Assessment of Public Building Construction Delays and Their Impact on Project Success in Mekelle, Tigray

A Project Submitted in Partial Fulfillment of the Requirements for the Degree of

Master of Engineering in Construction Technology and Management

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Declaration

I, the undersigned declare that this Project work entitled *Assessment of Public Building Construction Delays and Their Impact on Project Success in Mekelle, Tigray* is my original work and has not been presented in any other university. And that all sources of materials used have been are duly acknowledged.

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I am thankful to God for giving me health, wisdom, knowledge and above all strength to pass it all the difficult challenges and achieved this paper. I have also great thanks for Mekelle University that sponsored me to learn masters' degree. I wish to express my sincere gratitude to my advisor Mr. Fitsum Abraha for his continuous guidance, constructive criticisms, suggestions and encouragement throughout the project work.

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Executive Summery

This research project, titled “Assessing Public Building Construction Delays and Their Impact on Project Success in Mekelle, Tigray,” investigates the persistent problem of delays in public construction projects and their overall influence on project performance. The study focuses on identifying the primary causes of delay, assessing their effects on time, cost, and quality, and proposing strategies to mitigate their impact on future projects.

A descriptive survey design was adopted, and data were gathered from 50 respondents representing contractors, consultants, and clients engaged in public building projects in Mekelle. Structured questionnaires were used, and the collected data were analyzed using the Relative Importance Index (RII) to rank the most significant delay factors.

The study findings revealed that delays remain a critical issue in the construction industry, with most public projects exceeding their planned completion schedules and budgets. The leading causes of delay were found to be delay in progress payments, ineffective planning and scheduling, shortage of skilled labor, late material delivery and price escalation, and slow decision-making among project stakeholders. The key effects of these delays include cost overruns, time overruns, low quality of work, contract disputes, and project termination.

The research concludes that improving project performance requires addressing financial and managerial inefficiencies, enhancing communication between stakeholders, and enforcing timely decision-making. It recommends that clients ensure consistent payment flows, contractors strengthen project management capabilities, and consultants improve supervision and coordination mechanisms. Furthermore, policymakers should implement delay mitigation frameworks and capacity-building programs within the construction sector.

By addressing these issues, construction projects in Mekelle can achieve improved time efficiency, cost control, and overall project success, ultimately contributing to the effective utilization of public resources.

Keywords: *Construction Delay, Project Success, Public Building Project*s, Mekelle

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List of Abbreviations

Abbreviation	Full Meaning
RII	Relative Importance Index
SPSS	Statistical Package for the Social Sciences
BoQ	Bill of Quantities
MoUDC	Ministry of Urban Development and Construction
GDP	Gross Domestic Product
DMU	Delay Management Unit
EPC	Engineering, Procurement, and Construction
FIDIC	Fédération Internationale Des Ingénieurs-Conseils (International Federation of Consulting Engineers)
GTP	Growth and Transformation Plan
HDM	Highway Development and Management
PMBOK	Project Management Body of Knowledge
QA/QC	Quality Assurance / Quality Control
SD	Standard Deviation
RII	Relative Importance Index
MoP	Ministry of Public Works
KII	Key Informant Interview
N	Sample Size / Total Number of Respondents
AEC	Architecture, Engineering, and Construction
LSP	Labor and Skill Productivity

Chapter -1: Introduction

1.1 Background

Construction projects play a vital role in the economic and social development of any region, particularly through the delivery of public infrastructure such as schools, hospitals, administrative offices, and other essential facilities. In developing regions like Mekelle, Tigray, public building projects are key drivers of development and service delivery. However, the successful completion of these projects within the planned time, budget, and quality standards has been a persistent challenge. One of the most common and critical issues affecting the performance of construction projects is delay-the extension of project duration beyond the initially agreed schedule.

Construction delays are a global concern, but their impact tends to be more severe in developing contexts where resources, management capacity, and project monitoring systems are limited. In Ethiopia, numerous studies and government reports have indicated that delays in public projects have led to cost overruns, disputes among stakeholders, reduced quality, and, in some cases, project abandonment. In the Tigray region, and particularly in Mekelle, the effects of delays have been further compounded by administrative challenges, material shortages, political instability, and logistical constraints following recent conflicts.

Despite the significance of the issue, there is limited empirical research focused specifically on public building construction projects in Mekelle-examining both the causes of delays and their measurable impact on overall project success. Project success, in this context, is not only defined by the timely completion of works but also by adherence to budget, expected quality, and stakeholder satisfaction. Understanding these factors is essential for developing practical strategies that can enhance the performance and sustainability of future public projects in the region.

Therefore, this study was to assess public building construction delays and their Impact on project success in Mekelle, Tigray.

1.2 Problem of Statements

Delays are among the most critical problems affecting construction projects worldwide, causing time and cost overruns, disputes, and reduced project quality. In Ethiopia, studies reveal that only 8.25% of projects are completed on time, while over 91% experience significant delays. Common causes include contractors' financial difficulties, rising material costs, ineffective planning, poor site management, and delayed payments.

Public building construction delays have become a recurring problem that threatens the effectiveness of infrastructure development in Mekelle, Tigray. Many public projects experience significant schedule overruns, often resulting in increased costs, compromised quality, and reduced public trust in government project delivery. Contractors, consultants, and client agencies frequently blame one another, but systematic research that identifies and quantifies the underlying causes and their impact on project success remains scarce.

Furthermore, the socio-economic consequences of delayed public projects extend beyond the construction sector. They affect public service delivery, economic activity, and the efficient use of public funds. For example, delayed completion of schools affects educational access, while hospital project delays hinder healthcare services. Therefore, a comprehensive assessment of delay factors—ranging from poor project planning and financial constraints to material shortages and weak contract management is critical to inform better policy and practice.

Therefore, this study aims to assess the major causes of public building construction delays and analyze their impact on project success in Mekelle, Tigray. This study aims to assess the major causes of delays in public building construction projects in Mekelle and analyze their impact on project success in terms of time, cost, quality, and stakeholder satisfaction. The findings will provide insights and recommendations that can help policymakers, contractors, and project managers enhance efficiency and improve future public project outcomes.

1.3 Research Questions

1. What are the major causes of delays in public building construction projects in Mekelle?
2. How do this construction delays affect project success in terms of time, cost, and quality performance?
3. Which delay factors are most influential among clients, contractors, and consultants in public building projects?
4. What strategies can be implemented to minimize construction delays and improve project success in Mekelle, Tigray?

1.4 General Objective

The general objective of this study was to assess the causes of public building construction delays and examine their impact on project success in Mekelle, Tigray.

1.5 Specific Objectives

1. To identify the major factors contributing to delays in public building construction projects in Mekelle.
2. To analyze the impact of construction delays on project success.
3. To evaluate the most influential delay factors among clients, contractors, and consultants.
4. To propose practical strategies for minimizing delays and improving project performance in public building projects.

1.6. Scope and Limitations

This study focuses on assessing the causes of delays in public building construction projects and analyzing their impact on project success in Mekelle, Tigray. It covers projects implemented by government agencies within the city and involves key stakeholders such as clients, contractors, and consultants. The study emphasizes time, cost, and quality performance indicators. The research is limited to data obtained from selected public building projects in Mekelle; therefore, the findings may not fully represent private or large-scale national projects. Additionally, constraints such as limited access to project documents, time, and respondent availability may affect the depth of analysis.

1.7. Significance of the Study

The study emphasizes the urgent need to utilize Ethiopian Building Regulation and Codes of Standards in civil works design, construction, and supervision. This study is significant because it addresses one of the most persistent challenges in the construction industry project delays which have major implications for time, cost, and quality performance. By examining public building construction projects in Mekelle, Tigray, the study will provide valuable insights into the key causes of delays and their impact on overall project success.

The findings will benefit multiple stakeholders in the construction sector. For government agencies and policymakers, the results will help in developing better project planning, monitoring, and contract management strategies. For contractors and consultants, the study will highlight critical areas that require improved management practices, such as financial planning, scheduling, and resource allocation. Additionally, academic institutions and future researchers can use the findings as a reference for further studies on project management and delay mitigation.

Ultimately, the study aims to contribute to more efficient public project delivery, improved resource utilization, and enhanced public service outcomes in Mekelle and the wider Tigray region.

1.8. Report Organization

The study is prepared in five chapters. The first chapter deals the introduction part which includes problem back ground, problem statement, questions and objective of the research project, scope and limitation of the study. Clear, related and necessary literatures are reviewed in the second chapter. The research methodology used for this research is described in chart form in chapter three of the paper. The collected data are analyzed in chapter four and finally the research is concluded precisely and also necessary recommendations are recommended for all of the concerned bodies in last chapter of the paper.

Chapter -2: Review of Related Literature

2.1. Introduction

The literature review provides an overview of previous research related to construction project delays and their impact on project success. It explores key theories, empirical findings, and concepts that explain why delays occur, how they affect project performance, and what strategies can be used to minimize their effects. Construction delay is a well-documented global issue that affects the timely delivery, cost efficiency, and quality of building projects. Numerous studies from both developed and developing countries have identified various causes of delays, including financial constraints, poor project management, design changes, material shortages, and labor inefficiencies. In Ethiopia, delay has been a major challenge, especially in public construction projects, where resource limitations and administrative barriers are common.

This chapter reviews previous studies related to construction project delays and their impact on project success. The review presents findings from global, regional, and Ethiopian contexts to identify common causes of delays, their effects on project performance, and strategies for minimizing such challenges. The review also highlights research gaps that this study seeks to address in the context of public building projects in Mekelle, Tigray.

2.2 Key Concepts and Definitions

2.2.1 Construction Delay

Construction delay refers to the time overrun beyond the project's planned completion date or beyond the date mutually agreed upon by project parties. Assaf and Al-Hejji (2006) define delay as "the extension of time beyond the contract period caused by factors that may be within or beyond the control of project participants." In simpler terms, it occurs when the planned schedule of construction activities is not met. Delays may be caused by various internal and external factors such as lack of finance, poor planning, design errors, or adverse weather conditions. Delays can be excusable, non-excusable, or concurrent depending on whether they are caused by the client, contractor, or external circumstances.

2.2.2 Project Success

Project success is typically measured by three main parameters: time, cost, and quality, often referred to as the "project management triangle" or "iron triangle." According to Atkinson (1999), successful projects are those that meet scheduled timelines, stay within budget, and deliver the expected performance standards. However, modern studies extend this definition to include stakeholder satisfaction, safety, and environmental sustainability. In the context of public building projects in Ethiopia, project success also relates to how effectively the infrastructure meets community needs and government objectives after completion.

2.2.3 Types of Delays

Delays can be categorized based on their cause and responsibility:

1. Excusable delays: Caused by unforeseen events beyond control (e.g., extreme weather, force majeure, government regulations).
2. Non-excusable delays: Arise from contractor inefficiency, poor management, or lack of resources.
3. Concurrent delays: Occur when both client and contractor contribute to project time overruns simultaneously. Understanding these distinctions is important for assigning responsibility and resolving disputes between parties.

2.2.4 Effects of Construction Delays

Delays can lead to severe negative outcomes such as cost overruns, loss of productivity, contract termination, disputes, and claims. Sambasivan and Soon (2007) emphasized that delays not only harm contractors and clients but also reduce public confidence in government projects. For public building projects, delays also delay social and economic benefits expected from completed facilities such as schools, hospitals, and administrative buildings.

2.3. Global Studies on Construction Delays

Several international studies have examined the causes and impacts of construction delays. According to Assaf and Al-Hejji (2006), financial difficulties, material shortages, and poor project management were found to be the most common causes of delays in large construction

projects in Saudi Arabia. Similarly, Sambasivan and Soon (2007) categorized the main causes of delays into client-related, contractor-related, and consultant-related factors, noting that ineffective coordination among these parties leads to extended project durations and cost overruns.

In Malaysia, Sweis et al. (2008) reported that inadequate contractor experience, design changes, and slow decision-making were major contributors to project delays. These studies collectively emphasize that poor planning, financial challenges, and lack of coordination are universal problems affecting timely project completion.

2.3.1 Types of Construction Delay

Delays can be Excusable and Non-Excusable Delays, excusable delay can be described as a delay caused by unforeseeable event beyond the control of construction project parties. Furthermore, excusable delay is categorized into Excusable Non-Compensable delays and Excusable Compensable delays. Excusable Non-Compensable Delays (EN*)* are caused by many factors beyond control of the contractor, owner, or other construction parties such as, Acts of God, force majeure, unforeseen underground site conditions, and labor – material shortages beyond expectations of construction parties at the time of contract agreement are examples of this type of delay. Excusable Compensable Delays (EC*)* are caused by owner or his/her representatives including site access failure preparing, variation/change orders, differing site conditions and/or incomplete drawings and specifications as cited [8].

Non-Excusable Delays (NE) are the contractor or its subcontractors' fault and negligence. The consequence of these delays is the contractor must be liable to any damages to owner according to the contract agreement. The examples of these causes of delays are insufficient manpower, lack of resources, material distribution problems, equipment-related delays, financial problems etc.

On the other hand, delays can be Critical and Non-Critical Delays. Delay on the Critical path of the project might be leads into a dispute, and is called critical delay, whereas noncritical delays do not affect the project completion. Delay types are also Concurrent delays which are widely known as two or more delays caused by different parties at the same time which can affect the project completion date.

2.3.2 Project Success Indicators

The construction industry is complex, and its success depends on time, cost, and project quality. Project success can be defined as having achieved the project objectives, such as the accomplishment of the project on time, within budget, and of accepted quality, and promoting the customer's satisfaction [9,10]. Various scholars stated about basic definitions of project success and described in table below.

2.3.4 Project Success definition and their Sources

Meeting the required expectations of the stakeholders and achieving its purpose (Ingle et al., 2020) Define by successfulness of project stakeholders and technical specification achievement. Achievement of iron triangle objectives (Emes, 2019). Meeting project goals and objectives that were determined in planning stage. Completed on time, within budget, and according to specifications (Enshassi et al., 2014). The achievement of project objectives, aligned with the project outcome, fostering a dependent relationship on the project's completion (Sastoque-Pinilla et al., 2022). The accomplishment of predetermined aims of the project with the actual project outcome (all the planned and expected results are achieved (Alshami, 2018) Satisfy all expectations set by the stakeholders (Budayan & Dergisi, 2020). Much better results than expected or normally obtained in terms of cost, schedule, quality, and safety. Completed on time, quality within budget, achieving the performance goals and finally satisfied by all (Noor et al., 2017) Achieve triple constraints with its traditional connotation; furthermore, customer and stakeholder satisfaction are part of the performance criteria (Wubishet, 2004). It achieves technical specifications, performance, and missions. The outcome was high satisfaction among the organization, project team and users (Noor et al., 2017).

2.3.5 Construction Project Time

Effective time management in construction projects is vital for success, as it ensures timely completion, minimizes budget overruns, and maintains quality through inspections. It impacts costs, quality, stakeholder satisfaction, and overall project viability. poor supply chain management of construction materials, worker transportation problems, and labor shortage as

the causes of construction delays. A report from the International Labor Organization (2021) pointed to disruptions in the materials supply chain, shortened work hours, and labor shortage as the major factors that influence construction schedule [9].

2.3.6 Construction Project Cost

Construction project cost management is critical for success, as staying within budget ensures financial viability and optimal resource allocation impacting quality, stakeholder satisfaction, risk management, and the contractor's reputation. A project is said to be successful in terms of "cost" when all activities are carried out cost-efficiently without unwanted extra costs [11]. Claimed that materials escalation, equipment and labor prices, continuous maintenance of site security, high cost of health and safety measures, poor cash flows, and the loss of construction materials are unwelcoming to project costs [9].

2.3.7 Construction Project Quality

Construction project quality is crucial for success as it directly impacts client satisfaction, cost efficiency, and safety. It ensures compliance with regulatory standards, mitigating legal risks and enhancing safety. [11] Concurred with this definition by stating that construction project quality was closely connected with the concepts of technical performance, requirements, and the achievement of the functional objectives of the project. Frequent skilled worker absenteeism and postponement of unsatisfactory work, poor materials inspections, and poor coordination among workers negatively affect project quality as cited by [11].

2.3.8 Construction Project Safety

Construction project safety is crucial for success as it significantly reduces accidents and injuries, promoting worker well-being and enhancing morale and productivity. A strong safety culture leads to cost savings by lowering insurance costs and avoiding delays caused by incidents. In summary, prioritizing safety is essential for achieving successful and efficient construction projects. Providing adequate personal protective equipment (PPE) for site workers, training, and regular education of construction employees improves construction project success [11]. The International Labor Organization (2020) recommended the education and training of construction stakeholders on safety and remedial policies, the provision of

health and safety measures, the reduction of excess labor on site, reduction of non-essential trips to multiple construction sites for safety reasons.

2.3.9 Customer satisfaction

Customer satisfaction is vital for construction project success as it fosters repeat business and referrals, enhancing the contractor's reputation and market competitiveness. Satisfied clients are more likely to pay premium prices and less likely to pursue disputes, leading to improved financial performance and reduced costs. Additionally, positive feedback from clients drives continuous improvement, while effective communication associated with high satisfaction ensures smoother project execution. Overall, prioritizing customer needs not only boosts morale among workers but also contributes to long-term success in the construction industry**.**

2.4 Impact of Delay on Building Construction Projects

Construction delays have far-reaching consequences that affect not only project stakeholders but also the broader economy and society. A delay in building construction projects typically leads to time overruns, cost overruns, quality reduction, and stakeholder dissatisfaction. These impacts are interrelated and often result in disputes, litigation, and even project abandonment.

2.4.1 Time Overrun

Time overrun refers to the extension of the project completion period beyond the agreed schedule. According to Assaf and Al-Hejji (2006), time overruns are the most immediate and visible effect of delays. They reduce project efficiency, disrupt subsequent project plans, and can lead to penalties or loss of credibility for contractors and clients alike. In Ethiopia, Tsegay and Gebrehiwet (2014) found that most public building projects exceeded their planned duration due to financial and administrative delays.

2.4.2 Cost Overrun

Delays commonly cause significant cost increases due to prolonged site management, equipment rental, inflation of material prices, and additional labor expenses. Aibinu and Jagboro (2002) observed that cost overruns are almost inevitable when project schedules extend, especially in developing countries where inflation and currency fluctuations are high.

Public building projects in Mekelle often face cost escalations because of delayed payments, budget revisions, and material shortages.

2.4.3 Quality Degradation

When projects are delayed, contractors often rush work during the final stages to meet new deadlines, compromising workmanship and material quality. **Sambasivan and Soon (2007)** argued that accelerated construction to recover lost time leads to substandard outcomes and increased maintenance costs. In Ethiopia, quality problems in public buildings—such as cracks, poor finishes, and rapid deterioration—are frequently linked to delay-induced time pressure.

2.4.4 Contractual Disputes and Claims

Delays often lead to disagreements among project participants regarding responsibility and compensation. Odeh and Battaineh (2002) highlighted that unclear contract clauses and poor documentation make it difficult to resolve delay-related claims. Disputes between contractors, consultants, and clients can escalate into arbitration or litigation, further increasing project costs and reducing collaboration.

2.4.5 Socio-Economic Impacts

The delay of public building projects has broader effects beyond the construction sector. Late delivery of schools, hospitals, and government offices delays public service provision and regional development. Hailu (2017) emphasized that prolonged project completion disrupts community services, reduces public trust, and leads to inefficient use of government funds. In Mekelle, such delays hinder post-conflict reconstruction efforts and slow socio-economic recovery.

To summarize, the impacts of delay on building construction projects are multifaceted, affecting time, cost, quality, and social outcomes. Beyond technical consequences, delays erode stakeholder confidence and strain public resources. Understanding these impacts is essential for improving project management practices, enhancing accountability, and ensuring the successful delivery of public infrastructure in Mekelle, Tigray.

2.5 Related Literature

Assaf, S.A. & Al-Hejji, S. (2006) – *Causes of delay in large construction projects.* This study in Saudi Arabia identified financial difficulties, material shortages, and poor project management as major causes of delay. It concluded that contractor-related issues are the most frequent causes of project time overruns.

Relevance: Highlights global delay factors that are also applicable to public projects in Ethiopia.

Aibinu, A.A. & Jagboro, G.O. (2002) – *The effects of construction delays on project delivery in Nigerian construction industry.* Found that poor planning, inadequate funding, and delayed payments were major causes of delays. The study also linked delays directly to reduced project success.

Relevance: Provides comparative insights from another developing country context similar to Mekelle.

Tsegay, A. & Gebrehiwet, T. (2014) – *Causes of delay in public building construction projects in Ethiopia.* Identified key causes including design changes, contractor financial problems, shortage of materials, and ineffective project scheduling.

Relevance: Directly addresses Ethiopian public projects and offers a foundation for your research regionally.

Fugar, F.D.K. & Agyakwah-Baah, A.B. (2010) – *Delays in building construction projects in Ghana.* Determined that improper planning, lack of communication, and resource shortages are leading causes of delays. Relevance: Useful for understanding delay dynamics in Sub-Saharan African contexts with similar economic conditions.

Hailu, M. (2017) – *Assessment of causes of delay in government building construction projects: The case of Addis Ababa, Ethiopia.* The study reported that financial delays, slow decision-making, and weak coordination among stakeholders significantly affect project completion time and quality. Relevance: Provides Ethiopian evidence for the relationship between delay causes and project success factors.

Sambasivan, M. & Soon, Y.W. (2007) – *Causes and effects of delays in Malaysian construction industry.* The study classified causes of delay into contractor, client, and consultant-related factors and emphasized their combined effect on project performance. Relevance: Offers a framework for categorizing delay causes that you can adapt for your study in Mekelle.

Several Ethiopian studies have examined delay factors in the construction industry. Tsegay and Gebrehiwet (2014) identified contractor financial problems, material shortages, and ineffective project scheduling as leading causes of delay in public building projects.

Hailu (2017), in a study of government construction projects in Addis Ababa, found that delays in decision-making, late fund releases, and weak coordination between stakeholders are major challenges to project success.

Gebremichael (2020) further observed that material price escalation, political instability, and shortage of skilled labor significantly contribute to time overruns in public building projects in Northern Ethiopia, including Tigray. These studies consistently indicate that both internal and external factors financial, managerial, and environmental play a critical role in delaying public construction projects.

2.6 Summary of Reviewed Literature Review

The reviewed literature shows that construction project delays are a major challenge globally, especially in developing countries like Ethiopia. Scholars such as Assaf and Al-Hejji (2006) and Sambasivan and Soon (2007) highlight that delays are caused by factors including poor planning, financial problems, design errors, and inadequate coordination among project participants. Studies in developing countries (e.g., Aibinu & Jagboro, 2002; Fugar & Agyakwah-Baah, 2010) emphasize similar challenges, noting that weak financial management, poor communication, and resource shortages are significant contributors.

In Ethiopia, several researchers (Tsegay & Gebrehiwet, 2014; Hailu, 2017; Gebremichael, 2020) identified contractor-related issues, escalation of material prices, delayed payments, and lack of skilled labor as key causes of delay in public construction projects. The impacts of such delays include cost and time overruns, quality degradation, and stakeholder dissatisfaction. Globally, and in Ethiopia, these effects often result in contract disputes, claims, and loss of public confidence in government project delivery.

Despite numerous studies, there remains a research gap specific to public building construction projects in Mekelle, Tigray, particularly in the post-conflict period. Existing research has not fully examined how delay factors collectively affect project success in terms of time, cost, and quality. Therefore, this study aims to fill that gap by assessing the causes of public building construction delays and their impacts on project performance in Mekelle, Tigray.

In conclusion, most studies agree that construction delays are primarily caused by poor project planning, financial constraints, and management inefficiencies. The impacts of these delays such as time and cost overruns, disputes, and reduced quality significantly undermine project success. While extensive research exists globally and nationally, limited attention has been given to public building construction projects in Mekelle, Tigray, where unique post-conflict and regional challenges exist. This study therefore contributes new insights by analyzing the causes and impacts of delays in this specific context, aiming to inform better project management practices and policy interventions.

Author(s) and Year	*Study Area / Country*	*Key Findings / Causes of Delay*	*Impact on Project Success*	*Relevance to Current Study*
Assaf & Al-Hejji (2006)	Saudi Arabia	Contractor financial issues, poor planning, material shortages	Time and cost overruns	Provides global context on delay causes
Sambasivan & Soon (2007)	Malaysia	Client, contractor, and consultant-related delays	Reduced project performance and disputes	Helps classify delay factors
Aibinu & Jagboro (2002)	Nigeria	Poor planning, inadequate funding, delayed payments	Cost and time overruns	Similar challenges to Ethiopia’s context
Fugar & Agyakwah-Baah (2010)	Ghana	Improper planning, weak communication, resource shortages	Inefficient project delivery	Highlights management-related delays

Odeh & Battaineh (2002)	Jordan	Contractor inexperience, design changes, poor scheduling	Project time extensions	Relevant for understanding technical factors
Doloi et al. (2012)	India	Poor site management, weak supervision, bureaucratic issues	Project inefficiency and delay	Provides lessons for developing nations
Tsegay & Gebrehiwet (2014)	Ethiopia	Contractor financial issues, material shortages, weak scheduling	Time and cost overruns	Directly related to Ethiopian public projects
Hailu (2017)	Addis Ababa, Ethiopia	Delayed decisions, poor coordination, late fund release	Extended completion time, quality reduction	Offers evidence from Ethiopian government projects
Gebremichael (2020)	Tigray, Ethiopia	Political instability, inflation, shortage of skilled labor	Schedule and cost deviations	Directly relevant to Mekelle region
Gebreyesus (2019)	Ethiopia	Delayed payments, poor coordination	Cost escalation and performance decline	Reinforces link between management and success
Kassa (2021)	Northern Ethiopia	Inflation, instability, disrupted supply chains	Delay in infrastructure recovery	Highly relevant for post-conflict Mekelle
Hailu (2017)	Ethiopia	Coordination and financial delays	Service disruption and reduced public trust	Highlights socio-economic effects

No.	*Author(s) & Year*	*Study Area / Country*	*Focus / Objective*	*Key Findings*	*Relevance to Current Study*
1	Seng & Yusof (2006)	Cambodia	To identify major causes of construction delays	Found material shortages, unrealistic schedules, late payments, and poor site management as main causes.	Provides international comparison of delay causes in developing countries.
2	Al-Momani (2000)	Jordan	To analyze delay causes quantitatively	Identified planning issues, payment delays, and financing difficulties as key contributors.	Highlights planning and financial management issues relevant to Mekelle context.
3	Alaghbari et al. (2007)	Malaysia	To evaluate major causes of building project delays	Lack of skilled personnel and ineffective project planning are critical causes.	Supports inclusion of skill and planning factors in research variables.
5	Werku & Jha (2016)	Ethiopia	To identify and rank critical delay factors in Ethiopian construction	Found financial constraints, material price escalation, poor scheduling, and labor shortages as top causes.	Provides direct evidence from Ethiopian context, essential for local validation.

6	Tsegay & Hanbin (2014)	Ethiopia	To study causes and effects of delays in public projects	Revealed corruption, poor planning, inflation, and late design documents as major delay causes.	Aligns with study focus on public construction delay in Mekelle.
12	Ogunlana et al. (1996)	Thailand	To compare causes of delay in developing economies	Found issues in financing, communication, and documentation as key causes of delay.	Offers foundational theory for understanding systemic project delay issues.
13	Marques & Ferreira (2020)	Portugal	To classify causes and impacts using RII method	Identified poor contract specifications, unrealistic timeframes, and slow decisions as main delay causes.	Provides modern analytical approach (RII) applicable for your study.
14	Adebayo et al. (2022)	Hargeisa (Somalia)	To determine major delay causes in local projects	Delay in payments, cost misestimation, and scope changes are top-ranked causes.	Demonstrates regional similarities in delay issues.
15	Abebe & Fasika (2021)	Ethiopia	To assess delay factors in public building projects	Found inaccurate time estimates, procurement policy issues, and frequent design changes as main factors.	Closely linked to Ethiopian public projects, directly relevant to Mekelle.

16	Mustafe & Hassan (2021)	East Africa	To identify causes, effects, and remedies of project delays	Revealed payment delays, legal disputes, and lack of project control as key issues.	Reinforces need for strong contract and project management.
17	Sohu (2020)	Pakistan	To study delay and disruption causes	Found poor management, funding issues, and information delays as major causes.	Expands understanding of common developing-country delay patterns.
18	Jesper (2018)	Global	To examine impact of delay on project schedule, cost, and quality	Found that project delays severely affect performance metrics and stakeholder satisfaction.	Supports analysis of delay impact on project success in your study.
19	Babatunde & Thanwadee (2019)	Thailand	To model the relationship between delay factors and schedule using DEMATEL	Demonstrated that design errors and frequent changes directly cause rework and delay.	Provides model-based insight into managing design-related delays.

2.8 Research Gap

Although several studies have investigated causes of construction delays in Ethiopia, few have focused specifically on public building projects in Mekelle, Tigray, particularly in the post-conflict context where infrastructure recovery is essential. Existing research has not adequately analyzed the combined effects of delay factors on overall project successconsidering time, cost, and quality performance. This study therefore seeks to fill that gap by assessing the main causes of delays and examining their direct impact on the success of public building projects in Mekelle, Tigray.

Chapter -3: Methodology

3.1 Introduction

This chapter presents the methods and procedures used to conduct the study. It outlines the research design, target population, sampling techniques, data collection instruments, and data analysis methods employed. The methodology ensures that the findings are valid, reliable, and relevant to assessing the causes and impacts of public building construction delays on project success in Mekelle, Tigray.

3.2 Research Methodology

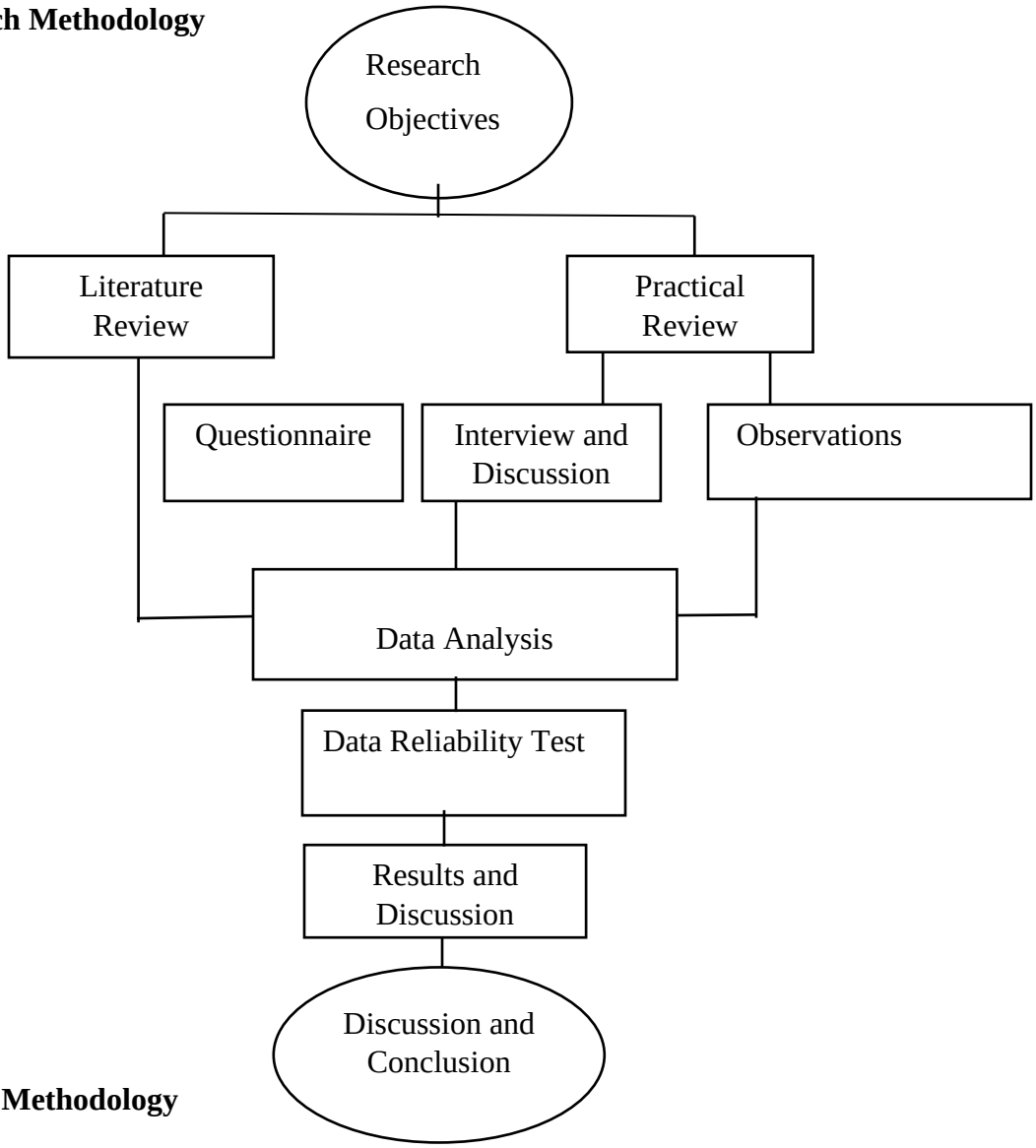

Figure 1. 1 Methodology

3.3 Research Design

This study adopted a descriptive and explanatory research design. The descriptive aspect was used to identify and describe the various causes of construction delays in public building projects, while the explanatory aspect aimed to examine how these delay factors influence project success in terms of time, cost, and quality performance. Both quantitative and qualitative approaches were applied to collect comprehensive data from key stakeholders involved in public construction projects.

3.4 Study area

This study is conducted in Mekelle city municipality of Tigray, Ethiopia. Tigray is found on the northern part of Ethiopia. As Mekelle is the capital city of Tigray region, many public construction projects and offices was there and therefore, it become a good source of data for the study. Mekelle city is established in 1880s and during the kingdom of Emperor Yohannes-IV, it becomes the capital city of Tigray. It is located at 39.467^0E, 13.483^0N and it is found at 780-kilometer distance from Addis Ababa city.

Mekelle has experienced significant public infrastructure development over the past decade, including government offices, schools, and healthcare facilities. However, most of these public building projects have suffered from frequent time and cost overruns, making the city an appropriate and representative setting for this study.

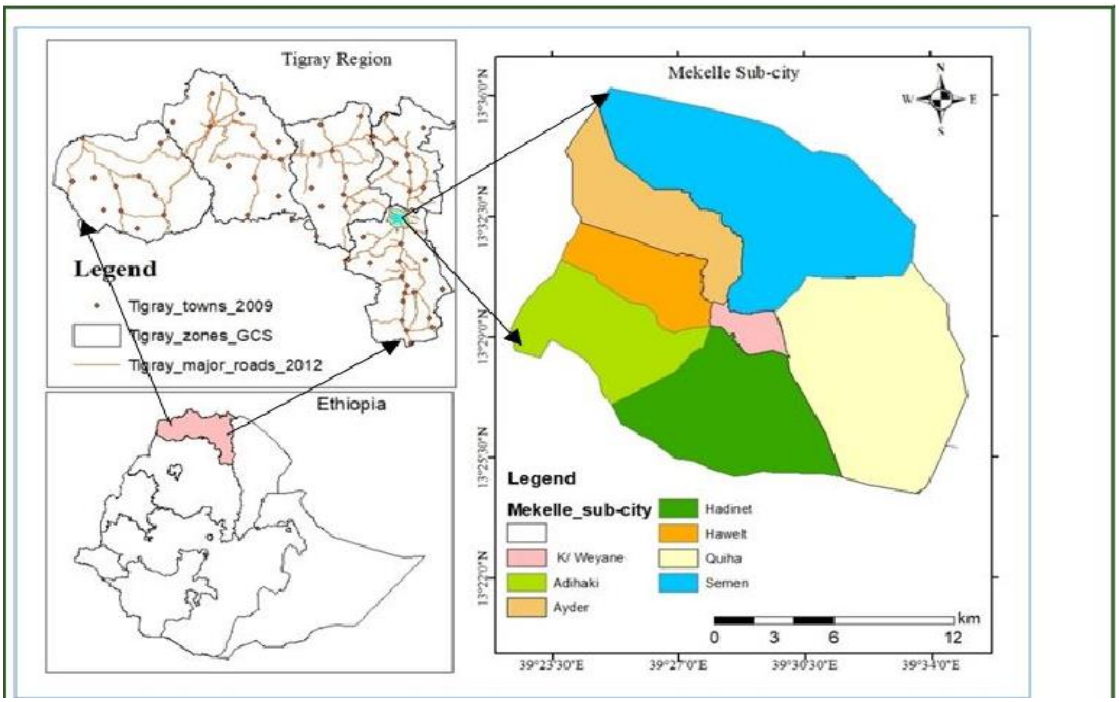

Figure 3. 1 Study area

3.5 Population of the study

The target population of this research includes stakeholders who are directly involved in public building construction projects within Mekelle. These include: Project managers and site engineers from public construction agencies, Contractors and subcontractors, Consultants and design professionals, Government officials from the Construction and Urban Development Bureau. The population was estimated at approximately 70 professionals involved in ongoing or recently completed public building projects in Mekelle.

3.6 Sampling Technique and Sample Size

A purposive sampling technique was employed to select respondents who possess relevant experience and technical knowledge of public building projects. This method ensured that participants could provide informed responses on the causes and effects of delays. The total study population consisted of 70 professionals, including contractors, consultants, project managers, and government officials. Using Yamane's (1967) sample size formula, a sample of 60 respondents was determined as adequate for valid and reliable analysis.

The sample was distributed as follows: The sample size was determined using **Yamane's (1967) formula**:

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

Where:

n = sample size,

N = total population =70

e = margin of error (0.05).

Substituting the values:

Step-by-step Calculation:

$(e)^2 = 0.05^2 = 0.0025$
$N(e)^2 = 70 \times 0.0025 = 0.175$
$1 + N(e)^2 = 1 + 0.175 = 1.175$
$n = \frac{70}{1.175} = \mathbf{59.57}$, Rounded Sample Size: 60 respondents

The sample was distributed as follows:

Table 1. 1 Sample size of Population

Category	**Number of Respondents**
Contractors	25
Consultants	15
Client Representatives (Government Officials)	10
Site Engineers / Supervisors	10
Total	**60**

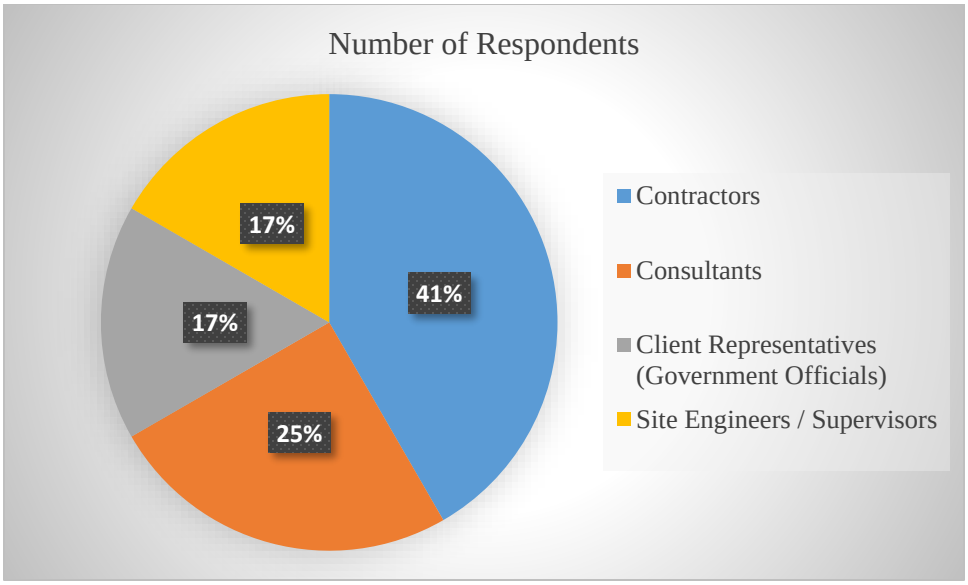

Figure 3. 2 Sample size population

This distribution ensured representation from all major stakeholder groups involved in public building projects.

3.7 Respondent Back Ground Information

Table 1. 2 Background Information of Respondents

Academic rank		
Degree	40	70%
Master and above	10	25%
Diploma	5	15%
Work experience		
1–5year	8	13.33%
6–10year	15	25%
11–15year	33	55%
>= 16year	4	6.67%

3.7 Respondents level of education

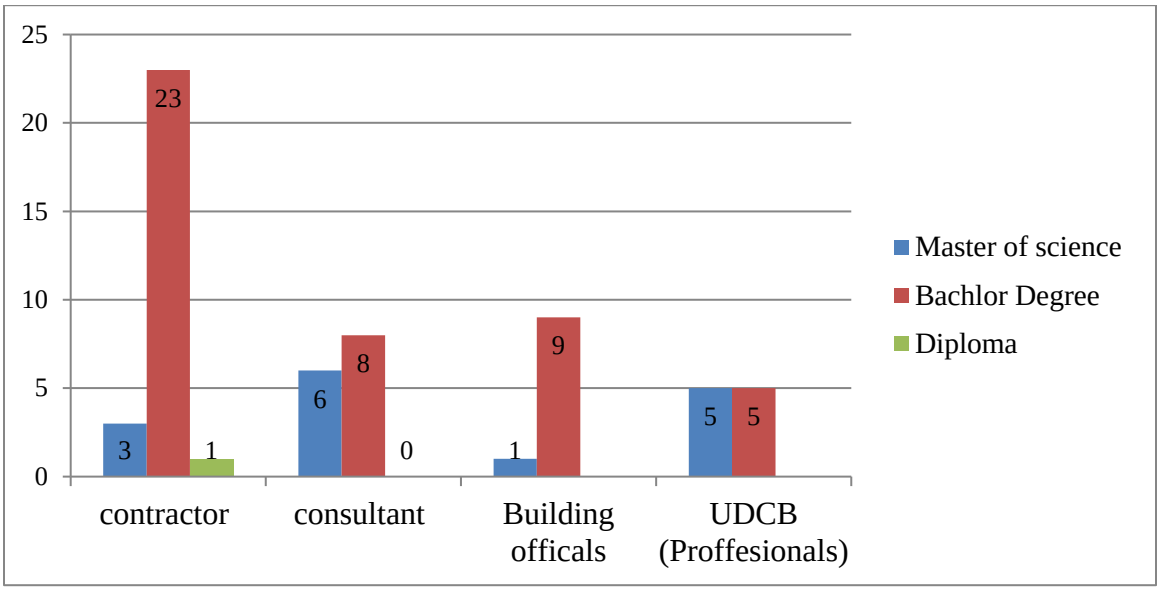

Figure 3. 3 level of education of the respondents

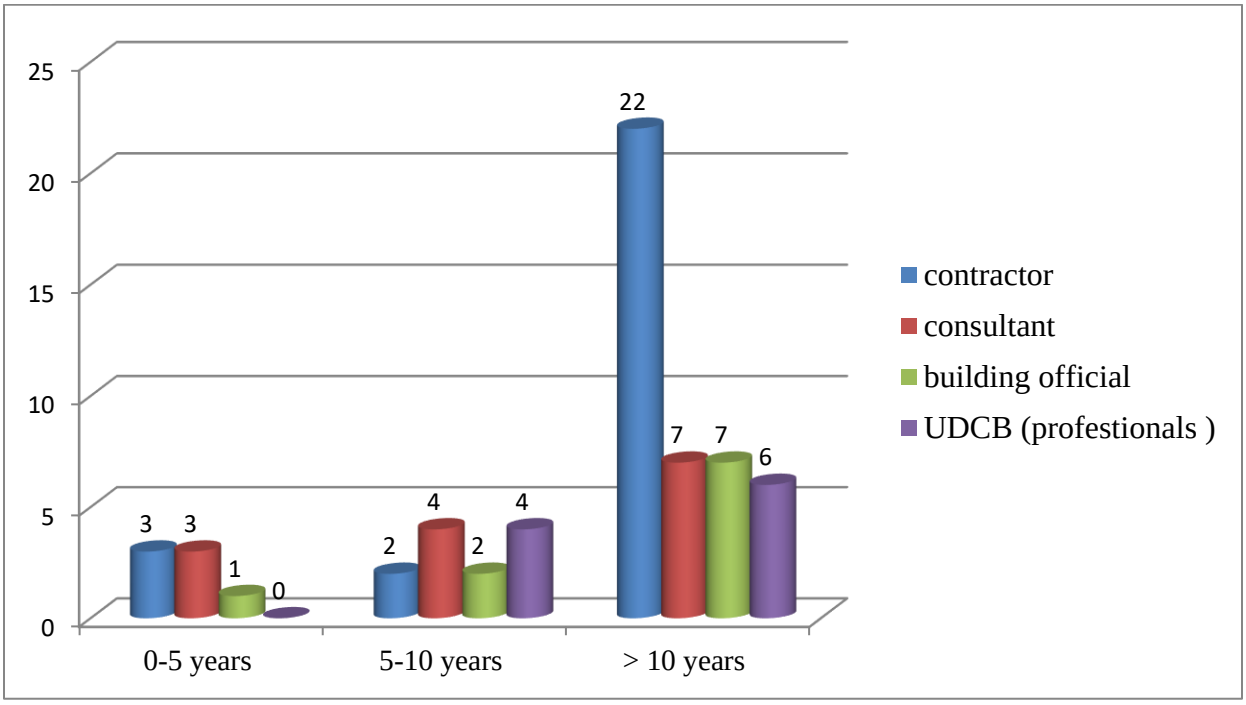

Figure 3. 4 Years of Experience of Respondents

3.7.1 Respondents job title

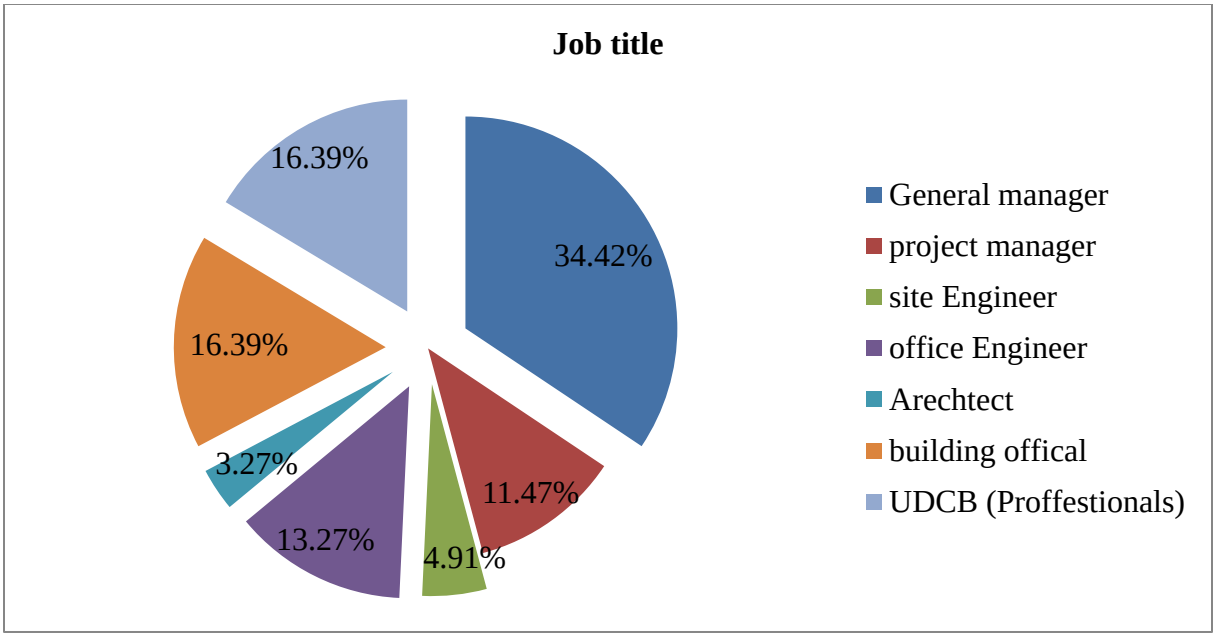

Figure 3. 5 Job Title of Respondents

As indicated in the table 2, the respondents for this study are professionals from contractor side (41%), consultants (25%) and Clients (17%). Contractors have taken the largest portion of this study in which is the main actor of building construction project. Respondents from the consultant side take the second largest portion next to contractors, and respondents from client have the smallest portion in the present study.

It was also required that the respondents' experiences, and provided as most of the respondents, as shown in the table are in the range of 11to 15 years. It indicates that the questionnaire was filled out by experienced professionals and is reliable data. The study was also intended to know the position of respondents who filled out the questioner, and it was found that from site engineers (16.67%) (20%). Project managers (16.67%), office engineers (16.67%) Architect (8.33%), Structural engineer or designer (16.67%), Site supervisor (8.33%) and Others (16.67%) which covers almost all departments i.e. the main participants in construction project.

3.8 Sources of Data

The study used both primary and secondary sources of data.

1. Primary Data: Collected directly from respondents using questionnaires and interviews.
2. Secondary Data: Obtained from project reports, government publications, academic journals, and previous research studies related to construction delays and project performance in Ethiopia and other developing countries.

3.9 Data Collection Instruments

3.9.1 Questionnaire

A structured questionnaire was developed to collect quantitative data from respondents. It was divided into three main sections:

1. Background information of respondents,
2. Causes of construction delays (using a 5-point Likert scale from “Very Low” to “Very High”),
3. Impacts of delay on project success in terms of time, cost, and quality.

3.9.2 Interviews

Semi-structured interviews were conducted with selected experts, including project managers and senior government officials, to gather qualitative data that provided deeper insights into organizational and policy-related delay issues. In-depth interview provides greatest opportunity to find out what someone thinks or feels, and how they react to various issues. The form of interview used was semi-structured which uses a combination of ‘open’ and ‘close-ended’ questions. This technique was used in order to give flexibility to the researcher and the interviewee during the interview session. According to(48), Interview is an instrument of data collection when compared to other data collection techniques like questionnaire is more powerful in producing narrative data that allow researchers to investigate people's views in greater depth and it helps to facilitate in obtaining direct explanation for human actions through a comprehensive speech interaction and also it is a powerful way of getting insights into interviewee's perceptions.

The interview protocol refinement framework comprised of a four-phase process for systematically developing and refining an interview protocol. The four-phase process includes: ensuring interview questions align with research questions, constructing an inquiry-based conversation, receiving feedback on interview protocols, and piloting the interview protocol. This method of interview protocol refinement can support efforts to strengthen the reliability of interview protocols used for qualitative research and thereby contribute to improving the quality of data obtained from research interviews.

3.10 Data Collection Procedure

Before data collection, an official permission letter was obtained from the appropriate authorities. Questionnaires were distributed in person and through email to ensure a high response rate. Follow-up phone calls were made to encourage completion. Interviews were conducted face-to-face and virtually depending on availability. Data collection took approximately six weeks.

3.11 Methods of Data Analysis

The data collected were coded, entered, and analyzed using Statistical Package for the Social Sciences (SPSS) software. The following analytical techniques were applied:

- Descriptive Statistics (frequencies, means, percentages) to summarize general information.
- Relative Importance Index (RII) to rank the causes of delay based on their severity and frequency.
- Correlation Analysis to examine the relationship between delay factors and project success indicators.
- Regression Analysis to determine the extent to which delay factors influence project time, cost, and quality performance.
- Qualitative data from interviews were analyzed using thematic analysis, where key themes and patterns were identified and compared with quantitative findings for validation.

3.12 Validity and Reliability of the Instruments

1. Content Validity: The questionnaire was reviewed by academic advisors and experts in construction management to ensure clarity and relevance.

2. Pilot Testing: A pilot survey was conducted with 10 respondents to refine the questionnaire and ensure that the questions were understandable and consistent.

3. Reliability Test: Cronbach's Alpha coefficient was calculated to assess internal consistency. A reliability coefficient above 0.7 was considered acceptable for this study.

3.13 Ethical Considerations

The study was conducted in accordance with research ethics. Respondents were informed about the purpose of the research and assured of confidentiality and anonymity. Participation was voluntary, and respondents had the right to withdraw at any stage. No identifying personal data were disclosed in the final report. Permission was obtained from the relevant authorities before administering the questionnaires and interviews.

The study aims to assess the practice on Ethiopia Building regulations and codes of standard in Mekelle city Municipality and give conclusion and recommendations in accordance with the outcome of the result. For this study, data was collected using both primary and secondary sources. The primary data was obtained through questionnaire, interview and observation directed to contractors, consultants, owners and other professionals that are involved in Ethiopian building construction projects. The secondary data was obtained from previously done different researches, internet, journals, seminar papers, books and different articles in published documents.

This research involves a cross-sectional survey approach from which statistical data were collected to answer questions in respect of the main subject of study. The population for the study comprises professionals in consulting, contracting and construction development firms who have been involved in the management and execution of building construction projects. The data were processed and analyzed using SPSS statistical analysis software.

3.14 Relative importance index

The Relative Importance Index (RII) is a statistical method which is used to determine the ranking of different project success factors. As this survey was designed to investigate the relative importance of various major success factors, the method was adopted in this study within various groups. The RII of Likert five or six -point scale, for example ranging from 1 (strongly dis agree) to 4 (strongly agree) was adopted and transformed the relative importance indices for each success factors as follows;

$$\text{RII} = \frac{\sum_{i=1}^{5} W_i}{A*N} = \frac{(1*n_1)+(2*n_2)+(3*n_3)+(4*n_4)+(5*n_5)}{A*N}, \ldots\ldots\ldots\ldots\ldots\ldots\ldots (1)$$

Where W is weighting given to each factor by respondents ranging from 1 to 5. (n_1 = number of respondents for strongly dis agree, n_2 = number of respondents for disagree, n_3 = number of respondents for agree, n_4 = number of respondents for strongly agree). "A"' is the highest weight (that is 5 in this case), and N is the total number of respondents. The RII value had a range between $0 \leq \text{RII} \leq 1$. The highest value of RII, the more important success factor and it is the major success factors. The RII was used to rank different success factors.

Factor Analysis

In order to identify critical factors, factor analysis is employed in this study. The study assumed factor loading of 0.6 as acceptable. Conventionally, variables that have a factor loading of 0.4 or greater within a particular factor are considered to be major components, and factors are usually given names relating to their major components.

The KMO statistics vary between 0 and 1 (Argyrols, 2005). A value of zero indicates that the sum of partial correlation is large relative to the sum of correlations indicating diffusions in the patterns of correlations, and hence, factor analysis is likely to be inappropriate (Costello & Osborne, 2005). A value close to 1 indicates that the patterns of correlations are relatively compact and so factor analysis should yield distinct and reliable factors (Cooper & Schindler, 2011).

According to Kaiser (1974), factor loading values that are greater than 0.4 should be accepted and values below 0.4 should lead to correction of more data to help researcher to determine

the values to include. Values between 0.5 and 0.7 are mediocre, values between 0.7 and 0.8 are good, values between 0.8 and 0.9 are great, and values above 0.9 are superb.

Reliability Analysis

Reliability of internal consistency was used to test the reliability of the questionnaire. The reliability coefficient of the scale was established by Cronback's Alfa using SPSS Version 20 (Statistical Package for the Social Sciences) software. All data and information from the questionnaire were entered into SPSS Version 20 program for statistical analysis in order to obtain Relative Important Index (RII) and Rank of variables. Reliability analysis is carried out to measure the consistency of ranking scale data or ordinal data in survey questionnaire. Reliability analysis used the Cronbach's alpha to measure data in SPSS. Below shows the Cronbach's Alpha Value Coefficient Range.

Table 3. 1 Cronbach's Alpha Value Coefficient Range

Cronbach's Alpha Range	Internal consistency
$\alpha < 0.6$	Poor reliability
$0.6 < \alpha < 0.7$	Acceptable reliability
$0.7 < \alpha < 0.8$	Good reliability
$0.8 < \alpha < 0.9$	Very good reliability
$\alpha > 0.9$	Excellent reliability

The questionnaire survey targeted the professionals who were directly engaged in the construction projects. Structured questionnaire with closed-ended questions was prepared to ensure consistency of respondent's feedback. Likert scale is basically a type of scale used to measure the respondent's opinions towards a specific subject. To interpret a 4/5-point scale, assign each response a point value from 1 to 4/5 based on the number of responses. The following rating scale has been used for the survey on the occurrence of cause factor affecting enforcement of Ethiopian building regulation and codes of standards, using a 1-5 scale.

Table 3. 2 rating scale for the survey

Response	Response (Points)
Not Contributor (ND)	1
Less Contributor (LC)	2
Medium Medium (MC)	3
High Contributor (HC)	4
Very High Contributor (VHC)	5

The levels of responses were; (ND) [100%, (LC) [75%, (MC) [50%], (HC) [25%] and (VHC) [0%].

Method of Data Analysis

The quantitative data from the questionnaires were entered into the Statistical Package for Social Sciences (SPSS 20) software, which was deemed user-friendly, following the reliability and consistency tests. The reasons for violations and inadequacies in building regulations, standards, and reduction strategies found in literature were thought to contribute to varying degrees.

Data analysis is the process of cleaning, changing, and processing raw data and extracting actionable, relevant information that helps businesses make informed decisions and the procedure helps to reduce the risks essential in decision making by providing useful insights and statistic. Method of data analysis is the last step and it needs high attention in order to remove false recording of data as they generate false result.

Chapter - 4: Data Analysis, Result and Discussion

4.1 Result Analysis on table and graph form

In this chapter, the survey results are reported and discussed. Statistical analyses of the replies were conducted utilizing the different techniques outlined in the research methodology following the completion of the questionnaire survey and data encoding. The 50 factors that cause delays in Mekelle construction industry have been ranked based on

Relative Importance Index (RII) to identify the most critical delay factors as shown on table 4. The range of relative important index is, $0 \leq RII \leq 1$

Range of RII	Degree of contribution
$0 < RII \leq 0.2$	Not contributor
$0.2 < RII \leq 0.4$	Less contributor
$0.5 < RII \leq 0.7$	high contributor
$0.7 < RII \leq 1$	Very high contributor

No	Delay Factor	1	2	3	4	5	Total Weighted Score	RII	Rank
1	Delay in progress payments	2	5	8	15	20	198	0.792	1
2	Slow decision-making process	3	6	10	18	13	179	0.716	3
3	Delay in site handover to contractor	4	8	12	14	12	170	0.68	4
4	Shortage of skilled labour	1	3	9	20	17	195	10.78	2
5	Escalation of material prices	5	6	10	13	16	177	0.708	5

From the calculated RII values: Delay in progress payments (RII = 0.792) was ranked the highest delay factor. This shows that late payments from clients significantly disrupt cash flow and progress, leading to time overruns .Shortage of skilled labour (RII = 0.78) also ranked highly, indicating that human resource constraints critically affect productivity and project timelines.

Slow decision-making (RII = 0.716) and delay in site handover (RII = 0.68) ranked moderately high, reflecting management and administrative inefficiencies. Escalation of material prices (RII = 0.708), though lower, still had a considerable impact, highlighting economic and market-related issues.

The results reveal that the most significant causes of delay in public building construction projects in Mekelle are financial and labor-related factors. Delays in progress payments and shortages of skilled labor lead to reduced productivity, cash flow problems, and extended project durations. Management-related factors such as slow decision-making and late site handover further exacerbate these issues. The findings are consistent with previous studies (Werku & Jha, 2016; Tsegay & Hanbin, 2018), which identified contractor-related and financial constraints as leading causes of delay in Ethiopian construction projects.

Overall, the data indicate that improving financial management, decision-making efficiency, and human resource capacity are crucial for minimizing project delays and enhancing success in the Mekelle public construction sector.

Delay causes related Clients/ Owners

The study included seventeen causes of delay related to Clients/ Owners. The study revealed that the average I.I. = 47.05 for this group. The analysis showed that the most crucial factors in this group is “Client’s changes to the design”. This factor ranked at first position due to the importance index rating 64.99. The other significant factors related to Clients/ Owners group which are causing delay problems are: using lowest bid tendering system, changes in the extent of the project, delay of progress payments, and shortage of cooperation between owner/client and contractor/subcontractor and delay in approval of contractor’s submittals. The results concerning this group are shown in table 2.

Table 4. 1 Ranking of significant client-related delay causes factors

Sources (groups) of delay Av. I.I = 47.05	F.I		S.I		I.I	
	Index	Rank	Index	Rank	Index	Rank
Increase in scope of work and change orders	78.82	3	82.46	1	64.99	1
Dispute between parties	79.63	2	80.28	2	63.93	2
Poor communication and coordination among contracting parties t	81.24	1	76.79	4	62.38	3
Contract procurement policy, inflation/price increase in material	76.82	4	77.26	3	59.35	4
Lack of cooperation between client and contractor	71.08	5	73.66	5	52.36	5
Delay in approval of contractor submittals	70.08	6	67.33	6	47.18	6

Delay factors related to Contractors/ Subcontractors

Twenty factors were included in this study which relate to this category. The average I.I. was 47.04. Table 2 presents the most significant factors within this group. It can be noticed that "Inadequate management and supervision" was highlighted as the most significant factor, within this group, causing delay in the Mekelle-public projects with I.I. = 68.45. The other significant factors are: cash flow problems suffered by the contractor, rework, level of productivity, technical problems, incorrect construction methods, delay due to subcontractors and shortage of resources.

Table 4. 2 Contractor-related delay causes factor

Sources of delay Av. I.I = 47.04	F.I		S.I		I.I	
	Index	Rank	Index	Rank	Index	Rank
Financial constraints on part of the contractor	81.76	1	83.72	1	68.45	1

Unexpected site conditions	81.22	2	79.63	2	64.67	2
Improper planning and scheduling	76.85	3	77.05	3	59.21	3
Construction methods adopted by the contractor are not efficient.	74.66	5	75.85	4	56.63	4
Technical problems faced by the contractor	75.40	4	74.33	6	56.04	5
The contractor is suffering of cash flow problems.	72.12	6	74.62	5	53.81	6
Delay due to subcontractors works	72.07	7	70.32	7	50.68	7
Shortage of resources	71.06	8	69.63	8	49.48	8

Consultants/ Designers related factors

Eleven factors included in the survey which relate to Consultants/ Designers with average I.I. = 44.13. "Errors in design and contract documents" was selected as the most influencing factor among them with I.I = 59.63. The other significant factors were: changes of the original design, drawings are not efficient enough and the consultant's staff is not always available on site. The results of the survey are shown in table 4

Table 4 Ranking of significant consultant-related delay causes factors

Sources of delay Av. I.I = 44.05	F.I		S.I		I.I	
	Index	Rank	Index	Rank	Index	Rank
Slow decision-making process	76.82	1	77.63	1	59.63	1
Delay in the approval of major orders.	76.42	2	75.63	2	57.80	2
Delay in progress of payments.	67.38	3	66.52	4	44.82	3
Drawings are not efficient enough on clarity	65.58	4	68.30	3	44.79	4

The significant factors of all groups

As mentioned, previously, the questionnaire included 55 delay factors. The study revealed that only 22 of them showed they are of significant effect. These are shown in table 5.

Table 4. 3 Ranking of most significant factors of delay

Cause of Delay	I. I	Rank	F.I	Rank	S.I.	rank	Group
Increase in scope of work and change orders	68.45	1	81.76	1	83.72	1	Client
Slow decision-making process	64.99	2	78.82	5	82.46	2	Consultant
Dispute between parties	64.67	3	81.22	3	79.63	4	Client
Delay in the approval of major orders.	63.93	4	79.63	4	80.28	3	Consultant
Improper planning and scheduling	62.38	5	81.24	2	76.79	8	Contractor
Financial constraints on part of the contractor	59.63	6	76.82	7	77.63	5	Contractor
Delay in progress of payments.	59.35	7	76.82	8	77.26	6	Consultant
Unexpected site conditions	59.21	8	76.85	6	77.05	7	Contractor
Contract procurement policy, inflation/price increase in material	57.80	9	76.42	9	75.63	10	Client
Poor communication and coordination among contracting parties	56.63	10	74.66	11	75.82	9	Client
The contractor is facing technical difficulties	56.04	11	75.40	10	74.33	12	Contractor
Construction methods adopted by the	53.81	12	72.12	12	74.62	11	Contractor

contractor are not efficient.							
Shortage of collaboration between client and contractor.	52.36	13	71.08	14	73.66	13	Client
The contractor is suffering of cash flow problems.	50.68	14	72.07	13	70.32	14	Contractor
Delay due to subcontractors works	49.48	15	71.06	15	69.63	15	Contractor
No approval of contractor submittals	47.18	16	70.08	16	67.33	18	Client
Bureaucracy and changes of government regulations	46.31	17	69.45	17	66.68	19	External
Drawings are not efficient enough on clarity	44.82	18	67.38	18	66.52	20	Consultant
Number and experience of the consultant's staff on site are not adequate.	44.79	19	65.58	20	68.30	17	Consultant
Other public works on site	44.30	20	64.82	21	68.36	16	External
Effect of local community	42.89	21	66.35	19	64.65	22	External
The variation of resources costs.	39.22	22	60.58	22	64.75	21	External

Table 3.5 above showed that 8 out of the first 10 factors are related to Clients/ Owners and Contractors/ subcontractors – 4 for each. There are only two factors within the first 10 related to Consultants/ Designers.

Achievement of the project due to delay

The study revealed that there are considerable effects of delay on the delivery of the project. The frequency of occurrence for each for each performance parameters are shown in table 6.

Table 4. 4 Effect of delay on project delivery

Effect Delay Causes	**Rank**	**Occurrence Frequency**
Overrun of the project duration	1	95.55
Overrun of the project cost	2	89.45
Disputes between parties	3	72.56
Arbitration	4	62.44
Abandonment of the project	5	59.62
Litigation	6	54.33

Reliability of factors analysis

A test for Cronbach's alpha (Cα) was accomplished on each group of factors to examine the reliability of the factors. This is, mainly, to judge if they were integrated. The range of results of Cronbach's alpha should be between 0 and 1.0. The standard recommended by [27] for the translation of the magnitude of coefficient was adopted to appreciate the results obtained from the analysis. Cα> 0.8, 'Excellent'; 0.8> Cα> 0.7 'Good'; 0.7> Cα>0.5 'Satisfactory' and Cα <0.5 ' Poor'. In this study Cα was calculated using statistical software SPSS V17. Table 7 shows the outcome of the analysis and the degree of satisfaction according to the criteria described for all groups of factors.

Table 4. 5 Analysis for Reliability

factors	Cα	Result
Factors related to Client	0.743	Good
Factors related to contractors	0.678	Satisfactory
Factors related to Consultant	0.863	Excellent
Factors related to external circumstances	0.688	Satisfactory
Factors related to all reasons	0.769	Good

Analysis of correlation

The evaluation of the relationship among variables that have interval data can be carried out using correlation analysis. This analysis was done to evaluate the empirical relationship between the series of causes and effects.

The analysis of correlation is presented in table3.8 below.

Table 4. 6 Correlation between items and effects of delays

Effects	**Causes of delay**			
	client	contractor	consultant	External
Overrun of the project duration	0.555	0.461	0.674	0.767
Overrun of the project cost	0.231	0.548	0.658	- 0.118
Disputes between parties	0.425	- 0.190	0.562	0.133
Arbitration	0.658	0.766	0.468	0.762
Abandonment of the project	0.378	0.492	0.490	0.856
Litigation	0.763	0.246	0.562	0.744

4.2. Data Presentation, Analysis, and Discussion

This chapter presents, analyzes, and discusses the data collected from 50 respondents representing contractors, consultants, client representatives, and site engineers involved in public building construction projects in Mekelle, Tigray. The main objective of this chapter is to identify, rank, and discuss the major factors causing project delays and to evaluate their impact on project success.

Both descriptive statistics and the Relative Importance Index (RII) method were employed to analyze the responses. The RII was used to determine the relative significance of each delay factor as perceived by respondents.

Response Rate

Out of the 60 questionnaires distributed, 50 were properly completed and returned, representing a response rate of 83.3%. This rate is considered satisfactory for reliable analysis in construction management research.

General Characteristics of Respondents

The respondents included 25 contractors (50%), 10 consultants (20%), 10 client representatives (20%), and 5 site engineers/supervisors (10%). Most participants had more than five years of experience in public building construction, which enhances the credibility and reliability of the responses obtained.

Analysis of Delay Factors Using Relative Importance Index (RII)

The Relative Importance Index (RII) was computed for each of the major delay factors identified from previous studies and field experience in Mekelle.

$$RII = \frac{\sum W}{A \times N}$$

Where:

- W = weighting given to each factor by respondents (1–5)
- A = highest possible weight (5)
- N = total number of respondents (50)

The results are summarized in the following table.

Table 4. 7 Major Delay Factors and Their Relative Importance Index

No	Delay Factor	Weighted Score	RII	Rank
1	Delay in progress payments	198	0.792	1
2	Shortage of skilled labour	195	0.780	2
3	Slow decision-making process	179	0.716	3
4	Escalation of material prices	177	0.708	4
5	Delay in site handover to contractor	170	0.680	5
6	Poor site management and supervision	168	0.672	6

7	Ineffective project planning and scheduling	165	0.660	7
8	Contractor's financial difficulty	160	0.640	8
9	Late delivery of materials	158	0.632	9
10	Fluctuating labor availability	154	0.616	10
11	Design changes and document errors	150	0.600	11
12	Delay in approval of completed works	148	**0.592**	12
13	Lack of communication among project parties	144	**0.576**	13
14	Late release of funds from client	142	**0.568**	14
15	Poor coordination between stakeholders	140	**0.560**	15

4.3 Discussion of Major Findings

Financial-Related Delays

The results reveal that delay in progress payments (RII = 0.792) is the most critical factor contributing to project delays in Mekelle. This finding aligns with previous research by Werku and Jha (2016) and Tsegay and Hanbin (2018), which identified financial constraints and late payments as dominant issues in Ethiopian construction projects. Delays in payments disrupt contractors' cash flow, making it difficult to pay workers, purchase materials, and maintain equipment, ultimately leading to time overruns.

Similarly, contractor's financial difficulties (RII = 0.64) and late release of funds from clients (RII = 0.568) were also identified as major causes of delay. These indicate systemic weaknesses in financial planning, contract administration, and fund allocation in public building projects.

Labour-Related Delays

Shortage of skilled labour (RII = 0.78) ranked second, confirming that the lack of experienced workers significantly impacts project productivity. The results also show fluctuating labour availability (RII = 0.616) as another major concern. These findings agree with Abebe & Fasika (2022), who found that seasonal labour shortages and low productivity contribute heavily to schedule overruns in Ethiopian construction.

Labour shortages are often caused by migration, low wages, and limited vocational training opportunities. Consequently, contractors are forced to rely on unskilled or semi-skilled workers, reducing efficiency and increasing rework

Management and Administrative Delays

Slow decision-making (RII = 0.716) and ineffective planning and scheduling (RII = 0.660) ranked third and seventh respectively, showing that administrative inefficiencies play a crucial role in project delays. In public projects, lengthy bureaucratic approval processes and communication gaps between stakeholders often stall critical decisions.

Poor site management and supervision (RII = 0.672) also contributes to inefficiency. This problem reflects inadequate managerial oversight, lack of proper monitoring mechanisms, and insufficient project control systems.

Material and Design-Related Delays

Escalation of material prices (RII = 0.708) and late delivery of materials (RII = 0.632) indicate supply chain disruptions and inflationary effects. These issues have been worsened by economic instability and import restrictions in Ethiopia, which increase construction costs and extend project durations.

Design changes and document errors (RII = 0.600) further add to delays, as modifications often require re-approval and rework, leading to time loss and disputes among project participants.

Coordination and Communication Delays

Lack of communication among parties (RII = 0.576) and poor coordination between stakeholders (RII = 0.560) were ranked among the lowest but still significant causes. The results highlight weak project integration mechanisms among clients, consultants, and contractors. According to Mustafe & Hassan (2021), poor communication often leads to misunderstandings, duplicated tasks, and slow responses to project changes.

Overall Interpretation

The analysis shows that **financial, labour, and management factors** are the top contributors to public building construction delays in Mekelle.

- Financial factors (RIIavg = 0.667) → major cause of stoppages and slow progress.
- Labour factors (RIIavg = 0.698) → significant reduction in productivity.
- Management factors (RIIavg = 0.682) → contribute to inefficiencies in coordination and execution.

The findings imply that project delays in Mekelle are **multifactorial**, stemming from systemic weaknesses in planning, financing, and human resource management rather than isolated technical issues.

4.4 Interview Results and Interpretation

Interview results from seven participants in construction projects namely, project managers, engineers and clients are presented here below in tabular form in table below. As table indicated all the interviewees (100%) proofed that time overran is a problem in building construction projects, and most of them confirmed that the project they were working in is experienced with time related impacts of delay such as; suspension of construction works, clashed and disturbed schedule.

85.71 % of the participant's perceived cost overrun is also other impact of delay and those 14.29% think cost overrun was not delaying impact. Here majority of the participants confirmed it is a problem and they mentioned almost similar cost related impacts of delay such as; Payment delays to project contractors, high cost of equipment, materials and labors,

disturbed cash flow, high prices of goods and services in general and Wastage of resources. This related to the present finding extra cost and cost escalation.

On the other hand, most of the participants (71.43%) responded that poor quality of works. Was the other impact, and listed quality related impacts from their experiences such as; aging of the project before its delivery and failure in structure sustainability, Poor and inconsistent communication between project stakeholders and material suppliers, Postponed or cancellation of materials and work done inspections.

The participants were asked that if there are other impacts (other than time, cost, and quality related) in their projects, and 57.14% of them responded yes, and they mentioned other delay impacts like lawsuits among contractors and owners, dissatisfaction of all parties and negatively impact on the community and economic lives.

Therefore, it can be concluded that the responds given by the participants in the interview are closely related to each other and the findings of the present study almost in all category of impact.

Table 4. 8 Results of Interview

Questions	Yes	No
Do you think time overrun is a problem in construction projects?	100%	0%
What time related impacts has been experienced your project?	Suspension of co nstruction works,	
Do you think cost overrun is also a problem in construction projects?	85.71%	14.29%
What cost related impacts has been experienced your project?	High cost and dis turbed cash flow	
Do you think poor quality is a problem in construction project?	71.43%	28.57%
What poor quality related impacts is experienced your project?	Aging and struct ural failure, etc.	
Do you think projects encountered with other impacts? Other than time, cost, and quality related.	57.14%	42.86%

What other impacts of delay has been experienced your project?		Lawsuits and dis satisfactions etc.	
Based on your experience, which of them is the most highly impact in your construct ion projects? Category under Low impact, medium impact, and high impact			
Impacts	Low	Medium	High
Time overrun			✓
Cost overrun			✓
Poor quality		✓	
Customer dissatisfaction, hazards and risks, termination		✓	

Finally, the participants in the interview were asked to classify the general impacts of delay as low, medium, and high impacts based on the severity of the impacts from their experiences, and as the result indicated in table 3.9., they classified time and cost overruns in high impacts, and poor quality and other impacts such as Customer dissatisfaction, hazards and risks, termination as medium impacts.

4.5 Comparison with Previous Studies

The findings of this study are consistent with prior research conducted across Ethiopia and other developing countries:

a Werku & Jha (2016) identified financial and labour constraints as the top delay factors in Ethiopian public projects.

b Tsegay & Hanbin (2018) emphasized corruption, poor site management, and material shortages as common causes.

c Babatunde & Thanwadee (2019) found that design changes and late approvals strongly affect schedule adherence.

The consistency of these results reinforces the conclusion that addressing financial flows, managerial capacity, and skilled manpower are vital for timely project completion in the region.

4.6 Impact of Delay on Project Success

Project success in construction is typically evaluated based on three key performance indicators: time, cost, and quality. Delays negatively affect all three dimensions, leading to cost escalation, poor quality output, and late delivery of facilities for public use. This section analyzes and discusses how delay factors have influenced project success in Mekelle public building projects, based on the responses of 50 participants.

Analysis of Delay Impacts Using Relative Importance Index (RII)

Respondents were asked to rate the severity of various impacts of delay using a 5-point Likert scale. The Relative Importance Index (RII) was computed for each impact factor as before.

Table 5: Impact of Delay on Project Success

Table 4. 9 Impact of Delay on Project Success

No	Impact Factor	Weighted Score	RII	Rank
1	Cost overrun (budget increase)	198	0.792	1
2	Time overrun (schedule extension)	190	0.760	2
3	Poor quality of construction works	178	0.712	3
4	Disputes between client and contractor	172	0.688	4
5	Contract termination or suspension	165	0.660	5
6	Loss of productivity and morale	160	0.640	6
7	Negative social and economic impacts	156	0.624	7
8	Arbitration and litigation	150	0.600	8
9	Damaged public trust in institutions	148	0.592	9
10	Reduction in facility service life	142	0.568	10

Discussion of Findings

A. Cost Overrun (RII = 0.792)

Cost overrun is identified as the most severe consequence of construction delays. Prolonged project durations increase administrative expenses, labor costs, and material prices due to

inflation. Respondents emphasized that public projects in Mekelle frequently exceed their initial budgets by 20–50%. This finding agrees with Ayalew (2021), who noted that poor financial management and delayed payments contribute to severe cost escalation in Ethiopian public works.

B. Time Overrun (RII = 0.760)

Time overrun ranked second, confirming that projects rarely meet their contractual completion dates. Respondents reported that projects planned for 12–18 months often extend to 24–36 months. Similar findings were reported by Tsegay & Hanbin (2018), indicating that bureaucratic procedures, poor planning, and payment delays significantly extend construction schedules.

C. Poor Quality of Construction (RII = 0.712)

Delays often lead to rushed work toward project completion, resource shortages, and reduced supervision quality. Contractors may compromise on workmanship or material quality to meet revised deadlines. This aligns with Abebe & Fasika (2022), who found that schedule pressure and limited budgets lead to structural and aesthetic quality defects in public buildings across Ethiopia.

D. Disputes and Contractual Conflicts (RII = 0.688)

Delays create friction among clients, consultants, and contractors. Respondents cited frequent disputes over extension-of-time (EoT) claims, cost variations, and penalties. Such conflicts often result in contract suspension or early termination (RII = 0.660). These outcomes reflect weak contract administration and lack of effective dispute resolution mechanisms, consistent with Babatunde & Thanwadee (2019).

E. Productivity and Morale (RII = 0.640)

Continuous delays demotivate project teams and reduce productivity. Prolonged uncertainty about payments and workload causes labor inefficiency, absenteeism, and reduced accountability. Productivity loss not only extends project duration further but also increases indirect costs.

F. Social and Institutional Impacts (RII = 0.624 – 0.568)

Delays in public projects, such as schools, hospitals, and offices, directly affect the community by postponing essential services. Respondents noted that incomplete public buildings are common in Mekelle, leaving communities underserved. In addition, repeated project failures damage public trust in government institutions and contractors' reputations.

Summary of Delay Impact Analysis

Impact Category	Mean RII	Level of Severity	Interpretation
Financial/Cost Impact	0.792	Very High	Most critical, leads to resource wastage
Time/Schedule Impact	0.760	Very High	Causes major project overruns
Quality Impact	0.712	High	Reduces durability and functionality
Contractual/Dispute Impact	0.674	Moderate to High	Leads to claims, litigation
Productivity & Social Impact	0.616	Moderate	Affects workforce efficiency and community benefits

Implications for Project Success

From the analysis, it is evident that construction delays have a multi-dimensional impact on project success in Mekelle. Financially, cost escalation burdens clients and disrupts funding cycles. Temporally, delayed projects disrupt development schedules and delay service delivery. Qualitatively, pressure to meet new deadlines compromises workmanship and long-term durability. Institutionally, repeated delays lower public confidence in local contractors and government agencies. Therefore, mitigating delays is not only essential for improving project performance but also for sustaining socio-economic growth in Mekelle.

4.7 Summary of Major Findings

The RII analysis revealed that delay in progress payments, shortage of skilled labour, and slow decision-making are the leading delay factors, while cost and time overruns are the most severe impacts.

Overall, the findings demonstrate that financial inefficiency, poor management practices, and inadequate skilled manpower are the primary contributors to project delay and underperformance in Mekelle's public building construction sector.

Based on the analysis of data collected from 50 respondents representing clients, contractors, and consultants, the following findings were obtained:

1. Prevalence of Delays: The study revealed that delay in project completion is a common phenomenon in public building construction projects in Mekelle. Very few projects are completed within their original contract period, with most experiencing significant time overruns.
2. Key Delay Factors: The most influential causes of delay, identified using Relative Importance Index (RII), were: Delay in progress payments for completed works; Shortage of skilled labor and poor labor productivity; Delay in material delivery and price escalation; Ineffective project planning and scheduling and Slow decision-making and poor coordination among stakeholders. These results indicate that both financial and managerial inefficiencies are the root causes of project delays.
3. Impact on Project Success: The findings showed that delay significantly affects project performance in terms of cost, time, and quality. The most critical impacts were:

Cost Overrun (RII = 0.792) – projects exceed budget due to extended duration and material inflation. Time Overrun (RII = 0.760) – planned completion dates are rarely achieved. Poor Quality (RII = 0.712) – workmanship and material quality decline due to rushed schedules and reduced supervision.

4. Institutional and Capacity Issues: Limited technical capacity among contractors, inadequate monitoring by consultants, and delayed decision-making within client organizations contribute to inefficiencies and delays.

Chapter - 5: Conclusion and Recommendations

5.1 Conclusion

From the analysis, it can be concluded that:

1. Construction delays are a major challenge in Mekelle's public building sector, primarily resulting from financial difficulties, poor management practices, and shortage of skilled professionals.
2. The impacts of delays are severe, leading to time and cost overruns, compromised quality, and strained relationships among stakeholders.
3. Contractor-related factors such as inadequate planning, low productivity, and weak financial management were found to be the most dominant causes.
4. Improving coordination and project monitoring mechanisms among clients, consultants, and contractors can significantly enhance project delivery performance.
5. Addressing these issues requires a systemic approach that includes better financing structures, skilled workforce development, and accountability at all project levels.

5.2 Recommendations

Based on the findings, the following recommendations are proposed to reduce delays and enhance project success:

A. For Contractors

Develop and strictly follow realistic project schedules and resource plans.

Improve financial management and cost control systems to handle payment delays and material price fluctuations.

Strengthen capacity building and training programs for engineers, supervisors, and laborers to enhance productivity and quality performance.

B. For Clients (Government Agencies)

Ensure timely progress payments to avoid work interruptions and financial strain on contractors.

Provide adequate project planning before contract award, including feasibility studies and accurate design documents.

Minimize bureaucratic delays by streamlining decision-making and approval processes.

C. For Consultants

Conduct regular supervision and performance evaluation throughout the project lifecycle.

Facilitate effective communication and coordination between clients and contractors.

Enforce contract provisions regarding time, quality, and performance standards to ensure accountability.

D. For Policymakers

Establish and enforce construction delay management policies and penalties for non-compliance. Promote transparent procurement systems to reduce corruption and inefficiencies. Encourage continuous professional development through certification and licensing systems for project managers and engineers.

5.3 Areas for Further Study

1. Comparative studies between public and private construction projects to evaluate delay causes and mitigation strategies.

2. Assessing the role of digital project management tools (e.g., BIM, Primavera) in minimizing delays.

Reference

1. Seng, S., & Yusof, N. (2006). Causes of delay in construction projects in Cambodia. Journal of Construction in Developing Countries, 11(1), 53–69.
2. Al-Momani, A. H. (2000). Construction delay: A quantitative analysis. International Journal of Project Management, 18(1), 51–59.
3. Alaghbari, W., Kadir, M. R. A., Salim, A., & Ernawati. (2007). The significant factors causing delay of building construction projects in Malaysia. Engineering, Construction and Architectural Management, 14(2), 192–206.
4. Werku, W., & Jha, K. N. (2016). Investigating causes of construction delay in Ethiopian construction industries. Journal of Construction Engineering and Management, 142(2), 04015079.
5. Tsegay, G., & Hanbin, L. (2014). Causes and effects of delay in Ethiopian construction projects. International Journal of Construction Management, 14(3), 1–12.
6. Ogunlana, S. O., Promkuntong, K., & Jearkjirm, V. (1996). Construction delays in a fast-growing economy: Comparing Thailand with other economies. International Journal of Project Management, 14(1), 37–45.
7. Marques, M., & Ferreira, A. (2020). Causes and impacts of construction project delays in Portugal using Relative Importance Index (RII). Journal of Civil Engineering and Management, 26(5), 421–434.
8. Adebayo, A. A., Ali, A. M., & Yusuf, M. (2022). Major causes of construction project delays in Hargeisa. International Journal of Civil and Structural Engineering Research, 9(1), 45–58.
9. Abebe, M., & Fasika, G. (2021). Assessment of delay factors in public building construction projects: The case of Ethiopia. Ethiopian Journal of Construction Management, 5(2), 55–70.
10. Mustafe, M., & Hassan, H. (2021). Evaluation of delay causes and remedies in construction projects. International Journal of Engineering and Technology Research, 9(3), 22–35.
11. Sohu, S. (2020). Causes and effects of delays and disruptions in construction projects. Journal of Project Management Research, 5(1), 12–25.

12. Jesper, L. (2018). The impact of project delays on schedule, cost, and quality in construction. International Journal of Project Economics, 6(4), 215–228.
13. Babatunde, S. O., & Thanwadee, W. (2019). Modeling the impact of delay factors on project schedule using DEMATEL and system dynamics. Journal of Construction Engineering and Project Management, 9(2), 13–27.
14. Assaf, S., & AL-Hejji, S. (2006). Causes of delay in large construction projects, International Journal of Project Management, Vol. 24, No. 4, 349-357.
15. Reuben Ayeni, et al () a risk analysis of construction projects delays factors in the United Kingdom London Southbank University, London, United Kingdom.
16. Endalkachew Kabtamu et al. (2025) Determinants of construction project delay and its effect on project beneficiaries: evidence from the Gurage Zone, Ethiopia
17. Luís M. and F. Ferreira, (2015), Delays in construction projects - Causes and impacts Departamento de Economia, Gestão e Engenharia Industrial, GOVCOPP Universidade de Aveiro, Portugal
18. Babatunde O. and Thanwadee C., (2022), Impact of Construction Delay-Controlling Parameters on Project Schedule: DEMATEL-System Dynamics Modeling Approach, School of Management Technology, Sirindhorn International Institute of Technology, Thammasat University, Bangkadi Muang, Thailand.
19. S. Sohu et al 2024, Assessing the Causes and Effects of Delay and Disruption in Construction Projects in Malaysia, Faculty of Engineering, The University of Larkano, Airport Road, Larkano, Sindh 77150, Pakistan,
20. zetta R. k. and Cintantya B. C., (2018), delays in construction project: a review, The 1st International Conference on Advanced Engineering and Technology, universitas Pembangunan national “veteran” Jawa Timur, Indonesia. Cronbach, L. J. (1951). Coefficient Alpha and the Internal Structure of Tests. Psychometrika, 16, 297-334.
21. Hamed T., (2016), Sampling Methods in Research Methodology; How to Choose a Sampling Technique for Research, Management (IJARM) Vol. 5, No. 2, 2016, Page: 18-27, ISSN: 22961747 © Helvetic Editions LTD, Switzerland.

Appendix - Questionnaire

Assessment of Public Building Construction Delays and Their Impact on Project Success in Mekelle, Tigray

A research project work at School of Civil Engineering, Ethiopian Institute of Technology, Mekelle University, Mekelle

Prepared By

Solomon Zeferu

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Questionnaire

Request

The objectives of this questionnaire are to assess of Public Building Construction Delays and Their Impact on Project Success in Mekelle, Tigray.

Data and information collected through this questionnaire shall be confidential, and will be analyzed only for this research project without reporting the person or company biodata.

This research work is possible only through your kind support and cooperation, we request you to respond to our representative approaching you for questionnaire.

Thanking you in anticipation.

QUESTIONNAIRE

1.1

Contractin	GC	BC				
Consultant	Architect	Designer	Grade 1	Grade 2	Grade 3	Grade 4
Other						

1.2 Organization Name (Optional)

_____

1.3 Telephone No (Email Address)

_____

1.4 Year of Establishment EC_____GC_____

1.5 Respondent Name (Optional) _____Position_____

1.6 Respondent Education_____ Experience_____

2 Put tick mark (✓) on each of the factor of delay listed below based on the level of contribution using the following Likert scale for delay factors in building projects;

Agreement Level	Not Contributor	Less Contributor	Medium Medium	High Contributor	Very High Contributor
Likert Point	1	2	3	4	5

S. No.	Factor (Reason) Type	Likert Point				
		1	2	3	4	5
1	Delay in progress payments					
2	Slow decision-making process					
3	Delay in site handing over to contractor					

Owner related delay factors	Increase in scope of work and change orders					
	Bureaucracy in clients organization					
Contractor related delay factors	Delays of subcontractors					
	Ineffective construction methods					
	Improper planning and scheduling					
	Errors during construction					
	Inadequate contractor experience					
	Site accidents					
	Poor site management and supervision					
	Financial constraints on part of contractor					
	Underestimation or overestimation of the project cost					
	Delay in site mobilization by contractor					
	Contractor procurement policy					
consultant related delay factors	Inflexibility of consultant					
	High complexity of drawings and delay in approval					
	Waiting time for approval of tests and inspections					
	Lack of control over subcontractors'					
	delay in the approval of major changes in the work scope					
	Inaccurate time estimates					

	Type of bidding and contract award process					
	Poor contract specifications					
	Frequent design changes.					
	late design and design documents					
Material related	Inadequate material quality					
	Shortage of construction materials					
	Delay in material delivery					
	Changes in material type and specifications after work commencement					
	Delay in materials procurement					
	inflation/price increases in materials					
Labor relate	Shortage and unskilled labor					
	Low labor productivity					
Equipment related factor	Shortage/lack of equipment					
	Breakdown/Failure of equipment					
	Low level operator's skills					
	low efficiency and effectiveness of equipment					
Common delay factors	Poor communication and coordination among contracting parties					
	Corruption					
	disagreement on the valuation of work done					
	complexity of project					
	Disputes between parties					
	Unforeseen site conditions					

external factors	Problems with neighbors					
	Unavailability of utilities in site					
	traffic control and restrictions at site					
	social and cultural factors					
	force majeure					
	Weather conditions					
Authority	Changes in government regulations					
	Delay in obtaining permits from authorities					

3 Rank the impact of delay to the following Likert scale

Delay Impact Level	Not impact	Minor impact	Medium	Major impact	Sever impact
Likert Point	1	2	3	4	5

Delay Impacts	Likert Point				
	1	2	3	4	5
Extended project delivery time					
Late payment					
Forceful layoff					
Suspension of construction works					
Challenges in recruiting competent workforce					
Poor materials supply chain management					
Revised timelines and rescheduled works					
Schedule conflicts					

	Change in market conditions						
Cost Related Impacts	Extra cost, Escalation in project cost						
	Poor contractor cash flow						
	High cost of supervision and contract administration						
	Loss of materials due to exposure on-site						
	Tying down of client capital						
	Delay in getting service and or profit by clients						
	Loss of profit for the contractor						
	Failure in achieving project objectives						
	Extended site and general overhead expenses						
	Wastage and under-utilization of resources/ idling resources/ pouring money unnecessarily						
	Penalties (liquidated damage) and Loss of incentives						
Quality Related	Failure of the project						
	Inadequate labour for jobs at hand						
	Unavailability of offsite construction methods						
	Postponed or cancellation of materials and work done inspections						
	Poor and inconsistent communication between project stakeholders and material suppliers						
	Rushed Work (compromised standards, increased errors)						
	Deterioration of equipment and materials						

	Hiring new and untrained workers					
Other Impacts (Abandonment, dissatisfactions unsafe conditions)	Negative impact and image on the city and economy of the country					
	Dispute among parties					
	Bankruptcy					
	litigation and Arbitration					
	Dissatisfaction by project owners and or by end-users					
	Operation of worker shifts					
	Termination of contract					
	Abandonment of building project					
	Unsecured Sites (risks and hazards)					

3 Please write 1 or -1 corresponding to your choice for Yes or No for the following queries.

S. No.	Query Type	1	-1
1	Is your project suffered because of delay?		
2	What client related delay factor has been experienced your project?		
3	What contractor related factor related impacts has been experienced your project?		
4	What consultant related factors is experienced your project?		
5	What, common factors and external factors related impacts has been experienced your project?		

Based on your experience, from which category have large contribution in your construction projects? Rate them, with Likert scale, low contribution, medium contribution, high contribution and very high contribution				
Category	Low Contribution	Medium Contribution	High Contribution	Very High
Client related factors				
Contractor related factors				
Consultant related factors				
Common delay factors				
External delay factors				

Interview questions for impacts of delay			
Do you think time overrun is a problem in your construction projects?			
What time related impacts has been experienced your project?			
Do you think cost overrun is also a problem in your construction projects?			
What cost related impacts has been experienced your project?			
Do you think poor quality is a problem in your construction project?			
What poor quality related impacts is experienced your project?			
What other impacts of delay has been experienced project?			
Based on your experience, which of them is the most highly impact your construction projects?			
Category under Low impact, medium impact, and high impact.			
Impacts of delay	Low Impact	Medium Impact	High Impact
Time overrun			
Cost overrun			
Poor quality			
Others (Stakeholders' dissatisfaction)			

Thank you!