a sophisticated network of stone-paved roads that connected the capital city of Aksum with trade centers, agricultural regions, and neighboring territories. These ancient roads, built using locally quarried stone and advanced engineering techniques, played a crucial role in facilitating trade, communication, and military conquests, contributing significantly to the empire's prosperity and regional influence (Munro-Hay, 1991).

In contemporary Ethiopia, particularly in Addis Ababa, the capital city has experienced rapid urbanization and population growth in recent decades. This demographic shift has placed immense pressure on the city's transportation infrastructure, necessitating substantial investments and collaborative efforts from various stakeholders. The Addis Ababa City Roads Authority (AACRA) is primarily responsible for the planning, design, construction, and maintenance of roads within the city. According to AACRA, their initiatives aim to improve connectivity and ease traffic congestion in Addis Ababa (Addis Ababa City Roads Authority, n.d.). Additionally, the Ethiopian Roads Authority (ERA), a federal government agency, oversees road infrastructure projects across the country, including those within Addis Ababa. ERA plays a pivotal role in funding and managing major road construction initiatives aimed at enhancing national and regional connectivity (Ethiopian Roads Authority, n.d.). Moreover, the Addis Ababa Integrated Transport Program (AAITP) represents a comprehensive approach involving multiple

agencies and stakeholders. This program encompasses various projects such as the expansion of the Light Rail Transit (LRT) system, development of bus rapid transit (BRT) routes, and construction of new road networks. These efforts are geared towards improving mobility options, reducing travel times, and enhancing overall transportation efficiency within the city (World Bank, 2016).

The road construction landscape in Addis Ababa has seen several notable milestones, including the development and expansion of ring roads like the Addis Ababa Ring Road Project (known as the "Sheger Expressway"), aimed at improving intra-city traffic flow. The introduction and expansion of the Addis Ababa LRT system have provided residents with a modern and efficient mode of public transportation, alleviating some of the strain on road networks. Furthermore, major expressways such as the Addis Ababa-Adama Expressway (also known as the "Adama-Awash Expressway") have been constructed to connect the capital with other regions, facilitating economic growth and regional integration.

In addition to physical infrastructure projects, there is a focus on urban beautification and streetscape enhancements to create more pedestrian-friendly environments and improve the overall quality of life for residents. The integration of smart transportation solutions, including intelligent traffic management systems and digital platforms for commuters, further underscores Addis Ababa's commitment to leveraging technology for sustainable urban development (African Development Bank, n.d.; World Bank, n.d.).

These ongoing efforts reflect Ethiopia's proactive approach to addressing the challenges of rapid urbanization and meeting the evolving transportation needs of its capital city. By investing in modern infrastructure and collaborative initiatives, Addis Ababa continues to strive towards enhancing its status as a vibrant and accessible urban center in Africa.

2.2.2. Key Factors Influencing Highway Construction Progress

Highway construction progress is a multifaceted process influenced by a lot of interconnected elements crucial for sustainable development. In Addis Ababa, Ethiopia, where urbanization and population growth are placing increasing demands on transportation infrastructure, understanding and effectively managing these factors is essential for ensuring the successful completion of highway construction projects. This section dives into the intricate web of planning, management, financial, technical, and

material factors that shape the trajectory of highway construction initiatives in the city, drawing insights from existing literature and empirical evidence (Smith & Johnson, 2022, 15(3), pp. 102-118).

- **Unrealistic Target Setting (Planning)**

Unrealistic target setting in highway construction project planning can significantly contribute to project delays due to several reasons. The first reason being, setting unrealistic targets regarding project time lines can lead to overly ambitious schedules that are difficult to achieve in practice. This can result in undue pressure on the construction team to meet unrealistic deadlines, leading to rushed work, increased likelihood of errors, and compromised quality. As noted by Mahamid and Koushki (2015), unrealistic scheduling can lead to project delays as it does not account for unexpected events and challenges that inevitably arise during construction.

In terms of budget allocation setting unrealistic targets can also lead to delays. If project budgets are underestimated or set too low, it may result in insufficient funds to cover the costs of materials, labor, and equipment, leading to delays in procurement or construction activities. According to Mahamid and Koushki (2015), inadequate budget allocation is a common cause of project delays in construction projects.

Furthermore, planning without considering site conditions and constraints can also lead to delays. For example, if project schedules are set without accounting for factors such as adverse weather conditions, difficult terrain, or the need for permits and approvals, it can lead to delays when these challenges inevitably arise during construction. As noted by Liu, Wang, and Xue (2020), failure to consider site-specific conditions in project planning can result in delays and cost overruns.

In addition, unrealistic target setting may also affect stakeholder expectations. If project schedules or budgets are set too optimistically, it may create unrealistic expectations among stakeholders regarding the project's progress and outcomes. When these expectations are not met, it can lead to dissatisfaction and potential disputes, further complicating the project and potentially causing delays.

In conclusion, unrealistic target setting in highway construction project planning can cause delays by creating undue pressure on the construction team, leading to rushed work and compromised quality, inadequate budget allocation, failure to consider site-

specific conditions, and unrealistic stakeholder expectations. It is essential for project planners to set targets that are realistic and achievable to minimize the risk of delays and ensure successful project delivery.

- **Management Factors**

Inadequate project management skills or experience among project managers and team leaders can lead to inefficiencies in planning, coordination, and execution of construction activities. This can result in delays in decision-making, lack of clarity in project objectives, and ineffective allocation of resources, all of which can impede project progress. According to Mahamid and Koushki (2015), poor project management is one of the primary factors contributing to construction time and cost overruns in highway projects.

Ineffective communication and collaboration among project stakeholders can also cause delays. When there is a lack of clear communication channels and coordination mechanisms between the project owner, contractors, subcontractors, suppliers, and regulatory authorities, it can lead to misunderstandings, conflicts, and delays in obtaining approvals or resolving issues. As highlighted by Arain et al. (2017), poor communication and coordination among stakeholders are significant contributors to delays in construction projects.

Furthermore, inadequate risk management practices can also lead to project delays. Failure to identify, assess, and mitigate potential risks such as adverse weather conditions, supply chain disruptions, or labor shortages can result in unforeseen delays and disruptions to project schedules. According to Faisal et al. (2016), ineffective risk management is a prevalent issue in construction projects, often leading to delays and cost overruns.

Moreover, changes in project scope, specifications, or requirements without proper evaluation and approval processes can cause delays. When project changes are made haphazardly or without considering their impact on project schedules, budgets, and resources, it can lead to rework, delays in procurement, and conflicts among project stakeholders. As noted by Ullah et al. (2018), changes in project scope are a significant cause of delays in construction projects.

In conclusion, managerial factors such as poor project management skills, ineffective communication and collaboration, inadequate risk management practices, and poorly managed project changes can all contribute to highway construction project delays. It is essential for project managers and stakeholders to address these issues proactively through effective leadership, communication, coordination, and risk management strategies to minimize the risk of delays and ensure successful project delivery.

- **Financial Factors**

Insufficient budget allocation or funding shortages can lead to delays in project commencement or progress. When project budgets are insufficient to cover the costs of materials, labor, equipment, and overhead expenses, it can result in delays in procurement, construction activities, or payments to contractors and suppliers. According to Mahamid and Koushki (2015), inadequate funding is one of the primary factors contributing to construction time and cost overruns in highway projects.

Delays in securing project financing or approvals can also cause delays. When there are delays in obtaining funding approvals from government agencies, financial institutions, or project sponsors, it can lead to delays in project planning, design, or construction commencement. Additionally, delays in securing permits, licenses, or regulatory approvals can further impede project progress. As highlighted by Ullah et al. (2018), delays in obtaining project financing and approvals are common issues in construction projects, often leading to delays in project execution.

Furthermore, fluctuations in currency exchange rates or inflationary pressures can affect project costs and financing arrangements, potentially leading to delays. When there are significant fluctuations in currency exchange rates or inflation rates, it can increase project costs, affect the availability of funding, or impact the financial viability of the project, leading to delays or disruptions. According to Faisal et al. (2016), currency exchange rate fluctuations and inflationary pressures are significant risk factors in construction projects, often leading to delays and cost overruns.

Moreover, delays in payments to contractors or subcontractors can also cause delays in project execution. When there are delays in processing payments or disputes over payment terms, it can lead to disruptions in construction activities, strained contractor relationships, and potential work stoppages, ultimately resulting in project delays. As

noted by Arain et al. (2017), delays in payments are a common issue in construction projects, often leading to delays and disputes among project stakeholders.

In conclusion, financial factors such as inadequate budget allocation, delays in securing project financing or approvals, currency exchange rate fluctuations, inflationary pressures, and delays in payments to contractors can all contribute to delays in highway construction projects. It is essential for project stakeholders to address these financial challenges proactively through effective financial planning, risk management, and communication strategies to minimize the risk of delays and ensure successful project delivery.

- **Technical Factors**

Deficient project design can lead to delays during the construction phase. If the project design is incomplete, inaccurate, or not optimized for the site conditions, it can result in difficulties during construction, such as unexpected challenges, rework, or design changes. As highlighted by Alkass et al. (2018), incomplete or inaccurate project design is a common cause of delays in construction projects, often leading to rework and schedule extensions.

Technical complexities or challenges in construction methods and techniques can also cause delays. When projects involve complex engineering requirements, specialized construction techniques, or unfamiliar materials, it can increase the risk of delays due to difficulties in implementation, procurement delays, or the need for additional training or expertise. According to Mahamid and Koushki (2015), technical complexities are a significant contributor to construction time and cost overruns in highway projects.

Furthermore, inadequate or outdated construction equipment and technology can also lead to delays. If projects lack access to modern construction equipment, tools, or technology, it can result in inefficiencies, lower productivity, and delays in completing construction activities. For example, outdated equipment may be less efficient or prone to breakdowns, leading to delays in project progress. As noted by Liu, Wang, and Xue (2020), inadequate construction equipment and technology are common causes of delays in road construction projects.

Moreover, environmental or geological challenges can also cause technical delays in highway construction projects. For example, projects located in environmentally

sensitive areas or areas with challenging terrain may require specialized construction techniques or mitigation measures to address environmental concerns or geological hazards. Failure to adequately plan for and address these challenges can result in delays and disruptions to project schedules. According to Faisal et al. (2016), environmental and geological challenges are significant risk factors in construction projects, often leading to delays and cost overruns.

In conclusion, technical factors such as incomplete or inaccurate project design, technical complexities in construction methods, outdated construction equipment and technology, and environmental or geological challenges can all contribute to delays in highway construction projects. It is essential for project stakeholders to address these technical challenges proactively through effective planning, design optimization, investment in modern technology and equipment, and environmental risk management strategies to minimize the risk of delays and ensure successful project delivery.

- **Material Factors**

Delays in material procurement can lead to delays in project commencement or progress. When there are delays in sourcing or obtaining construction materials such as asphalt, concrete, steel, or aggregates, it can impede project activities, such as road pavement or bridge construction. As noted by Liu, Wang, and Xue (2020), delays in material procurement are a common cause of delays in road construction projects.

Shortages or unavailability of construction materials can also cause delays. If there is a shortage of specific materials due to market conditions, supply chain disruptions, or unforeseen events, it can result in delays in project execution. For example, shortages of steel or concrete may delay structural work, while shortages of aggregates may delay road pavement construction. According to Faisal et al. (2016), material shortages are a significant risk factor in construction projects, often leading to delays and cost overruns.

Furthermore, quality issues or defects in construction materials can also cause delays. If materials do not meet quality standards or specifications, it may require replacement, rework, or additional testing, leading to delays in project progress. For example, if concrete mixtures do not achieve the required strength or durability, it may require additional curing time or reconstruction, delaying the completion of structural elements. As highlighted by Arain et al. (2017), quality issues in construction materials are a common cause of delays in building construction projects.

Moreover, changes in material specifications or requirements can also lead to delays. When there are changes in project specifications or design requirements that affect the type, quantity, or quality of materials needed, it can lead to delays in procurement, rework, or redesign, impacting project schedules and budgets. According to Ullah et al. (2018), changes in material specifications are a significant cause of delays in construction projects.

In conclusion, material factors such as delays in procurement, shortages or unavailability of materials, quality issues or defects, and changes in material specifications can all contribute to delays in highway construction projects. It is essential for project stakeholders to address these material challenges proactively through effective supply chain management, quality control measures, and communication strategies to minimize the risk of delays and ensure successful project delivery.

2.2.3. Types of Project Delay in Highway Construction Projects

Projects that include construction are huge investment that need a well thought plan for timely completion in a successful and quality manner. Avoidance of factors influencing a satisfactory result in necessary. In light of this matter, Teams created for projects collectively work on a specific site under unrepeatable conditions. Road projects are often difficult, need intensive team work, transportation of materials, and related tasks to achieve the set-out requirements. Delay experts help contractors regarding claim. The experts conduct a site analysis to pin point the type and scope of the influencing factor in the construction project.

Delays in construction can prevent the timely progress in the projects. According to Smith & Johnson (2018), the main types of schedule delays in a construction project are Excusable Delays, Non-excusable Delays, Critical Delays, Non-Critical Delays, Concurrent Delays, and Compensable Delays. Excusable delays are caused by unforeseen circumstances beyond any party's control, allowing contractors to request time extensions and additional compensation. It's crucial to specify potential excusable delays in the project contract. Examples include natural disasters (like floods or earthquakes), unexpected events (such as the Covid-19 pandemic at Lebu Intersection), and errors in project plans caused by the client or others. On the other hand, non-excusable delays stem from factors under the control of either the contractor or the

client, determining liability for associated costs or damages. These include delayed mobilization, late submission of required designs or documents, material supply delays, or inadequate planning by the contractor. Depending on the situation, there may be opportunities to seek time extensions to mitigate these delays' impact on project schedules.

It is very important to consider is a delay is critical to the project. The critical schedule delay has a sizable impact on the due date for the delivery of the project. Depending on whether the impact on the critical path of the construction processes, the impact may be unnoticeable. However, in other cases, critical delays are major cause of delayed project delivery. Compared to critical delays, non-critical delays affect completion of specific activities but have no direct impact on the completion date. The determining factor is whether the delay extends the Critical Path of the project.

Concurrent delays occur when both owners and contractors contribute to disruptions in the project schedule. These delays do not necessarily need to happen simultaneously but impact the project timeline independently. Expert analysis and detailed documentation are typically required to establish concurrent delays and determine each party's responsibility and liability. Based on findings from Levin, P., Stevens, M., & Barnes, C. E. (2019), the claim for damages exist due to different circumstances that occur during project commencement. Compensable delays are those for which the affected party is entitled to compensation, either in the form of time extension or additional payment, to cover the costs incurred due to the delay. These delays are significant because they involve financial compensation, necessitating the presence of witnesses and delay experts to substantiate claims and defend against damages. Understanding the distinction between concurrent and compensable delays is crucial for effectively managing project disruptions and ensuring fair resolution of liability issues between owners and contractors.

- **Causes and Effects of Delays**

In rare cases, construction projects proceed without delays, though numerous studies have examined the causes and impacts of such delays. The Construction Industry Researcher (2021) categorized delay causes into four main groups. Contractors contribute to delays due to financing difficulties, inadequate site management and supervision, poor planning and scheduling, and insufficient technical staff

qualifications. Consultants cause delays through inadequate site supervision, lack of experience, delayed review and approval of design documents, and slow preparation of drawings. Clients contribute to delays by not approving shop drawings and samples promptly, delaying decision-making processes, suspending work, facing financial issues, modifying contracts, and lacking coordination with contractors. External factors, such as natural disasters or labor disputes, also contribute to delays.

Delays in construction projects often lead to adversarial relationships, litigation, and cash-flow problems among clients, contractors, and consultants. Sambasivan and Scon (2007) highlighted time and cost overruns as the most significant effects reported by respondents in their survey. Cost overruns, where project costs exceed expectations, are particularly inconvenient for stakeholders and taxpayers. Additionally, construction delays may lead to project abandonment, impacting employment, economic activity, government expenditures, and investor confidence in the construction sector (Mbachu & Nkado, 2004).

2.3. REVIEW OF EMPERICAL STUDIES

The following section presents a collection of project studies exploring the factors contributing to project delays globally across various industries. The finding of some of the studies are summarized below.

Smith and Brown (2019) conducted a qualitative study to explore the relationship between stakeholder engagement and project delays in the construction industry. They interviewed project managers and stakeholders from various construction projects to identify factors contributing to delays. Through thematic analysis, they identified 7 key factors from which the top 3 factors included:

1. Poor communication with stakeholders, leading to misunderstandings and delays in decision-making processes.
2. Lack of stakeholder involvement in decision-making, resulting in delays due to unresolved issues and changes in project requirements.
3. Stakeholder conflicts over project goals or priorities, causing disruptions and disagreements that impact project progress.

Kim and Chen (2022) investigated the impact of project planning practices on project delays in the construction industry. They conducted a survey of construction project

managers and analyzed project data to identify factors influencing project delays. Through factor analysis, they identified 8 main factors of which the top 3 included:

1. Inadequate project scheduling and time management, leading to delays in project execution and increased risk of budget overruns.
2. Poor risk identification and mitigation strategies, resulting in unexpected events or issues that disrupt project progress and cause delays.
3. Lack of contingency planning for unforeseen events, such as adverse weather conditions or material shortages, leading to delays in project schedules and increased project costs.

In their exploratory study conducted in Hargeisa, Somaliland, Fashina et al. (2021) investigated the key factors influencing delays in construction projects. Their findings revealed the following project delay factors where identified and mentioned as follows: delays in honoring progressive payments, underestimation or overestimation of project costs, delays in the approval of major changes in work scope, errors in design and contract documents, delays in subcontractor's work, poor communication and coordination with contracting parties, shortage or lack of equipment, shortage or lack of labor, difficulties in materials procurement (lateness), unfavorable site conditions, and lack of significant experience among consultants.

There are also studies done in Ethiopia regarding the factors that cause project delays using different types of projects as case studies. Some of the findings related to this project are presented below.

Abdurezak Mohammed and Neway Seifu (2019) conducted a study on the Causes of Delay in Public Building Construction Projects in Addis Ababa, Ethiopia. Their project identified the top ten factors contributing to construction delays in these projects. These factors include challenges in project financing, deficiencies in project management systems, delays in the issuance of designs and working drawings, scarcity of imported construction materials and goods in the market, design errors and complexities, delays in progress payments for completed works, tardiness in project commencement and resource mobilization to the site, financing issues, inaccuracies in site investigation reports, and price inflation (Abdurezak Mohammed and Neway Seifu, 2019).

Adem Abera (2022) conducted a quantitative study to identify the main causes of the delay in Ethio Telecom's ODN projects. A total of 39 ODN project delay factors were identified which were further categorized into 4 major groups. The study revealed that design related delay factors to be the highest-ranking cause followed by the owner related delay factors, then external related delay factors, and contractor related delay factors.

Abdo (2006) investigated delays in public building construction projects and their repercussions in Ethiopia. The study encompassed 52 public building projects executed by local contractors from 1995 to 2005. Data on delays were collected through a questionnaire survey, with analysis based on mean scores from 62 responses representing contractors, consultants, public owners, and construction professionals. The researcher categorized 80 delay causes into six groups: design-related, management-related, construction-related, finance-related, code-related, and force majeure-related. Among these, design-related causes were identified as the most prevalent, followed by management-related delays. The study highlighted 10 critical delay causes in Ethiopian public building projects, including material scarcity in the market, delayed material supply, overdue payments to contractors, unrealistic performance schedules, subsurface condition changes, client financial shortages, adverse weather conditions, insufficient planning emphasis, material and labor cost escalation, and variations (Abdo, 2006).

2.4. CONCEPTUAL MODEL/FRAMEWORK

There are a total of five general categories identified as factors affecting the progress of highway construction from the literature review namely Planning Factor, Management Factor, Financial Factor, Material Factor, and Technical Factor. The conceptual framework describes how each factor causes time delay in highway construction project, specifically observed by the researcher in Lebu Intersection Project.

- Setting unrealistic deadlines for completing a specified task led to challenges in quality management and scoping the work accurately. Consequently, rather than saving time, it resulted in delays.
- The project timeline was delayed due to inadequate management, resulting in work delays, resource mismanagement and budget misallocation.

- Financial issues such as funding shortages and payment delays compelled contractors to compromise on the quality of materials and personnel. This sometimes led to stopping project work as they were unable to pay the workers on site, further contributing to delays in the project timeline.
- The failure to hire sufficiently skilled professionals and companies capable of providing proper technical support became the primary cause of multiple errors in the site work. This, in turn, exacerbated project delays and resulted in losses for all parties involved.
- Rising material costs, material shortages, and occasional late deliveries forced parties involved to either compromise on quality or stop work until the materials became available again. Consequently, this led to further delays in the project.

Building upon the overview provided, the study will dive into a detailed exploration of the factors and their underlying causes utilizing various research methods.

CHAPTER THREE

3. RESEARCH METHODOLOGY

3.1. INTRODUCTION

The project methodology serves as the road map guiding researchers through their investigative journey. It expresses how researchers formulate their problems and objectives and subsequently present their findings derived from the data gathered throughout the study period (Jilcha, 2019). Essentially, methodology constitutes a structured plan of action, illustrating how researchers will explore their project questions, gather relevant information employing specific methods, and subsequently analyze this data to draw conclusions and formulate recommendations.

The project is structured around a systematic approach, beginning with preliminary work to establish a foundational understanding of the topic. This is followed by an extensive literature review to explore existing studies and insights. Subsequently, a questionnaire is designed and data collection is conducted to gather relevant information. The collected data is then analyzed to derive meaningful findings. Finally, conclusions are drawn based on the analysis, accompanied by recommendations for future action.

The initial stage in conducting a study on the Lebu Ring Road Junction Improvement Project is gathering relevant information and data. This process encompasses various activities, such as:

- Gathering primary data through field measurements and surveys.
- Acquiring secondary data from institutions, research publications, traders, and stakeholders in the freight transport and logistics sector.
- Obtaining pertinent information through unofficial interviews with involved professionals.

3.2. RESEARCH DESIGN AND APPROACH

"Research design" is the blueprint of scientific inquiry, encompassing the planning and organization of a study (Polit & Hungler, 1985). Designing a research study involves crafting a comprehensive strategy to guide data collection and analysis effectively. The

project work employs a primarily descriptive research design to evaluate different aspects of the selected projects, state and describe the major factors affecting progress of highway construction in the case of Lebu Intersection project and ranking them based on their importance.

While predominantly quantitative in approach qualitative data collection method will also be employed. Data analysis method is also mainly quantitative to articulate the project findings and conclusions, but qualitative analysis will also be employed. Qualitative data collection methods, such as observations, discussions, and desk study, provide rich, detailed insights into participants' experiences, perceptions, and contexts. These methods are particularly well-suited for exploring complex phenomena, understanding subjective meanings, and generating theoretical frameworks (Creswell & Poth, 2018). On the other hand, quantitative data analysis methods, such as statistical analysis, allow researchers to quantify relationships, patterns, and associations within the data. This approach enables generalization of findings, and comparison across different groups or conditions (Creswell & Creswell, 2017).

By combining quantitative and qualitative data collection with quantitative data analysis, the researcher can enhance the validity, reliability, and comprehensiveness of their research findings. Qualitative data provide depth and context to quantitative results, while quantitative analysis adds precision and generalizability to qualitative insights. This integrated approach fosters a more nuanced understanding of the research problem, yielding richer and more actionable findings for theory development, or practical applications (Creswell & Creswell, 2017).

3.3. DESCRIPTION OF STUDY VARIABLES

The methodology of this study involves selecting specific cases aligned with the parameters of the Ethiopian Asphalt Road project. After reviewing of numerous literatures, the researcher has identified the major categories as follows: Planning Factor, Management Factor, Financial Factor, Technical Factor, and Material Factor. The study will involve detailed description of how these factors influence the progress of highway construction specifically in Lebu Intersection Project.

3.4. DESCRIPTION OF THE STUDY AREA AND TARGET POPULATION

3.4.1. The Study Area

The Addis Ababa City Administration is committed to providing quality and standardized roads and transport infrastructure, covering 20% of the city area, to ensure smooth traffic flow for the community (Addis Ababa City Roads Authority, n.d.). This initiative aligns with the city's broader urban development goals, aiming to enhance accessibility and connectivity for residents and businesses alike. Completion of projects is pivotal for their success, minimizing issues for all stakeholders and opening avenues for related projects. Despite modern management techniques, construction delays are common globally, necessitating efficient project management strategies and stakeholder coordination.

Previously, the city had 1300km of roads, with 900km being gravel and 400km asphalt surfaced. Over the past 12 years, the Addis Ababa City Roads Authority has significantly expanded and upgraded the road network, reflecting the city's rapid urbanization and economic growth. This expansion has been crucial in supporting the city's development and facilitating transportation within and beyond its borders. Currently, the city boasts 3324km of roads, covering 12.21% of the developed area. This extensive road network plays a vital role in enabling mobility and access to essential services for the city's growing population.

This study primarily focuses on one ongoing project. The Addis Ababa City Roads Authority, under the Addis Ababa City Administration, is undertaking the Ring Road Junction Improvement Project as part of Package 37 Lot-1: Lebu Intersections. These projects underscore the city's commitment to continuous infrastructure development and urban renewal efforts. The junction is:

Table 0-1 Contract Data of Lebu Intersection

Contract Signing Date:	June 16, 2020
Commencement date:	July 20, 2020
Works Supervision Period:	365 cal. days (1 Year)
Original Contract completion date:	July 20, 2021

Lebu Junction:

Lebu junction is located in Addis Ababa and used to facilitate for traffic coming from four directions which are from German Roundabout, Lafto, Haile Garment and Jemo. It's all approaching legs are paved with an average existing entry width of about 16m, 9.3m, 16m, and 9.3m for German Roundabout, Lafto, Haile Garment and Jemo respectively as compared to the anticipated roadway width 25m the existing road is narrow and all with pedestrian walkway with an average of width 3.5m.

3.4.2. Target Population

The project encompassed a road project, namely the Lebu Intersection project. The population for the study comprised 70 staff members from various entities including the contractor, employer, and consultants, involved in the road projects.

3.5. SAMPLING TECHNIQUE

3.5.1. Sample Size

The process of deciding how many replicates or observations to include in a statistical sample is known as sample size determination. Project managers, contract administrators, project team leaders, supervisors, different engineers, clients, consultants, and contractors from the Lebu Interchanges Road projects make up the sample size for calculating a population proportion based on the assumptions.

The sample size determination technique (Yamane, 1967) is used to calculate the sample size needed to estimate a population proportion. The formula is:

$$\mathbf{n=N/1+N\ (e)^2}$$

Where: n= sample size

N=population size/total number of managers, contractors, contract admins, consultants etc.

1= constant

E= margin of safety or error margin

An often-stated recommendation for quantitative data analysis is that, for basic statistical analyses involving descriptive statistics, a minimum sample size of 50 is generally considered sufficient (Thompson, 2002). The population breakdown for Lebu Intersection Project involved 10 Clients, 44 Contractors, and 21 Consultants. While

selecting the sample size, the selection criteria considered participants who were directly involved or have significant knowledge about the project, diversity of chosen parties to get comprehensive view, and participants who were available and willing to provide the necessary data within the study period. The selection process involved nominating marginal error to be 5% to consider errors based on the study requirements and practical constraints.

Collectively from the total population of seventy (75) clients, consultants, contractors registered in road, the researcher unofficially interviewed and officially collected questionnaire from the selected sample size being 10 Clients, 40 Contractors, and 20 Consultants working in specific areas concerned in Lebu Intersection. These respondents having been in construction sector and directly working in departments perceived to be oriented in dealing with road construction therefore aligned to the study project objectives.

3.5.2. Sampling Techniques

It is essential to gather data using a suitable sampling technique that directs the researcher. After determining the sample size, this study used a stratified random sampling approach followed by a systematic random sampling strategy to select the specific participants. A stratified random sample technique necessitates that the researcher split the population into smaller groups, according to Deribsa (2018). Because stratified random sampling is essential for creating strata for various job categories, it is recommended. From each of the Lebu Intersection Project's stratified occupational categories, a representative sample was chosen. Selecting sample members from a larger population using a random beginning point and a fixed, periodic interval is known as systematic random sampling.

3.6. DATA COLLECTION

To comprehensively understand the various mechanisms influencing the identification of Factors Affecting Asphalt Road Project completion, this study adopted a multifaceted approach to data collection. This involved a combination of diverse techniques, each tailored to extract specific insights relevant to the project context.

3.6.1. Desk Survey

In order to address the identified problem comprehensively, relevant data is extracted from various sources within the Asphalt Road project framework. This includes scrutinizing project correspondence letters exchanged among the client, consultant, and contractor, as well as examining project time extension documents and monthly progress reports. By exploring into these documents, the study aims to clarify the intricate relationship between theoretical constructs and real-world practices within Asphalt Road projects. The collection of such data will be facilitated through a meticulous desk study, which will serve to assess the significance and viability of the project topic.

3.6.2. Survey

Interviews: In this study, face-to-face unofficial interviews will be conducted with selected individuals to elicit their insights and perspectives on the project topic. Interviews are recognized as a valuable method for gathering data that may not be easily accessible through other means such as observations or questionnaires. Particularly in qualitative approach, interviews with professionals serve as a means to gain in-depth understanding and preliminary opinions regarding the project problem at hand. The aim of these interviews is to gather preliminary insights into the extent of the issues being investigated.

Questionnaires: Using questionnaires provides a direct and efficient means of gathering data from a large number of respondents within a relatively short time frame. Informed by factors identified in the literature review, the questionnaire was carefully crafted to collect numerical data from professionals actively involved in highway construction projects, with a specific focus on the Lebu Intersection. Drawing on previous projects, questions were adapted from Yitayew (2023) to explore potential factors contributing to delays in the Adey Ababa International Stadium Construction Project. Additionally, insights from Faisal et al. (2016) informed the construction of sub-factors within the questionnaire. The questionnaire consisted of two parts: the first aimed at gathering demographic information from respondents, while the second allowed them to assess potential delay factors in highway construction projects using a five-point Likert scale. This scale, consistent with those used by researchers mentioned,

facilitated comparison of project delay factors across studies and aids in the quantitative data analysis method.

3.6.3. Discussion

The project employs dramaturgy as a methodological approach, facilitating conversations with individuals from relevant governmental bodies without eliciting the sense of being interviewed. Additionally, group discussions will be conducted with project personnel directly involved in the project to gather information effectively. This method enables a deeper understanding of the significance of the issue at hand, particularly in terms of performance evaluation.

3.6.4. Variable Measurement and Instrument

The instrument intended to be used in this study include questionnaire administration. Primary data will be collected by the use of questionnaires. The questionnaires are used to collect data from the respondents. The questionnaires will be divided into subheadings that touches on the basic information of the respondents. Walonick (1997) suggests that items in structured questionnaires must be exhaustive; otherwise, the instrument may not generate sufficient data to address the project objectives. In this study piloting was done to test the validity and reliability of the instruments.

Out of the factors identified from the literature review, below listed factors are found to be appropriate to go with Factors Affecting the Progress of Road Construction Projects Management of Lebu Intersection projects, Addis Ababa City Administration subdivided as Planning, Management, Financial, and Technical and Material factor.

The instruments will undergo piloting with a selected group of respondents, and this process will be reiterated. Those respondents who participated in the pilot phase will be included in the study sample to prevent biased study results. A combination of open-ended and close-ended questions will be utilized, considering the expertise of the respondents. Providing respondents with the freedom to express their thoughts in detail will not undermine the integrity of the findings. The administration of the questionnaire will be conducted by the researcher.

3.6.5. Piloting the Research Instrument

After being examined by the supervisor of the project, the questionnaire is tested on a small pilot group of participants who share the same traits as the study participants.

Four employees who work on road construction will make up the pilot sample; they were chosen at random. Piloting aids in identifying potentially ambiguous questions so that they can be reviewed until all participants understand them equally (Mugenda and Mugenda, 2003). When choosing a project instrument, validity and reliability are two crucial aspects to take into account (Leedy and Ormrod, 2005).

According to Creswell (2003), an instrument's validity is determined by the ability to derive relevant and practical conclusions from test results. Thus, the usefulness of the data—rather than the instrument—is what determines validity. Face validity, content validity, and criterion-related validity are the three different forms of validity (Mouton, 2001). In face validity, a researcher uses his discretion to carefully consider and adjust the questions to be answered in order to determine whether they are appropriate for the goals of the study. In order to determine if an instrument offers sufficient coverage of a study, the researcher in content validity depends on the opinions of experts and searches of the literature. Response options will be provided for most of the questions to ensure that the answers given are in line with the project questions they are meant to measure.

3.7. DATA ANALYSIS

The questionnaire responses will be structured based on Likert's five-point ordinal scale, ranging from 1 to 5, organized in ascending order to indicate the level of contribution to each question. In this study, the qualitative data analysis method used is thematic analysis method. Thematic analysis involves identifying, analyzing, and reporting patterns or themes within qualitative data. Researchers systematically identify recurring themes or patterns across the dataset, often through coding, categorizing, and organizing data based on similarities and differences. This approach helps uncover underlying meanings and interpretations within the data. Quantitative data analysis will also be conducted using specialized software to ensure accuracy and control. Descriptive analysis and reliability assessments calculations will be performed using SPSS (Statistical Packages for Social Scientists). This software will facilitate the analysis of descriptive statistics, including measures of central tendency and data distribution. Thus, all questionnaire data will be interpreted using SPSS to derive meaningful insights.

After the data has been collected from the required respondents and interviewees, the datum will then be analyzed qualitatively and quantitatively with appropriate tools of data analysis. First, Relative Importance Index is used to rank the factors which will be performed in Microsoft Excel software. It is used to rank the different causes of delays from the perspective of clients, consultants, contractors and other stakeholders. In addition, weighted averages of each RII were evaluated with client, consultants and contractor's response ratio. This can be represented as:

$$RII=\frac{1n_1+2n_2+3n_3+4n_4+5n_5}{5(n_1+n_2+n_3+n_4+n_5)}$$

Where, n_1 = number of respondents who answered not important,

n_2 = number of respondents who answered slightly important,

n_3 = number of respondents who answered moderate important,

n_4 = number of respondents who answered very important, and

n_5= number of respondents who answered extremely important.

And Weighted averages of RII given as: RII of each factor clients' view * clients' response ratio+ RII of each factor consultants' view * consultants' response ratio + RII of each factor contractors' view * contractors' response ratio.

3.7.1. Questionnaire Approach

A questionnaire is a research instrument that consists of a set of questions or other types of prompts that aims to collect information from a respondent. It will be developed to assess the perceptions of client, consultants, and contractors due to the importance index of Factors Affecting the Progress of Highway Construction. Factors Affecting the Progress of Highway Construction were first examined and identified through a relevant literature review and by conducting interviews with experienced professionals in road construction industry.

3.7.2. Questionnaire Design

The draft questionnaire is discussed with the supervisor of the project work. The final questionnaire contains 5 general factors (Planning, Management, Financial, Technical and Material) including 59 factors influencing the Progress of Highway Construction. The respondents were asked to fill the questionnaire and they have assured that the information will be confidential and only for research purpose.

3.7.3. Questionnaire Content

The questionnaire includes five factors collectively that are related to the factors of delay of construction projects in Addis Ababa, these parts are subdivision as Planning, Management, Financial, Technical and Material factors.

The responses from the client, contractors and consultants regarding performance factors will be computed using relative importance index method (RII). The performance factors were identified on a five-point Likert scale as: not important, slightly important, moderate Important, very important, extremely important. Then, the RII was computed as used by (Saraf. 2015).

$$RII = \frac{\sum_{i=1}^{N} Wi}{A*N}$$

Where,

W is the weight given to each factor by the respondents, from 1 to 5;

A is the highest weight = 5; and

N is the total number.

The RII values have a range of 0 to 1 (0 not inclusive). In comparing two factors, the factor which scores greater value of RII is more important than the other corresponding factor which scores low value of RII.

3.7.4. Data Measurement

In order to be able to select the appropriate method of analysis, the level of measurement must be understood. For each type of measurement, there is an appropriate method that can be applied and not others. In this project, ordinal scales will be used. Ordinal scale is the 2nd level of measurement that reports the ranking and ordering of the data without actually establishing the degree of variation between them. It is a ranking or a rating data that normally uses integers in ascending or descending order. It was organized in the form of a priority scaling (1 = Not important, 2 = Slightly important, 3 = Moderate Important, 4 = Very important, and 5 = Extremely important).

The numbers assigned to the agreement or degree of influence (1, 2, 3, 4, 5) do not indicate that the interval between scales is equal, nor do they indicate absolute quantities. They are merely numerical labels. Based on Likert scale researcher has the following:

Table 0-2 Scales that represent chances of occurrence

Chances of occurrence	Extremely important	Very important	Moderate Important	Slightly important	Not important
Scale	5	4	3	2	1

3.8. RELIABILITY ANALYSIS

Reliability refers mainly to the consistency of a project study or measuring test. Reliability analysis makes sure the probability that a product, system, or service will perform its intended function adequately for a specified period of time, or will operate in a defined environment without failure.

Reliability analysis of the questionnaire is made through SPSS 27. Alpha (Cronbach) is a model of internal consistency, based on the average inter-item correlation. Used for multiple Likert questions in questionnaire determine if the scale is reliable. Thus, if the association in reliability analysis is high, the scale yields consistent results and is therefore reliable. In this study, the overall Cronbach's alpha coefficient for all scaled questions was above 0.7 which satisfies the reliability test requirements as shown below.

Table 0-3 Reliability Analysis

Reliability statistics	**Cronbach's Alpha**	**No of Items**
Planning Factors	0.805	9
Management Factors	0.750	24
Financial Factors	0.840	12
Technical Factors	0.735	8
Material Factors	0.702	6

3.9. ETHICAL STANDARD AND PROCEDURES

According to (Kumar and Kandalama, 2012) the major ethical considerations in project work are the following:

- ✓ Right to choose: everyone has the right to determine whether or not to participate in the project.

- ✓ Informed consent: Project participants had the right to be informed aspects of a project task. Knowing what is involved, how long it took, and what would be done with the data, etc.
- ✓ Respect for anonymity: all informants have right to Privacy and security. This researcher followed all the ethical standards considering confidentiality and data protection mentioned above.

CHAPTER FOUR

4. RESULTS AND DISCUSSION

4.1. INTRODUCTION

This chapter dives into the analysis, interpretation, and presentation of the findings. The primary objective of this project is to investigate the factors influencing the progress of highway construction, with a specific focus on the Ring Road Junction Improvement Project: Lebu Intersection. Furthermore, the study aims to establish benchmarks for project management and the utilization of information technology to enhance the effectiveness and efficiency of delivering Asphalt Road construction projects. Additionally, it examines the impact of project completion time-lines on the effective and efficient delivery of road construction projects.

The findings of the study are based on these responses, interview and document review. These are presented by objectively answering the project questions using a combination of the statements from different sections that have a relation with the project questions. The researcher made use of frequency tables, percentages, mean and standard deviation to present data.

4.2. RESPONSE RATE

The sample description addresses key issues crucial to the current project's objectives. It aids in gauging the overall credibility and dependability of the data sourced from respondents. This data set comprises insights from seasoned professionals from companies of varying scales and geographical locations. Notably, all respondents involved in road construction projects may offer relevant data to address the project inquiries.

The study sampled of 70 employees were selected from the Lebu Intersection Road Project Client, Consultant and Contractors and questionnaires were distributed. Amongst 67 questionnaires were obtained from the field. This constitutes 95.8% return rate. The questionnaire return rate results are shown in Table 4.1.

Table 0-1 Type of respondents` organization

No. of Respondents	Questionnaire Distributed		Questionnaire Returned		Response Rate	
	No	%	No	%	No	%
Client	10	14.7	10	100	10	100
Contractor	40	56	39	97.5	39	97.5
Consultant	20	29.3	18	90	18	90
TOTAL	**70**	**100**	**67**	**95.8**	**67**	**95.8**

Source: Own Survey (2024).

4.3. DEMOGRAPHIC PROFILE OF RESPONDENTS

4.3.1. Population characteristics

This part mainly designed to provide general information about the respondents in detail.

4.3.1.1. Type of respondent's organization

In this study, 90% (18) consultant, 100% (10) client, 97.5% (39) contractor participated in the questionnaire. The general response rate for contractors, clients and consultants was 95.8% and the total number of respondents for the three parties was 67 out 70 respondents. The response rate of consultant was 90% (18 out of 20 respondents), for the owner 100% (10 out of 10 respondents) and 97.5% (39 out of 40 respondents) for contractor. Therefore, most of the respondents were Contractors.

Table 0-2 Respondent's Demographic Characteristics

Description		Frequency	Percent
Gender	Female	22	32.8
	Male	45	67.2
	Total	67	100
Work Experience	0-4 years	29	43.4
	4- 8 years	24	35.8
	8-12 years	7	10.4
	above 12 years	7	10.4
Educational level	Diploma	15	22.4

	BA/ Bsc	44	65.7
	MA/MSc	8	11.9
	Other	0	0
Role in the project	Project owner	3	4.5
	Contract administration	6	9.0
	Project team leader	7	10.5
	Project managers	2	3.0
	Consultant	15	22.3
	Contractors	34	50.7
How many roads project have been involved	Less than 2 projects	32	47.8
	3-5 projects	26	38.8
	More than5 projects	9	13.4

Source: Own survey Data, (2024)

4.3.1.2. Gender of the Respondents

Respondents were requested to indicate their gender. From the findings, majority, 67.2% (n=45) of the respondents were male while 22 of the respondents or 32.8% of the respondents were female. This implied that there is a high male dominance.

4.3.1.3. Educational status of respondents

The questionnaire was designed to collect information specifically from professionals who have a significant role in the construction projects. As shown in Table 4.2, the educational status of most of the respondents was BSc. with a percentage of 65.7% followed by Diploma level (22.4%). Respondents having MA/MSc. covered the minimum percentage with 11.9. This clearly indicates that most of the respondents completed Diploma and Bachelor's Degree. That implies the respondents have enough educational knowledge to respond the area of the study

4.3.1.4. Respondents' designation

The result shows that 4.5% (n=3) of the respondents are Project Owner/Client, 9% (n=6) are Contract Administrator, 10.5% (n=7) are Project Team Leaders, 3% (n=2) are Project Managers, 22.3% (n=15) of respondents are Engineers' Consultant, and 50.7% (n=34) who are Contractors.

4.3.1.5. Experience of respondents

The table shows that 43.4% (n=29) of the respondent's firm have experience between 0 to 4 years at construction works and 35.8% (n=24) of the respondent's experience between 4 to 8 years, 10.4% (n=7) of respondents have experience from 8 to 12 years, and 10.4% (n=7) who have experience more than 12 years.

4.3.1.6. Experience of respondents on road projects

As the table 4.2 indicated, 47.8% (n=32) of the respondent's firm have experience on less than 2 projects at construction works and 38.8% (n=26) of the respondent's experience between 3 to 5 projects, and 13.4% (n=9) who have experience more than more than 5 projects.

4.4. KEY FACTORS INFLUENCING THE COMPLETION OF ASPHALT ROAD CONSTRUCTION PROJECTS

It is recalled that the causes of delays have been categorized into five major groups depending on the source of delay. Ranking of these major groups has also been exercised based on the importance indices of the factors under each of them. The importance index of each group was determined by taking the average of the importance index of the factors under the group in question.

These groups have then been ranked and checked for the agreement among the three parties. The results of ranking and concordance test have been indicated in Tables 4.3 to 4.7 as shown below.

4.4.1. Result of Unrealistic Target Setting (Planning);

This section of the questionnaire aims to distinguish respondents' viewpoints on Unrealistic Target Setting (Planning). Table 4-3 below displays the numerical rankings of Unrealistic Target Setting (Planning) as assessed by the respondents (Clients, Consultants, and Contractors).

Table 0-3 result of Unrealistic target setting (planning)

NO		Description of the factors	CONSULTANT		CONTRACTOR		CLIENT		COMBINED	
			RII	RANK	RII	RANK	RII	RANK	RII	RANK
Unrealistic target setting (planning)	1	Lack of specific experience of the contractor for that project	0.756	2	0.862	1	0.76	2	0.818	**1**
	2	In appropriate project delivery system (DBB, DB etc…)	0.756	2	0.759	3	0.78	1	0.761	**2**
	3	Lack of specialized resource; manpower, equipment…	0.733	3	0.745	5	0.78	1	0.747	**3**
	4	Scope of the project was not clearly defined or changed every time	0.700	4	0.764	2	0.76	2	0.746	**4**
	5	Problem during the tendering stage in fixing project duration	0.767	1	0.754	4	0.64	4	0.741	**5**
	6	Incremental weather condition on site	0.633	7	0.723	6	0.74	3	0.701	**6**
	7	Vague or unclear speciation of the of the project	0.678	5	0.687	7	0.76	2	0.696	**7**
	8	Improper fixing of project precedence and consecutive project	0.656	6	0.682	8	0.76	2	0.687	**8**
	9	Inappropriate Procurement method and procedures	0.656	6	0.646	9	0.74	3	0.663	**9**

Source: Own survey Data, (2024)

As evident from the outcome presented in Table 4-3, the primary issue identified regarding Unrealistic Target Setting (Planning) within the case project is the absence of specific contractor experience, attaining an RII of 0.818. This finding corresponds precisely with the contractor's perspective, underscoring the significance of this factor. Acquiring specific expertise is pivotal for fostering sustainable advancement, enhancing the construction sector, and refining infrastructure delivery methods, thereby increasing construction capabilities.

The analysis shows that besides the main factor of "Lack of specific contractor experience," additional significant contributors to delays in Unrealistic Target Setting (Planning) encompass the "Inappropriate project delivery system (DBB, DB, etc…)" and "Lack of specialized resources." These issues, ranked second and third, respectively, exhibit RII values of 0.761 and 0.747. The inappropriate selection of project delivery

systems and the scarcity of specialized resources both wield substantial influence on project time lines. Such findings highlight the complex interaction of various factors in hindering efficient planning and underline the imperative need for addressing these intricacies to enhance project execution efficacy.

4.4.2. Result of Management Factors

In this category, a comprehensive list of twenty-four (24) Management Factors contributing to project delays was compiled. Table 4-4 below displays the numerical rankings of these Management Factors on a road project, as assessed by the respondents, including Clients, Consultants, and Contractors.

Table 0-4 Result of Management Factors

No		Description of the factors	CONSULTANT		CONTRACTOR		CLIENT		COMBINED	
			RII	RANK	RII	RANK	RII	RANK	RII	RANK
MANAGEMENT FACTORS	1	Proper selecting of Project Manager	0.778	2	0.851	1	0.84	1	0.830	1
	2	Speed of information transfer between project participant	0.789	1	0.769	2	0.84	1	0.785	2
	3	Lack proper pre construction planning and detail work program before commencement of the project and identify the project millstones	0.767	3	0.744	3	0.76	3	0.753	3
	4	Lack of proper budgeting allocation for the project	0.700	6	0.769	2	0.76	3	0.749	4
	5	Frequent change made on the original design and specification	0.722	4	0.744	3	0.74	4	0.738	5
	6	Delay in site handover and right of way clearance	0.644	11	0.713	5	0.84	1	0.732	6
	7	Delay in payment by the client	0.689	7	0.744	3	0.72	5	0.726	7
	8	Poor leadership skill of project manager	0.644	11	0.723	4	0.78	2	0.710	8
	9	Unrealistic resources; labor, equipment and material assignment	0.689	7	0.713	5	0.72	5	0.708	9
	10	Lack of proper monitoring/evaluation and motivation	0.711	5	0.672	9	0.84	1	0.708	10

	11	Low usage of information technology and new ideas	0.678	8	0.713	5	0.7	6	0.702	11
	12	Lack of experience in dealing with the consultant, client, local authority	0.678	8	0.703	6	0.72	5	0.699	12
	13	Approval of variations being delayed and unfair analysis	0.667	9	0.703	6	0.72	5	0.696	13
	14	Unclear organizational structure and delegation of professional and staffing	0.689	7	0.692	7	0.72	5	0.695	14
	15	Poor controlling of workers, materials and equipment	0.633	12	0.723	4	0.68	7	0.692	15
	16	Late response for working drawing and material approval by the Engineer or delayed decision	0.644	11	0.682	8	0.76	3	0.683	16
	17	Insufficient follow up for issues requiring approval	0.667	9	0.672	9	0.7	6	0.675	17
	18	Too much variation order issued	0.644	11	0.692	7	0.66	8	0.674	18
	19	Misunderstanding between project team	0.656	10	0.682	8	0.66	8	0.672	19
	20	Poor relation with site staff and head office	0.633	12	0.692	7	0.66	8	0.671	20
	21	Problem and late delivery of information among the team	0.633	12	0.662	10	0.66	8	0.654	21
	22	Unclear instruction from the supervisor and client	0.622	13	0.621	11	0.68	7	0.630	22
	23	Lack of training for contractor staff	0.644	11	0.621	11	0.58	10	0.621	23
	24	Poor recording and record keeping	0.667	9	0.600	12	0.6	9	0.618	24

Source: Own survey Data, (2024)

Table 4-4 above illustrates the Relative Importance Index findings concerning Management Factors contributing to project delays. According to statistical analysis, the selection of a Project Manager emerges as exceptionally crucial, with a relatively high index of 0.830. Competent project managers have considerable influence over project outcomes and organizational success. While managerial proficiency is pivotal, the industry must prioritize comprehensive training initiatives spanning from entry-level positions to executive leadership.

Respondents identified the Speed of Information Transfer between project participants as the second most critical factor, with a high Relative Importance Index of 0.785. Following closely is the Lack of Proper Pre-construction Planning and detailed work program establishment prior to project commencement, garnering an RII of 0.753. Information exchange in collaborative projects operates dynamically and non-linearly, with network structures significantly impacting efficiency and effectiveness. Meanwhile, construction planning stands as a fundamental yet challenging task in project management and execution, both wielding substantial influence when not managed meticulously.

4.4.3. Result of Financial Factors

The objective of this section of the questionnaire is to initially measure respondents' viewpoints regarding Financial Factors. Presented in Table 4-5 below are the numerical rankings of Financial Factors as assessed by respondents, including Clients, Consultants, and Contractors.

Table 0-5 Result of Financial Factors

No		Description of the factors	CONSULTANT		CONTRACTOR		CLIENT		COMBINED	
			RII	RANK	RII	RANK	RII	RANK	RII	RANK
FINANCIAL FACTORS	1	Quality of equipment's in project	0.722	2	0.774	1	0.680	4	0.746	1
	2	Financial problems for purchasing, renting construction equipment	0.700	4	0.764	2	0.720	2	0.740	2
	3	Low risk management for cost increment	0.689	5	0.744	3	0.700	3	0.723	3

	4	No budget to speed construction or extended working hours	0.733	1	0.723	4	0.7	3	0.722	4
	5	Budget shortage to purchase construction material	0.700	4	0.703	6	0.680	4	0.699	5
	6	Financial problem for increasing spare part cost for equipment	0.667	7	0.713	5	0.680	4	0.696	6
	7	Failure of the client to pay payment resulted from claim	0.700	4	0.682	7	0.700	3	0.690	7
	8	Improper utilization of advance payment	0.711	3	0.682	7	0.660	5	0.687	8
	9	Lack of credit facilities for working capital	0.689	5	0.672	9	0.740	1	0.687	9
	10	Failure to employ skilled and experienced staff and operators due to high salary	0.689	5	0.672	8	0.720	2	0.684	10
	11	Lack of credit facilities for capital investment to acquire all required equipment	0.678	6	0.672	8	0.680	4	0.675	11
	12	Claim Processing is extended not treated fairly	0.656	8	0.662	7	0.660	5	0.660	12

Source: Own survey Data, (2024)

Each response was examined to pinpoint the financial factors contributing to delays. Through meticulous analysis, the major contributors were identified among the potential effects. This analysis was conducted based on the Relative Importance Index of the survey participants.

From each of these responses to identify the financial factor of delay, results were analyzed in order to identify the major ones among the potential effects. The result of

this analysis based on their relative importance index of the parties involved in the survey.

The table above (Table 4-5) shows, Quality of equipment's in project takes the highest rank with RII value of 0.746. the second and third part is financial problems for purchasing, renting construction equipment and Low risk management for cost increment with RII value of 0.74 and 0.723 respectively. Since equipment should be capable of doing the job required of it, Quality of equipment's play an important role for the success of the project.

4.4.4. Result of Technical Factors

The questionnaire was structured to prompt respondents to select and list the Technical Factors contributing to project delays. Respondents have identified and listed the primary Technical Factors responsible for delays in construction projects. Table 4-6 below presents the compiled questionnaires distributed concerning Technical Factors.

Table 0-6 Result of Technical Factors

No		Description of the factors	CONSULTANT		CONTRACTOR		CLIENT		COMBINED	
			RII	RANK	RII	RANK	RII	RANK	RII	RANK
TECHNICAL FACTORS	1	Skill and experience and of site technician	0.756	4	0.821	1	0.840	1	0.806	1
	2	Skill and experience of senior Engineers; Material Engineer, highway Engineer, structural Engineer etc	0.800	1	0.785	2	0.840	1	0.797	2
	3	Experience and capacity of consulting firm	0.778	2	0.774	3	0.820	2	0.782	3
	4	Availability of the Resident Engineer and site technician	0.767	3	0.723	4	0.820	2	0.749	4
	5	Unforeseen site condition especially subsurface	0.656	7	0.713	5	0.780	3	0.708	5
	6	Incomplete design and/or document	0.711	5	0.662	7	0.720	4	0.684	6
	7	Poor estimation of quantities	0.689	6	0.682	6	0.660	6	0.681	7

	8	Errors made due to misunderstanding, mistakes, mis-communication or in adequate experience	0.633	8	0.662	7	0.68	5	0.657	8

Source: Own survey Data, (2024)

As per the respondents' feedback, the primary technical factor identified was the Skill and Experience of site technicians, with an RII value of 0.806. Following closely are the Skill and Experience of senior Engineers, Material Engineer, Highway Engineer, Structural Engineer, etc., and the Experience and Capacity of the consulting firm, with RII values of 0.797 and 0.782, respectively.

Knowledge encompasses both theoretical understanding and practical proficiency gained through experience or education. Skill and experience stand out as pivotal factors contributing to the success of a project. Any deficiency in skill and experience within the project can significantly impact the entire project execution process.

4.4.5. Result of Material Factors

The primary components of construction costs directly relate to material expenses. The construction sector bears the brunt of these Material Factors. Below, Table 4-7 presents the compiled questionnaires distributed concerning Material Factors.

Table 0-7 Result of Material Factors

No.		Description of the factors	CONSULTANT		CONTRACTOR		CLIENT		COMBINED	
			RII	RANK	RII	RANK	RII	RANK	RII	RANK
MATERIAL FACTORS	1	Rising cost of material	0.733	2	0.764	1	0.820	1	0.764	1
	2	Lack of material in local market	0.700	4	0.733	2	0.740	2	0.725	2
	3	Time takes to rectify defective material and difficulties to identify the defects	0.722	3	0.713	3	0.700	3	0.714	3
	4	Late in purchasing and delivery of construction material	0.744	1	0.703	5	0.660	4	0.708	4
	5	Substandard material	0.700	4	0.692	6	0.700	3	0.695	5

	6	Failure to get construction material on credit bases	0.692	5	0.711	4	0.640	5	0.695	5

Source: Own survey Data, (2024)

From the preceding Table 4-7, it's evident that the Rising Cost of Materials emerges as the primary delay factor, having an RII value of 0.764. Following closely are the Lack of Materials in the local market (due to unreliable suppliers) and the Time taken to rectify defective materials, with RII values of 0.725 and 0.714, respectively. With market demand persistently high and supply reduced, material prices have soared to unprecedented levels globally. This situation not only impacts project demand and profitability in the construction sector but also contributes to project delays.

4.5. RESEARCH OBJECTIVES (MAJOR ISSUES OF ANALYSIS)

The road construction performance determinant factors are ranked and presented in the table 4.8 below as per the perspectives of the Client, Consultant and Contractor. Based on the analysis the first ranked critical determinant factor found as Proper selecting of Project Manager with a relative importance index value of 0.83. The second and third factor was found as Lack of specific experience of the contractor for that project and Skill and experience and of site technician with a value of 0.818 and 0.806 respectively. Skill and experience of senior Engineers; Material Engineer, highway Engineer, structural Engineer etc. ranked in fourth place with a RII value of 0.82.

4.5.1. Analysis of Major Categories of Delay Causes

It is recalled that the causes of delays have been categorized into five major groups depending on the source of delay. Ranking of these major 59 factors collectively has also been exercised based on the importance indices of the factors under each of them. The importance index of each group was determined by taking the average of the importance indices of the factors under the group in question. The results of ranking and concordance test have been indicated in Tables 4.8 below.

Table 0-8 factor of delay analysis from the client, Consultant and Contractor's perspectives

NO	Description of the Factors	Contractor		Consultant		Client		Combined	
		RII	Rank	RII	Rank	RII	Rank	RII	Rank
1	Proper selecting of Project Manager	0.851	2	0.778	3	0.84	1	0.83	1
2	Lack of specific experience of the contractor for that project	0.862	1	0.756	8	0.76	14	0.818	2
3	Skill and experience and of site technician	0.821	3	0.756	8	0.84	1	0.806	3
4	Skill and experience of senior Engineers; Material Engineer, highway Engineer, structural Engineer etc	0.785	4	0.8	1	0.84	1	0.797	4
5	Speed of information transfer between project participant	0.769	7	0.789	2	0.84	1	0.785	5
6	Experience and capacity of consulting firm	0.774	5	0.778	3	0.82	7	0.782	6
7	Rising cost of material	0.764	9	0.733	12	0.82	7	0.764	7
8	In appropriate project delivery system (DBB, DB etc…)	0.759	12	0.756	8	0.78	10	0.761	8
9	Lack proper pre construction planning and detail work program before commencement of the project and identify the project millstones	0.744	15	0.767	5	0.76	14	0.753	9
10	Lack of specialized resource; manpower, equipment…	0.749	14	0.733	12	0.78	10	0.747	10
11	Quality of equipment's in project	0.774	5	0.722	15	0.68	41	0.746	11
12	Financial problems for purchasing, renting construction equipment	0.764	9	0.7	22	0.72	26	0.74	12
13	Lack of material in local market	0.733	19	0.7	22	0.74	21	0.725	13
14	Low risk management for cost increment	0.744	15	0.689	29	0.7	34	0.723	14
15	Time takes to rectify defective material and difficulties to identify the defects	0.713	25	0.722	15	0.7	34	0.714	15

Source; Own Survey Data, (2024)

4.5.1.1. Consultant's view

The primary factor identified by consultants as causing delays, with a significant Relative Importance Index (RII) score of 0.8, was the expertise and proficiency of senior engineers, including Material Engineers, Highway Engineers, and Structural Engineers. This factor is crucial for ensuring effective infrastructure delivery and advancing construction skills. Following closely behind, the consultants ranked the "Speed of information transfer between project participants" as the second factor contributing to delays, with an RII score of 0.789. This aspect is fundamental for facilitating efficient decision-making, promoting coordination, managing risks, enhancing customer satisfaction, ensuring regulatory compliance, and fostering adaptability to change, all of which are pivotal for the success of construction projects. The third factor identified by consultants, with a notable RII score of 0.778, was the experience and capacity of the consulting firm. This factor underscores the importance of engaging experienced and capable consulting firms to navigate the complexities of construction projects effectively. In contrast, consultants ranked "Low-risk management for cost increment" as the least influential factor contributing to delays, with an RII score of 0.6, as depicted in Table 4.8. However, it is essential to recognize that inadequate risk management in this area can lead to a range of detrimental outcomes in construction projects. These include cost overruns, budget depletion, financial instability, contractual conflicts, schedule disruptions, compromised quality, negative stakeholder perceptions, and even project abandonment. Thus, effective risk management for cost increments is imperative to mitigate these potential risks and ensure the overall success of construction endeavors.

4.5.1.2. Client's View

"Skill and experience of senior Engineers; Material Engineer, highway Engineer, structural Engineer etc ", "Skill and experience and of site technician", "Speed of information transfer between project participant", and "Proper selecting of Project Manager" were the highest-ranking factors to cause delay on road projects according to client with a RII score of 0.84 which is also top 3 ranking important factors that cause delay according to consultants. Knowledge is both the theoretical and the practical information, facts or skill which we acquire through experience or through learning. Skill and experience are considered as one of major factor for increasing the success of project. As any lack of Skill and experience in the project will affect the whole process

allocated for the project. “Rising cost of material " and “Experience and capacity of consulting firm”, were ranked as the third factors of delay with a RII score of 0.82. The cost of materials used for the project is rising and fluctuating to a degree where contractors can no longer accurately quote projects they have on hand. This mainly causes effective delivery of materials and delay of the project. Enhancing the skills, knowledge and abilities of consulting engineering firms and professionals within firms worked independently is very important factor for the project success.

Table 4.8 shows that clients ranked the “Quality of equipment’s in project “as the last factor with a RII score of 0.68. The negative impacts of bad quality equipment can extend beyond immediate operational challenges to affect project time lines, budgets, safety, quality, and stakeholder relationships.

4.5.1.3. Contractors View

Table 4.8 shows that contractors ranked "Lack of specific experience of the contractor for that project " in the first position with RII score of 0.862. Lack of specific experience of the contractor for a project can pose significant risks and challenges, affecting project success, quality, safety, budget, and stakeholder satisfaction.

“Proper selecting of Project Manager" was ranked as the second major factor of delay by contractors with a RII score of 0.851. A skilled Project Manager plays a pivotal role in guiding the project team, mitigating risks, resolving issues, and delivering high-quality, on-time, and within-budget project outcomes.

The third factor of delay was “Skill and experience of site technician’’ with a RII score of 0.821. The contractors ranked ‘Time takes to rectify defective material and difficulties to identify the defects’’ as the least factor that cause delay with a RII score of 0.62.

A. Unrealistic Target Setting (Planning)

Planning construction is a critical and complex aspect of managing and carrying out construction projects. It encompasses selecting technology, defining tasks, estimating resources and duration for each task, and identifying task interactions. The primary aim during the initial phase of road development is to set clear objectives and requirements for road network expansion, including broader location considerations. Detailed project time statistics are provided in the accompanying table.

Table 0-9 Unrealistic target setting (planning)descriptive statics

Unrealistic target setting (planning)					
Descriptive Statistics					
Planning Factors	N	Minimum	Maximum	Mean	Std. Deviation
Lack of specific experience of the contractor for that project	67	1.00	5.00	4.0597	.98289
In appropriate project delivery system (DBB, DB etc…)	67	2.00	5.00	3.8060	1.01860
Lack of specialized resource; manpower, equipment…	67	2.00	5.00	3.7313	.99365
Valid N (list wise)	67				

The findings indicate that a significant portion of respondents identified the lack of specific contractor experience as a prominent factor, with a mean value of 4.0597. This deficiency in relevant project experience significantly impacts projects and often results in delays.

B. Management Factors

Success in reaching the project objective hinges on skillful planning, organization, control, and leadership. Survey participants concur that this involves arranging production factors, efficiently assembling and organizing resources, and seamlessly integrating them to meet objectives. It guides collective efforts toward predetermined goals and provides relevant feedback accordingly.

Table 0-10 Management Factors descriptive statics

MANAGEMENT FACTORS					
Descriptive Statistics					
Management Factor	N	Minimum	Maximum	Mean	Std. Deviation
Proper selecting of Project Manager	67	2.00	5.00	4.1493	.95749
Speed of information transfer between project participant	67	2.00	5.00	3.9254	.97411
Lack proper pre construction planning and detail work program before commencement of the project and identify the project millstones	67	1.00	5.00	3.7463	1.11930
Valid N (list wise)	67				

According to the findings, the majority concurred that the proper selection of a project manager is the primary management factor contributing to project delays, with a mean value of 4.1493.

C. Financial Factors

Finance plays a crucial role in project management because every project requires careful planning within a specified budget. Projects are structured to achieve objectives while adhering to financial constraints, making finance a pivotal contributor to project success.

Table 0-11 Financial Factors descriptive statics

FINANCIAL FACTORS					
Descriptive Statistics					
Financial Factors	N	Minimum	Maximum	Mean	Std. Deviation
Quality of equipment in project	67	1.00	5.00	3.7313	1.03839
Financial problems for purchasing renting construction equipment	67	1.00	5.00	3.7015	1.14170
Low risk management for cost increment	67	1.00	5.00	3.6119	1.08649
Valid N (listwise)	67				

The study revealed that respondents acknowledged the quality of equipment in a project as a primary factor, with a mean value of 3.7313. The quality of project equipment and machinery significantly impacts the performance of road construction projects.

D. Technical Factors

It encompasses managing communication among technical and non-technical stakeholders, ensuring that projects adhere to proposed time lines, budgets, and scopes.

Table 0-12 Technical Factors Descriptive Statics

TECHNICAL FACTORS					
Descriptive Statistics					
Technical Factors	N	Minimum	Maximum	Mean	Std. Deviation
Skill and experience of site technician	67	2.00	5.00	4.0299	.85227
Skill and experience of senior Engineers; Material	67	2.00	5.00	3.9851	.87892

Engineer, highway Engineer, structural Engineer etc					
Experience and capacity of consulting firm	67	1.00	5.00	3.9104	.98059
Valid N (list wise)	67				

From the Descriptive Statistics above, Skill and experience of site technicians is main factor having mean of 4.0299. Site technicians' knowledge allows them to effectively troubleshoot issues, ensure quality workmanship, and implement best practices. Experienced site technicians can also provide guidance to less experienced team members, ultimately contributing to smoother project execution and higher-quality outcomes.

E. Material Factors

Effective construction project management requires a relentless focus on optimizing the use of labor, materials, and equipment. Among these resources, materials play a pivotal role in ensuring the successful completion of projects.

Table 0-13 Material Factors Descriptive Statistics

MATERIAL FACTORS					
Descriptive Statistics					
Material Factors	N	Minimum	Maximum	Mean	Std. Deviation
Rising cost of material	67	1.00	5.00	3.8209	1.01392
Lack of material in local market (unreliable supplier)	67	1.00	5.00	3.6269	1.15254
Time takes to rectify defective material and difficulties to identify the defects	67	1.00	5.00	3.5672	1.13115
Valid N (list wise)	67				

According to the study, a majority of respondents concurred that the rising cost of materials significantly impacts the performance of road construction projects, with a high mean score of 3.8209. The responses gathered from questionnaires underscore the substantial influence of material costs on construction project performance.

4.5.2. Results of Desk Study, Interview and Discussion

Desk studies gathered data from various archival records such as completion reports, progress reports, payment certificates, and contract documents, supplemented by unstructured interviews. The investigation into the factors influencing highway construction project progress involved reviewing payment certificates, progress reports, and completion reports of selected

road construction projects during desk studies, interviews, and discussions. Since this method of data collection is identified as qualitative approach, the results will be presented using qualitative data analysis namely Thematic Analysis.

Using thematic analysis, we can identify several key themes from the provided findings:

- Stakeholder Involvement: Stakeholders were highly involved at the project's commencement, suggesting the importance of stakeholder engagement and collaboration in project planning and execution.
- Right of Way Issues: The unresolved Right of Way issue before starting the project highlights the significance of addressing legal and regulatory concerns to avoid delays and disputes during project implementation.
- Design Review and Integration: Integrated design reviews of utilities were lacking, indicating potential gaps in coordination and communication among project stakeholders, particularly regarding infrastructure design and planning.
- Subcontracting Challenges: Unauthorized subcontracting and limited subcontractor capacity hindered project progress, underscoring the need for effective subcontractor management and oversight.
- Contract Price Adjustments and Procurement Risks: Concerns were raised about the accuracy of contract price adjustments and the impact of material cost escalation risks and foreign currency shortages on procurement processes.
- Design Approval Processes: Delays in approving design modifications suggest inefficiencies in decision-making processes and highlight the importance of timely approvals to maintain project momentum.
- Impact of External Factors: The COVID-19 pandemic affected material delivery and staff activity, emphasizing the vulnerability of construction projects to external disruptions and the need for contingency planning.
- Planning and Scheduling Challenges: Unrealistic planning and failure to adhere to schedules were evident, indicating the importance of realistic project planning, scheduling, and monitoring to mitigate delays and disruptions.
- Resource Allocation and Staffing: Issues with resource allocation and inadequate staffing levels on the project suggest the importance of resource

management and workforce planning to ensure project efficiency and effectiveness.

- Quality Control: Insufficient testing of production materials during manufacturing highlights potential risks to project quality and underscores the importance of quality assurance measures in construction projects.

These themes provide valuable insights into the challenges and opportunities associated with the project, informing potential areas for improvement and future research directions.

CHAPTER FIVE

5. CONCLUSION AND RECOMMENDATIONS

5.1. INTRODUCTION

In this chapter summary of major findings, conclusion and recommendations formulated by the researcher regarding factors affecting the progress of highway construction will be presented.

5.2. SUMMARY OF MAJOR FINDING

The qualitative findings of the study showed the main cause of the delay was the involvement of the client and stakeholders, particularly regarding traffic management, which necessitated design amendments. This process, which should ideally have been addressed before project commencement, took a year for approval. Design changes often lead to cost overruns or schedule delays. Given that effective change management is crucial in project management, this project incurred a delay of approximately one year due to design alterations, resulting in higher expenses than initially estimated to rectify the issue. The second reason for delays stems from Right of Way issues. Utilities like electric power, telecommunication, water supply, and sanitary sewer lines are often placed within highway Right-of-Way (ROW) to minimize land acquisition, disruption, and costs. However, their shallow burial depth frequently leads to unexpected discoveries during excavation.

From the case study, several key factors affecting project time performance emerged:

- ✓ Expertise and experience of senior engineers (Material Engineer, Highway Engineer, Structural Engineer, etc.)
- ✓ Selection of a competent Project Manager
- ✓ Capacity and experience of the consulting firm
- ✓ Skill and experience of site technicians
- ✓ Availability of the Resident Engineer and site technicians
- ✓ Quality of project equipment
- ✓ Efficiency of information transfer among project participants

The employer should assume greater responsibility from project initiation by clearly defining the project scope manageable by local contractors' capacity. Scientifically determining project timelines equivalent to the project's workload volume is crucial. Cooperative procurement procedures, from design to contractor selection stages, positively impact project performance. Pre-qualification criteria play a vital role in assessing a contractor's capabilities, including financial soundness, technical ability, management capability, and reputation, before awarding the project.

The quantitative findings of the study showed that management factor is the top ranked factor causing delay of progress of highway construction. On the contrary from findings of Smith and Brown (2019), this study revealed that poor communication with clients, leading to misunderstandings and delays is not the highest ranked factors in relative comparison with the remaining 58 factors. This study also revealed that financial factors causing delay are ranked within the top 10 factors listed. Moreover, project management issues are ranked within the top 3 factors. Both of these findings agreed with the findings of Abdurezak Mohammed and Neway Seifu (2019). Based on the combined results from the ranking made on the responses collected from Clients, Contractors, and Consultants the following findings were acquired. From the 9 factors identified in the planning factor, top 3 factors that impede the progress of highway construction include lack of specific experience of the contractor for the project, inappropriate project delivery system (DBB, DB etc…), and lack of specialized resource; manpower, equipment. Taking into account the 24 factors identified, top 3 management factors include proper selecting of project manager, speed of information transfer between project participant, and lack proper pre construction planning and detail work program before commencement of the project and identify the project millstones. Among the 12 delay factors identified, top 3 financial factors include quality of equipment's in project, financial problems for purchasing, renting construction equipment, and low risk management for cost increment. The technical factors identified in this study were 8 in number of which the top 3 include Skill and experience and of site technician, Skill and experience of senior Engineers; Material Engineer, highway Engineer, structural Engineer etc, and Experience and capacity of consulting firm. Material factors was the 5^{th} and final factor identified in the category which involves 6 factors of which the top 3 include Rising cost of material, Lack of material

in local market, and time takes to rectify defective material and difficulties to identify the defects.

Finally, the study showed that by combining all the factors, the top 10 major factors that impede the progress of highway construction include Proper selecting of Project Manager with an RII value of 0.83, Lack of specific experience of the contractor for that project with an RII value of 0.818, Skill and experience and of site technician with RII value of 0.806, Skill and experience of Senior Engineers; Material Engineer, Highway Engineer, Structural Engineer etc. With an RII value of 0.797, Speed of information transfer between project participant with an RII value of 0.785, Experience and capacity of consulting firm with an RII value of 0.782, Rising cost of material with an RII value of 0.764, In appropriate project delivery system (DBB, DB etc….) with an RII value of 0.761, Lack proper pre construction planning and detail work program before commencement of the project and identify the project millstones with an RII value of 0.752, and Availability of the Resident Engineer and site technician with an RII value of 0.749.

5.3. CONCLUSIONS

This section includes the conclusions and recommendations that would help in solving the problem of delay Factors Affecting the Progress of Highway Construction: The case of Ring Road Junction Improvement Project: Lebu Intersection.

The project aimed to achieve several objectives: assessing the primary factors influencing the progress of Road Construction Projects, identifying the impacts of project delays, and providing recommendations to enhance the progress of such projects. To fulfill these goals, the study employed desk research and questionnaire surveys as project instruments. Data collected from the surveys underwent analysis using the SPSS method and the thematic method.

After conducting a meticulous literature review and other methods of data collection, 59 factors were found to be crucial in the delay of Lebu Intersection Project. These factors where then categorized into 5 main categories namely: Planning Factor, Management Factor, Financial Factor, Technical Factor, and Material Factor.

Based on the results from the analysis the following conclusions have been derived and summarized in accordance with the objectives of the project.

The initial aim of this project was to evaluate the primary managerial factors influencing the Progress of Highway Construction Projects. To accomplish this, a questionnaire survey was conducted, encompassing factors impacting the progress of such projects, both internally and externally. These factors, identified through literature review and desk study, were ranked by respondents based on their frequency of occurrence. The ranking was done using the RII (Relative Importance Index). The findings identified 24 factors and the highest-ranking factors overall is a factor listed within the 24 factors identified. This shows that among the remaining factors stated, management factor has the highest influence in delaying the progress of highway construction.

The second objective of this project aimed to establish control measures using checklists and a framework to address issues in Addis Ababa Asphalt Road Construction Projects. The survey results identified employing skilled and experienced senior Engineers and utilizing experienced consulting firms as effective control measures for road construction projects.

As economic and population growth in Addis Ababa continues, traffic congestion, particularly in Nifas Silk Lafto Sub-City, has become a pressing issue. Proposed solutions include carpooling and the use of public transportation. Opting for public transportation is considered the most effective approach due to its efficiency, cost-effectiveness, and reliability. As Charles Kettering once said, "A problem well stated is a problem half solved." Identifying and defining the main factors contributing to delays in projects is a crucial step towards finding solutions.

The final objective aimed to recommend measures to enhance the management of factors in asphalt road construction projects. To achieve this, a questionnaire survey and discussions were conducted and analyzed using the thematic method. The findings underscored that solving the Right of Way problem before project commencement, preventing unauthorized subcontracting, adhering to realistic plans and schedules, timely resource allocation, and expediting design modification processes and approval are essential methods to effectively manage and administer road construction projects.

The overall results of this project generally support findings of similar studies done in different project sectors but focusing on project delay factors within different counties in different continents. However, the finding that showed communication issues

between involved parties was not that significant in relation to the other factors mentioned was not supported by the other studies.

5.4. RECOMMENDATIONS

The aim of this project was to derive insights from the mentioned issues outlined in the literature review via questionnaire surveys and desk studies. Additionally, one of the project's objectives was to provide recommendations for enhancing the timely completion of road construction projects based on the study's findings. Consequently, the recommendations will primarily target addressing the significant problems identified throughout the project's processes.

Drawing upon the results of the desk study analysis and respondents' feedback, the following conclusions have been reached.

For Clients

- Performance evaluation should extend beyond traditional metrics like time, cost, quality, safety, productivity, and profitability. Factors such as technology adaptability, material management effectiveness, and the performance of designers and supervisors should also be taken into account.
- Clients need to establish clear and robust selection criteria for choosing qualified contractors and subcontractors. Effective leadership and ongoing training for workers are essential components of this process.
- Addressing the Right of Way issue before commencing the project is crucial.

For Consultants

- Consultants and designers should conduct regular design checks and comprehensive document reviews promptly to minimize design alterations, thus reducing the need for rework.
- Prior to delivery to the client, thorough checks for defects or bugs should be performed. Construction materials should undergo testing, including essential examinations of all structural components, to ensure compliance with increasingly stringent national and international standards and regulations.

For Contractors

- Unauthorized subcontracting and the limited capacity of such subcontractors can significantly impact project performance. To mitigate this, assign experienced personnel dedicated to preparing and revising work schedules and plans.

For All Parties

- Establishing a centralized project information database is essential to provide stakeholders with comprehensive information on the project area's status, including contractor work repetition. This helps remove miscommunication and/or misunderstanding issues between the participants involved.
- Enhancing the performance of professionals and firms in the construction industry can be achieved through capacity-building programs like the ERA Master program for road sector professionals. This will help reduce the lack of skilled and experienced technicians which basically solves the top 3 major factors mentioned in the findings.
- Contracting parties such as consultants, contractors, and owners should prioritize thorough supervision and control of every project activity. This will help in accomplishing satisfying results up to the expectation of the clients and reduces mistakes or quality compromises made in site.
- Inadequate installation, relocation, maintenance, and management of utilities within road right-of-way can lead to project delays, utility damage, service disruptions, and post-project pavement cuts. It's imperative to evaluate the management practices of telecommunication, electric power, and water supply utilities.

5.5. RECOMMENDATIONS FOR FUTURE STUDIES

Based on the project's findings, the following areas need further investigation:

I. Exploring the indirect impacts of delays on the construction industry.

II. Evaluating alternative solutions to prevent or minimize delays in critical projects' progress.

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Appendix:

Appendix I; Questionnaire

SURVEY QUESTIONNAIRE

Dear Sir/Madam

This is a questionnaire prepared to undertake a Project study entitled Factors affecting the progress of highway construction: Understanding Key Challenges and Remedial Measures in a Case of the Ring Road Junction Improvement Project: Lebu Intersection which is being conducted as partial fulfillment M.A. in project management by Mr. Biruk Lelisa at Addis Ababa University School of Commerce. The main objective of the research to examine the main factors affecting the completion of road projects and makes recommendation based on findings.

Dear Respondents:

Please use (√) mark for Choice Questions and write on the blank spaces on open ended questionnaires.

1. Gender:

□ Male □ Female

2. Academic Background _____

□ Diploma □ Degree □ Post graduate □ other

3. What is your role in the project?

□ Project owner □ contract administrator □ project team leader

□ PM □ Consultant □ Contractor.

4. Working experience in road construction (years)

□ 1-4 □ 4 -8 □ 8-12 □ above 12

5. How many road projects you have been involved in?

□ Less than two projects □ 3-5 projects □ more than 5 projects

6. What kind of method did you use for project planning and scheduling? Choose all appropriate

□ Bar Chart Method □ CPM

any other method please specify _____

7. How often your project being evaluated, monitored, updated and controlled? Choose all appropriate

□ Daily □ Weekly □Monthly □Quarterly □ NA

8. What were your communication practices with the parties and your staff in the project? choose all appropriate

□Letter □Site meeting □ Verbal discussion

if any other method, please Specify_____

9. Do you feel that pre-construction planning is crucial for better time performance?

□Always □Often □ Sometime □ May not have any impact

II: Main questions

Instruction: - For the close ended questions in table forms, please use the following Key words to answer. And put this mark (√) on the corresponding tables/boxes.

E. I= Extremely important (5)

V.I = Very important (4)

M.I= Moderate Important (3)

S.I = Slightly important (2)

N.I = Not important (I)

NO	Description of the factors	E.I (5)	V.I (4)	M.I (3)	S.1 (2)	N.1 (1)
A	**Unrealistic target setting (planning);**					
	Problem during the tendering stage in fixing project duration					
	In appropriate project delivery system (DBB, DB etc.…)					
	Improper fixing of project precedence and consecutive project					
	Inappropriate Procurement method and procedures;					
	i) Experience of the contractor for the project					
	Lack of specific experience of the contractor for that project					
	Lack of specialized resource; manpower, equipment ...					
	ii) Nature of the project					
	Vague or unclear speciation of the of the project					
	Scope of the project was not clearly defined or changed every time					
	iii) Adverse weather condition					
	Incremental weather condition on site					
	Problem during Construction					
B	**MANAGEMENT FACTORS**					
	iv) Planning and scheduling					
	Lack proper pre construction planning and detail work program before commencement of the project and identify the project millstones					
	Unrealistic resources; labor, equipment and material assignment					
	Lack of proper budgeting allocation for the project					
	Proper selecting of Project Manager					
	Unclear organizational structure and delegation of professional and staffing					
	Low usage of information technology and new ideas					
	v) Coordination					
	Poor controlling of workers, materials and equipment					
	Lack of experience in dealing with the consultant, client, local authority					
	Poor relation with site staff and head office					
	Poor leadership skill of project manager					

	vi) Communications					
	Misunderstanding between project team					
	Problem and late delivery of information among the team					
	Speed of information transfer between project participant					
	Unclear instruction from the supervisor and client					
	vii) Approval from the client and/or the consultant					
	Late response for working drawing and material approval by the Engineer or delayed decision					
	Insufficient follow up for issues requiring approval					
	Delay in site handover and right of way clearance					
	Delay in payment by the client					
	viii) Variation and changes					
	Frequent change made on the original design and specification					
	Too much variation order issued					
	Approval of variations being delayed and unfair analysis					
	ix) Documentation					
	Poor recording and record keeping					
	x) Evaluation and Motivation					
	Lack of proper monitoring/evaluation and motivation					
	Lack of training for contractor staff					

- Please specify if there are any other financial factors that affect project time performance

---

NO	Description of the factors	E.I (5)	V.I (4)	M.I (3)	S.1 (2)	N.1 (1)
C	**FINANCIAL FACTORS**					
	xi)Problem of cash flow management					
	Improper utilization of advance payment					
	Low risk management for cost increment					
	xii) Cash flow shortage					
	No budget to speed construction or extended working hours					
	Budget shortage to purchase construction material					
	Financial problems for purchasing, renting construction equipment					
	Financial problem for increasing spare part cost for equipment					
	Failure to employ skilled and experienced staff and operators due to high salary					
	xiii) Claim					
	Failure of the client to pay payment resulted from claim					
	Claim Processing is extended not treated fairly					
	xiv) Lack of credit facilities					
	Lack of credit facilities for capital investment to acquire all required equipment					
	Lack of credit facilities for working capital					
	Quality of equipment's in project					

- Please specify if there are any other financial factors that affect project time performance

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NO	Description of the factors	E.I (5)	V.I (4)	M.I (3)	S.1 (2)	N.1 (1)
D	**TECHNICAL FACTORS**					
	xv) Design related problem					
	Errors made due to misunderstanding, mistakes, miscommunication or in adequate experience					
	Incomplete design and/or document					
	Poor estimation of quantities					
	Unforeseen site condition especially subsurface					
	xvi)Poor site supervision and contract administration					
	Experience and capacity of consulting firm					
	Availability of the Resident Engineer and site technician					
	Skill and experience of Senior Engineers; Material Engineer, Highway Engineer, Structural Engineer etc.					
	Skill and experience and of site technician					
E	**MATERIAL FACTORS**					
	xvii)Procurement					
	Late in purchasing and delivery of construction material					
	Lack of material 1n local market (unreliable supplier)					
	Rising cost of material					
	xviii) Credit facilities					
	Failure to get construction material on credit bases					
	xix) Defective material					
	Substandard material supplied by dealers					
	Time takes to rectify defective material and difficulties to identify the defects					

- Please specify if there are any other financial factors that affect project time performance

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End of questionnaire

Thank you for your time taken in filling this questionnaire

Appendix II: List of VARIABLES

NO	Description of the factors
A	**Unrealistic target setting (planning);**
	Problem during the tendering stage in fixing project duration
	In appropriate project delivery system (DBB, DB etc…)
	Improper fixing of project precedence and consecutive project
	Inappropriate Procurement method and procedures;
	i) Experience of the contractor for the project
	Lack of specific experience of the contractor for that project
	Lack of specialized resource; manpower, equipment…
	ii) Nature of the project
	Vague or unclear speciation of the of the project
	Scope of the project was not clearly defined or changed every time
	iii) Adverse weather condition
	Incremental weather condition on site
Problem during Construction	
B	**MANAGEMENT FACTORS**
	iv) Planning and scheduling
	Lack proper pre construction planning and detail work program before commencement of the project and identify the project millstones
	Unrealistic resources; labor, equipment and material assignment
	Lack of proper budgeting allocation for the project

	Proper selecting of Project Manager
	Unclear organizational structure and delegation of professional and staffing
	Low usage of information technology and new ideas
	v) Coordination
	Poor controlling of workers, materials and equipment
	Lack of experience in dealing with the consultant, client, local authority
	Poor relation with site staff and head office
	Poor leadership skill of project manager
	vi) Communications
	Misunderstanding between project team
	Problem and late delivery of information among the team
	Speed of information transfer between project participant
	Unclear instruction from the supervisor and client
	vii) Approval from the client and/or the consultant
	Late response for working drawing and material approval by the Engineer or delayed decision
	Insufficient follow up for issues requiring approval
	Delay in site handover and right of way clearance
	Delay in payment by the client
	viii) Variation and changes
	Frequent change made on the original design and Specification

	Too much variation order issued
	Approval of variations being delayed and unfair analysis
	ix) Documentation
	Poor recording and record keeping
	x) Evaluation and Motivation
	Lack of proper monitoring/evaluation and motivation
	Lack of training for contractor staff

NO	**Description of the factors**
C	**FINANCIAL FACTORS**
	i) Problem of cash flow management
	Improper utilization of advance payment
	Low risk management for cost increment
	ii) Cash flow shortage
	No budget to speed construction or extended working hours
	Budget shortage to purchase construction material
	Financial problems for purchasing, renting construction equipment
	Financial problem for increasing spare part cost for equipment
	Failure to employ skilled and experienced staff and operators due to high salary
	iii) Claim
	Failure of the client to pay payment resulted from claim
	Claim Processing is extended not treated fairly

	iv) Lack of credit facilities
	Lack of credit facilities for capital investment to acquired all required equipment
	Lack of credit facilities for working capital
	Quality of equipment's in project
NO	**Description of the factors**
D	**TECHNICAL FACTORS**
	i) Design related problem
	Errors made due to misunderstanding, mistakes, miscommunication or in adequate experience
	Incomplete design and/or document
	Poor estimation of quantities
	Unforeseen site condition especially subsurface
	Employer change of original planning during or/and after design is completed
	ii) Poor site supervision and contract administration
	Experience and capacity of consulting firm
	Availability of the Resident Engineer and site technician
	Skill and experience of Senior Engineers; Material Engineer, Highway Engineer, Structural Engineer etc
	Skill and experience and of site technician
E	**MATERIAL FACTORS**
	iii) Procurement
	Late in purchasing and delivery of construction material
	Lack of material in local market (unreliable supplier)
	Rising cost of material

	iv) Credit facilities
	Failure to get construction material on credit bases
	v) Defective material
	Substandard material supplied by dealers
	Time takes to rectify defective material and difficulties to identify the defects

Appendix III: Computation of Indices and ranking of variables

NO	Description of the Factors	Consultant		Contractor		Client		Combined	
		RII	Rank	RII	Rank	RII	Rank	RII	Rank
1	Proper selecting of Project Manager	0.778	3	0.851	2	0.840	1	0.830	1
2	Lack of specific experience of the contractor for that project	0.756	8	0.862	1	0.760	14	0.818	2
3	Skill and experience and of site technician	0.756	8	0.821	3	0.840	1	0.806	3
4	Skill and experience of Senior Engineers; Material Engineer, Highway Engineer, Structural Engineer etc.	0.800	1	0.785	4	0.840	1	0.797	4
5	Speed of information transfer between project participant	0.789	2	0.769	7	0.840	1	0.785	5
6	Experience and capacity of consulting firm	0.778	3	0.774	5	0.820	7	0.782	6
7	Rising cost of material	0.733	12	0.764	9	0.820	7	0.764	7
8	In appropriate project delivery system (DBB, DB etc.…)	0.756	8	0.759	12	0.780	10	0.761	8
9	Lack proper pre construction planning and detail work program before commencement of the project and identify the project millstones	0.767	5	0.744	15	0.760	14	0.752	9
10	Availability of the Resident Engineer and site technician	0.767	5	0.723	20	0.820	7	0.749	10
11	Lack of specialized resource; manpower, equipment	0.733	12	0.749	14	0.780	10	0.749	11
12	Lack of proper budgeting allocation for the project	0.700	22	0.769	7	0.760	14	0.749	11
13	Scope of the project was not clearly defined or changed every time	0.700	22	0.764	9	0.760	14	0.746	13

14	Quality of equipment's in project	0.722	15	0.774	5	0.680	41	0.746	13
15	Problem during the tendering stage in fixing project duration	0.767	5	0.754	13	0.640	56	0.740	15
16	Financial problems for purchasing, renting construction equipment	0.700	22	0.764	9	0.720	26	0.740	15
17	Frequent change made on the original design and specification	0.722	15	0.744	15	0.740	21	0.737	17
18	Delay in payment by the client	0.689	29	0.744	15	0.720	26	0.725	18
19	Lack of material 1n local market (unreliable supplier)	0.700	22	0.733	19	0.740	21	0.725	19
20	Low risk management for cost increment	0.689	29	0.744	15	0.700	34	0.722	20
21	No budget to speed construction or extended working hours	0.733	12	0.723	20	0.700	34	0.722	20
22	Time takes to rectify defective material and difficulties to identify the defects	0.722	15	0.713	25	0.700	34	0.713	22
23	Delay in site handover and right of way clearance	0.644	49	0.713	25	0.840	1	0.713	23
24	Poor leadership skill of project manager	0.644	49	0.723	20	0.780	10	0.710	24
25	Late in purchasing and delivery of construction material	0.744	11	0.703	31	0.660	48	0.707	25
26	Unrealistic resources; labor, equipment and material assignment	0.689	29	0.713	25	0.720	26	0.707	26
27	Lack of proper monitoring/evaluation and motivation	0.711	18	0.672	47	0.840	1	0.707	26
28	Unforeseen site condition especially subsurface	0.656	44	0.713	25	0.780	10	0.707	26
29	Incremental weather condition on site	0.633	54	0.723	20	0.740	21	0.701	29
30	Low usage of information technology and new ideas	0.678	36	0.713	25	0.700	34	0.701	29
31	Lack of experience in dealing with the consultant, client, local authority	0.678	36	0.703	31	0.720	26	0.699	31
32	Budget shortage to purchase construction material	0.700	22	0.703	31	0.680	41	0.699	32
33	Vague or unclear speciation of the of the project	0.678	36	0.687	40	0.760	14	0.696	33
34	Unclear organizational structure and delegation of professional and staffing	0.689	29	0.692	35	0.720	26	0.696	33

35	Approval of variations being delayed and unfair analysis	0.667	40	0.703	31	0.720	26	0.696	33
36	Financial problem for increasing spare part cost for equipment	0.667	40	0.713	25	0.680	41	0.696	33
37	Substandard material supplied by dealers	0.700	22	0.692	35	0.700	34	0.696	33
38	Poor controlling of workers, materials and equipment	0.633	54	0.723	20	0.680	41	0.693	38
39	Failure of the client to pay payment resulted from claim	0.700	22	0.682	41	0.700	34	0.690	39
40	Failure to get construction material on credit bases	0.711	18	0.692	35	0.640	56	0.690	39
41	Improper utilization of advance payment	0.711	18	0.682	41	0.660	48	0.687	41
42	Improper fixing of project precedence and consecutive project	0.656	44	0.682	41	0.760	14	0.687	42
43	Lack of credit facilities for working capital	0.689	29	0.672	47	0.740	21	0.687	42
44	Late response for working drawing and material approval by the Engineer or delayed decision	0.644	49	0.682	41	0.760	14	0.684	44
45	Failure to employ skilled and experienced staff and operators due to high salary	0.689	29	0.672	47	0.720	26	0.684	44
46	Incomplete design and/or document	0.711	18	0.662	52	0.720	26	0.684	44
47	Poor estimation of quantities	0.689	29	0.682	41	0.660	48	0.681	47
48	Too much variation order issued	0.644	49	0.692	35	0.660	48	0.675	48
49	Lack of credit facilities for capital investment to acquire all required equipment	0.678	36	0.672	47	0.680	41	0.675	48
50	Insufficient follow up for issues requiring approval	0.667	40	0.672	47	0.700	34	0.675	50
51	Misunderstanding between project team	0.656	44	0.682	41	0.660	48	0.672	51
52	Poor relation with site staff and head office	0.633	54	0.692	35	0.660	48	0.672	52
53	Inappropriate Procurement method and procedures;	0.656	44	0.646	56	0.740	21	0.663	53
54	Claim Processing is extended not treated fairly	0.656	44	0.662	52	0.660	48	0.660	54

55	Errors made due to misunderstanding, mistakes, miscommunication or in adequate experience	0.633	54	0.662	52	0.680	41	0.657	55
56	Problem and late delivery of information among the team	0.633	54	0.662	52	0.660	48	0.654	56
57	Unclear instruction from the supervisor and client	0.622	59	0.621	57	0.680	41	0.630	57
58	Lack of training for contractor staff	0.644	49	0.621	57	0.580	59	0.621	58
59	Poor recording and record keeping	0.667	40	0.600	59	0.600	58	0.618	59