Debre Markos University

Colleges of Business and Economics

Department of Economics

Determinant Factors Causing the Delay of Construction Project Implementation: In Case of Debre Markos Air Field Construction, Ethiopia

By: Nebretu Teketelew

A Thesis Submitted to the Collage of Business and Economics, Department of Economics For the Partial Fulfillment of the Requirements for the Award of Degree of Master of Science (Msc.) In Project Planning and Management

Advisor: Dr.Assefa Delesho

JANUARY 1, 2025

DEBRE MARKOS, ETHIOPIA

DECLARATION

I declared that this is my original work which was done in collaboration with my advisor and has never been presented for the award of any master's degree or other award in any other university to the best of my knowledge, and that all sources of materials used for this paper have been dully acknowledged.

Declared by:

Nebretu Teketelew___________.___________________.___________

Name of student Signature Date

DEBRE MARKOS UNIVERSITY

POST GRADUATE PROGRAM

ADVISORS' APPROVAL SHEET

This is to certify that the thesis prepared by Nebretu Teketelew, entitled "Determinant factors causing the delay of construction project implementation in case of Debre Markos Airfield construction, Ethiopia" and submitted in partial fulfillment of the requirements for the degree of Master of Science in project planning and management. Therefore, as thesis advisor, I hereby confirm that this thesis is the output of research undertaken by him under my supervision and that it be submitted for the MSc Degree in project planning and management award. Therefore, I recommend that the student fulfilled the requirement and hence thereby can submit the thesis to the department of Economics.

Approved by:

____._______________

Name of advisor Signature Date

DEBRE MARKOS UNIVERSITY

POST GRADUATE STUDIES

EXAMINERS'APPROVAL SHEET

This is to certify that the thesis entitled "Determinant factors causing the delay of construction project implementation in case of Debre Markos Airfield construction, Ethiopia" submitted in partial fulfillment of the requirement for the Degree of Maser's with specialization in Project Planning and Management, in the graduate program of the Department of Economics, and has been carried by Nebretu Teketelew, under our Examination. Therefore, we recommend that the student fulfilled the requirement and hence thereby can submit the thesis to the department.

Approved by the examining committee:

1. ____________________________. ____________________. ___________________

Name of the Chairperson Signature Date

2. ____________________________. ____________________. _________________

Name of Internal Examiner Signature Date

3. ____________________________. ____________________. _________________

Name of External examiner Signature Date

ACKNOWLEDGEMENT

First of all I would like to express my limitless Praise to Almighty God together with its Virgin mother St. Marry for granting me good health and the motivation to successfully complete my thesis. Next, I would like to express my heart full thanks to my instructor and thesis advisor Dr. Assefa Delesho for his valuable and constructive professional advice, comments by spending his valuable time and his follow up for the successful completion of this paper as well his friendly approaches to me. I am also especially grateful to Debre Markos Air Field construction workers for shared their views at different stages of the paper and who gave me their time to hear my problems and afford me valuable data. I am also greatly indebted to all Economics department staff members in Debre Markos University for boundless moral support, continuous encouragement and material support. Last but not the least, I would like to thank all of my friends and to my family for giving me courage and help me to pass my difficulties.

TABLE OF CONTENTS

DECLARATION.. i

DEBRE MARKOS UNIVERSITY.. ii

ADVISORS' APPROVAL SHEET.. ii

EXAMINERS'APPROVAL SHEET.. iii

ACKNOWLEDGEMENT.. iv

ABSTRACT.. viii

CHAPTER ONE.. 1

INTRODUCTION.. 1

1.1 Background of the Study.. 1

1.2 Statement of the Problem.. 3

1.3 Research Questions.. 4

1.4 Objectives of the Study.. 5

1.4.1 General objective.. 5

1.4.2 Specific Objectives.. 5

1.5 Hypothesis of the study.. 5

1.6 Significance of the Study.. 6

1.7 Scope of study.. 6

1.8 Organization of study.. 7

CHAPTER TWO.. 8

REVIEW OF RELATED LITRATURE.. 8

2.1. Theoretical Literature Review.. 8

2.1.1. The Project Management Process or Life Cycle.. 8

2.1.2. Nature and Characteristics of Construction Projects.. 9

2.1.3. Types of Project Delays.. 9

2.1.4. Factors Affecting Construction Duration.......... 16
2.2. Empirical Literature Review.......... 18
2.3. Conceptual Framework of the Study.......... 21
CHAPTER THREE.......... 22
RESEARCH METHODOLOGY.......... 22
3.1 Description of the Study Area.......... 22
3.2 Research Design and Approach.......... 23
3.3 Type and Sources of Data.......... 23
3.4. Methods of Data Collection.......... 24
3.5. Target Population.......... 24
3.6. Method of Data Analysis.......... 24
3.7. Model specification.......... 25
3.8. Operational Definition of Variables.......... 25
3.9. Reliability Test and Relative Importance Index.......... 26
3.9.1. Reliability Test.......... 26
3.9.2. Relative Importance Index.......... 27
3.10. Ethical issues.......... 27
CHAPTER FOUR.......... 28
RESULTS AND DISCUSSION.......... 28
4.1. Response Rate.......... 28
4.2. Background Information of the Respondent.......... 28
4.3. Data Reliability Test.......... 31
4.4. Analysis of the factors that influence Airfield construction project delays.......... 32
4.4.1. Analysis of delay factors related to clients.......... 33
4.4.2. Analysis of delay factors related to public authority.......... 33

4.4.3. Analysis of delay factors related to project team....35
4.4.4. Analysis of delay factors related to contractors....36
4.4.5. Analysis of delay factors related to consultants....37
4.4.6. Analysis of delay factors related to external parties....38
4.4.7. Ranking of the ten most significant factors that causes construction delays....39
4.5. Correlation Analysis....41
4.6. Multiple Regression Analysis....43
4.6.1. Hypothesis Testing....44
4.6.2. Post estimation tests....45
4.7. Discussion of Regression Results....47
CHAPTER FIVE....50
CONCLUSION AND POLICY RECOMMENDATIONS....50
5.1. Conclusion....50
5.2. Policy Recommendations....51
5.3. Area for Future Research....52
REFERENCES....53
APPENDIX....58

ABSTRACT

Construction projects, particularly large-scale infrastructure developments like the Debre Markos Air Field, *often face significant delays due to a variety of interconnected factors. The main objective of this study is to examine the significant factors that influence delays in construction projects in Debre Markos Airfield construction project, Ethiopia. Through a questionnaire survey with 46 critical delay factors that are categorized into seven major groups, data were collected from 30 clients, 50 contractors and 20 consultants of the project based on simple random sampling. Data collected from the respondents was analyzed using Relative Importance Index (RII) for ranking purposes. In addition, both descriptive and econometric methods of data analysis were applied to identify the significant factors of project delay. Results showed that improper planning and scheduling by the project team, war during construction, modifications in orders, mistakes made by contractors, escalated inflation, delays in approving shop drawings and materials by consultants, unforeseen climate conditions, material shortages, and poor cash flow management by contractors were ranked as the top ten major causes of delays in construction projects in Debre Markos Airfield project. Moreover, the results showed that factors such as client-related, public authority-related, project team-related, contractor-related, consultant-related, and external-related factors significantly contribute to project delays in the study project. The study provides valuable insights for stakeholders involved in construction projects and offers evidence-based strategies to improve project efficiency and minimize delays, ultimately contributing to the successful completion of infrastructure for projects like the Debre Markos Air Field. Therefore, this study recommends the construction project's stakeholders to make efforts to use the appropriate project management practices needed to manage the major causes identified critical delay factors.*

Keywords: *Debre Markos Airfield, Project Delay, Construction, Project implementation, Relative Importance Index*

CHAPTER ONE

INTRODUCTION

1.1 Background of the Study

The construction industry plays a critical role in economic development, driving infrastructure advancement and fostering growth. However, it is often plagued by delays, which can significantly impact project timelines, costs, and overall effectiveness. Delays in construction projects are particularly critical in airfield development, where timely completion is vital for operational efficiency, safety, and economic benefits. Globally, delays are one of the most persistent issues in construction projects, defined as the failure to complete the project on the specified date, either outlined in the contract or mutually agreed upon by the parties involved (Ramya *et al*., 2015).

Timely completion of construction projects is a key objective in project management. Failing to achieve this objective can lead to dissatisfaction among both contractors and clients. Such delays often result in cost overruns and numerous challenges to project implementation (Ika, 2012). Ideally, projects should be executed without delays. Yet, construction delays remain one of the most significant challenges faced by the global industry, with many major projects failing to meet their deadlines due to inadequate management of delays (Aibinu and Jagboro, 2002). These delays not only disrupt economic activities but also reduce employment opportunities and can deter foreign investment. In turn, delayed projects typically have undesirable consequences on the contract's final outcome (Neary, 2009).

Delays are commonly attributed to project mismanagement, which could have been mitigated with better planning and analysis (Ika, 2012). Research suggests that the challenges contributing to delays in construction projects, especially in developing countries, could be significantly reduced through the application of effective project management practices. However, despite adopting such practices, delays remain a persistent issue in many low- and middle-income countries (Africa and Sachs, 2016).

Construction delays do not only affect the construction sector but also have broader economic implications. The most frequent causes of these delays are typically tied to failures by either clients or contractors. Studies have highlighted that clients' failure to secure necessary financing and contractors' failure to meet project schedules are common contributors to delays (Meena and Suresh, 2018; Borhan, 2014; Le-Hoai *et al*., 2008). In Ethiopia, poor project management systems and financial constraints are also frequently cited as major causes of delays in construction projects (Abdurezak & Neway, 2019; Werku & Jha, 2016). Another significant factor is inflation, which, even when accounted for in project contracts, tends to exceed expectations when projects are delayed. Additionally, delays in the supply of construction materials, particularly imported goods, have a considerable impact on project timelines in Ethiopia (Abdo, 2006).

Debre Markos, a key city in Ethiopia’s Amhara region, is strategically located about 300 kilometers northwest of Addis Ababa. Serving as an important economic and administrative center, the city has immense potential for regional growth. However, Debre Markos faces infrastructural challenges that hinder its economic development and connectivity. The construction of a new airfield in Debre Markos is a crucial project aimed at improving regional connectivity and boosting economic growth. The airfield is expected to facilitate better transportation, enhance trade and tourism, and create job opportunities. This project is part of a broader initiative by the Ethiopian government to improve infrastructure, especially in underdeveloped regions (Ethiopian Ministry of Transport, 2022; World Bank, 2020; Debre Markos City Communication Office, 2023).

The Ethiopian Airlines Group and Ethiopian Airports have allocated a substantial budget for the design and construction of the Debre Markos Airfield project, with the work being executed through a Design and Build Contract strategy. A contract agreement was signed between the employer (Ethiopian Airlines Group of Ethiopian Airports) and the contractor (Ethiopian Construction Works Corporation), with a total project cost of ETB 505,038,582.91 (including 15% VAT). The project commenced on January 16, 2022, with an expected completion date of July 17, 2024, a total duration of 913 calendar days. However, as of now, the project is 956 days into its timeline, which is already beyond the original contract period. The physical progress stands at 35%, with a reported expenditure of ETB 176,763,504.015 (Ethiopian Airports, 2024;

Ethiopian Construction Works Corporation, 2024). Given this delay, it is crucial to investigate the underlying causes. The main objective of this study is to identify the factors that have affected the timely completion of the Debre Markos Airfield project, focusing specifically on the causes of delay during the construction phase.

1.2 Statement of the Problem

Mega projects are essential drivers of economic growth, job creation, and infrastructure development in many countries, including Ethiopia. These large-scale projects, such as hydropower plants, factories, railways, and airports, are integral to the country's ambitions of industrialization and regional development. However, the timely completion of such projects remains a significant challenge, often due to delays that extend beyond the original schedules, leading to increased costs, missed economic opportunities, and a loss of public trust (Koshe & Jha, 2016; Meaza, 2015).

Despite Ethiopia's extensive engagement in mega project construction over the past few decades, delays have become a recurring issue. The country has experienced prolonged timelines in several key projects, including the construction of hydropower plants, industrial facilities, and transport infrastructure. These delays not only drain the national budget but also delay the expected benefits of the projects, such as improved regional connectivity, employment, and economic stimulation. For instance, the Debre Markos Airfield Construction Project**,** a crucial infrastructure initiative designed to boost regional economic development and enhance connectivity, has faced significant delays. These delays have resulted in cost overruns, prolonged project timelines, and disruptions to the broader regional development plans (Abdurezak & Neway, 2019).

While the causes of delays in mega projects have been studied in various contexts, there is a notable gap in comprehensive research specific to Ethiopia. Few studies have investigated the underlying factors contributing to project delays in Ethiopia, and those that have, focus mainly on isolated case studies or do not explore the full range of potential causes. Previous research has highlighted factors such as financing difficulties, poor project management, design errors, and inadequate material supply as key contributors (Molaye, 2020; Abdurezak & Neway, 2019). However, factors such as political instability, war, exchange rate volatility, and inflation have not been sufficiently addressed, despite their potential influence on the successful execution of mega projects in Ethiopia (Koshe & Jha, 2016; Meaza, 2015). Moreover, many previous studies, including those by Fashina *et al*. (2021), Molaye (2020), Abdurezak & Neway (2019), Habtemariam (2022), Demissew and Abiy (2023), Tola (2024), and Shedaga et al. (2024), have identified a variety of factors contributing to construction project delays. However, the applicability of these findings to the Ethiopian context is limited. The causes of delays can vary considerably across countries and project types, and the socio-cultural, economic, and political landscape in Ethiopia introduces unique challenges that may not be fully captured in studies conducted in other regions and other projects. Furthermore, this study examined the contributions of key stakeholders such as client, contractor, and consultant and ranked the delay factors based on their impact. It also highlighted the top ten causes of delay in the Debre Markos Airfield construction project, providing valuable insights for future construction projects in Ethiopia.

Consequently, this study aimed to fill a significant knowledge gap by pointing out and examining the major factors that have affected the timely completion or delays of the Debre Markos Airfield Construction Project, Ethiopia, with a focus on both previously identified factors and additional determinants not addressed in prior research. By identifying these causes, this research seeks to provide actionable insights for policymakers, project managers, and stakeholders to implement strategies that ensure the timely completion of the current project and future mega projects, minimize delays, and maximize the economic benefits of such infrastructure investments.

1.3 Research Questions

Based on the above statement of the problem, the key questions to be answered were:

1. What are the determinant factors of delay for construction project implementation in case of Debre Markos Air Field construction?
2. What is the level/rank of each factor in the total delay of the project?
3. What is the effect of client related, public authority related, project team related, contractor related, consultant related and external factor on project delay in the study project?

4. Who shall take the responsibility regarding to the delay of the project: the client, the contractor or the consultant?

1.4 Objectives of the Study

1.4.1 General objective

The general objective of the study was to examine the causes of delay in the Debre Markos Air Field construction project, Ethiopia.

1.4.2 Specific Objectives

The specific objectives of the study are:

1. To analyze the factors contributing to the delay in the Debre Markos Airfield construction project.
2. To identify the level /rank of influence that each delay factor has on the total delay time of the project.
3. To analyze the effect of client related, public authority related, project team related, contractor related, consultant related and external factor on project delay of Debre Markos Airfield construction project.
4. To assess the responsibility of each stakeholder mainly to client, contractor and consultant involved in the project with regards to the delay of the project.

1.5 Hypothesis of the study

Based on the research objectives stated above the following research hypothesis are developed in alternative hypothesis form.

H1: Client-related factors are expected to have a significant negative impact on the project completion of Airfield construction projects.

H2: Public authority-related factors are expected to have a significant negative impact on the project completion of Airfield construction projects.

H3: Project team-related factors are expected to have a significant negative impact on the project completion of Airfield construction projects.

H4: Contractor-related factors are expected to have a significant negative impact on the project completion of Airfield construction projects.

H5: Consultant-related factors are expected to have a significant negative impact on the project completion of Airfield construction projects.

H6: External factors are expected to have a significant negative impact on the project completion of Airfield construction projects.

1.6 Significance of the Study

Public and private construction projects are the major investment phenomenon in Ethiopia which are growing year to year. However, few studies were conducted whether they have been finalized as per the contract agreement or not. Construction project delay is a very critical factor in Ethiopia which consumes enormous resources. The factors of construction delay are many and differ from project to project as per the researches obtained internationally and a few from Ethiopians. The case of Debre Markos air field Construction Project will be prone to such an issue as to the researcher's knowledge. The researcher could not find any study conducted on this case specific project construction delay factors. As it is stated on the problem statement the researcher added some new cause factors which were not referred before to see the level of influence of such added factors on the delay of the Debre Markos air field construction project. Taking the above facts in to consideration, the intention of the research was to throw some fine stones on the ground.

By addressing the issue of delays in the Debre Markos Airfield construction, this study seeks to contribute valuable knowledge that can enhance project management practices and inform future infrastructure development projects. The findings will be relevant not only to stakeholders directly involved in the Debre Markos Airfield project but also to policymakers, project managers, and researchers within the construction industry. Ultimately, this research aims to foster improvements in project execution, ensuring that critical infrastructure projects are completed on time and within budget, thereby maximizing their socio-economic benefits. Understanding the causes of delay in the Debre Markos Air Field construction project is crucial for various reasons, including economic development, infrastructure improvement, job creation, and educational opportunities. Addressing these delays will contribute to timely project completion and overall societal benefits.

1.7 Scope of study

The scope of this study is defined by the parameters of time, location, and subject matter, focusing specifically on the construction delays experienced in the Debre Markos Airfield project. The following outlines the scope in detail. This research is confined to the Debre Markos

Airfield construction project, situated in Debre Markos, Amhara Region, Ethiopia. The study focused exclusively on this site to ensure a thorough and context-specific analysis of the factors contributing to delays. The analysis covered the construction timeline from the project's initiation to the present status as of September 2024. The study identified various determinant factors causing delays in the construction of the Debre Markos Airfield. These factors include: The causes of delay by the contractor such as incompetence project delay, Difficulties in financing project, Poor site management and supervision. The causes of delay by the consultant such as Delay in approving major changes in the scope of work, Late in reviewing and approving design documents, Conflicts between consultant and design engineer ,Causes of delay by the client such as Delay to furnish and deliver the site to the contractor, Delay in progress payment, change order by owner during construction. The causes of delay due external factors such as worst weather condition, civil war, political instability, Contractual relationship delays such as Short and unrealistic contract duration, legal dispute between parties, Inaccuracy in cost estimates and Causes of delay by public authorities such as inflation, obtaining permit from the government.

1.8 Organization of study

This study has been organized into five chapters. Chapter one provides a brief about introduction of the study. Chapter two contains a brief theoretical and empirical literature review, and formulation of the conceptual framework. Chapter three deals with research methodology used to answer the research questions. Chapter four presents results and analysis of the study. Chapter five concludes, and finally forwards some policy recommendations and area for future researches.

CHAPTER TWO

REVIEW OF RELATED LITRATURE

2.1. Theoretical Literature Review

2.1.1. The Project Management Process or Life Cycle

The Project Management Life Cycle consists of several critical stages that guide a project from its initiation to its closure, ensuring the achievement of its objectives. The process begins with the definition of the project, where the project is recognized as a temporary endeavor aimed at creating a unique product, service, or result. It has a clear start and finish, concluding when the objectives are met or when the project is terminated if the goals become unachievable (PMI, 2007). The next phase, project initiation**,** involves the identification of the project by an external entity such as a project sponsor, program management office (PMO), or governing body. At this stage, the need for the project is assessed through a feasibility study, business case, or needs analysis to ensure alignment with organizational goals (PMBK, 2017). The goal is to define the project's broad scope and secure stakeholder agreement on its objectives (Cobb, 2012).

Following initiation, the project planning phase involves creating a detailed plan that includes task schedules, resource allocation, and strategies for execution. Effective planning ensures the efficient use of resources and a higher likelihood of completing the project on time and within budget. This stage includes critical appraisals and a strategic approach to task sequencing (Maylor, 1999; Lock, 2007). A well-structured plan is essential for cost-effectiveness and profitability. Once the planning is completed, the project moves into the project launch phase, where initial resources are committed, and the work begins. This is a critical juncture that requires careful attention from project leaders to ensure smooth execution and avoid any disruptions (Maylor, 1999; Cobb, 2012). During the project execution phase, the project team carries out the tasks necessary to keep the project on track. Project managers must monitor progress, control costs, ensure quality, and adapt to unforeseen changes or pressures (Lock, 2007; Cobb, 2012; Wellman, 2011). Coordinating resources, maintaining stakeholder support, and addressing challenges are vital to ensure successful execution.

Finally, in the project closing phase, the completed product or service is delivered to the client. This stage involves reviewing the project's scope, costs, and quality to ensure that it aligns with initial plans. Reflecting on the project's successes and challenges provides valuable insights for future projects and helps integrate lessons learned into the organization's overall goals and strategies (Cobb, 2012).

2.1.2. Nature and Characteristics of Construction Projects

Construction project management is distinct from other industries due to several inherent characteristics that influence project success. Tsegaye (2017) emphasizes that managing construction projects involves complexities not commonly found in other sectors. These complexities arise from the nature of construction work, which is typically capital-intensive, complex, and requires extensive coordination across various specialized fields (Chartered Institute of Building, 2002). Furthermore, construction projects are generally executed outdoors, exposing them to external variables such as weather and traffic disruptions (Gould & Joyce, 2003). They also require careful consideration of the project site's geographical conditions and environmental factors (PMI, 2007). The legal and regulatory frameworks governing construction —aimed at ensuring public safety and minimizing environmental impacts—add another layer of complexity (Bennett, 2003). Additionally, compared to many other industries, construction relies heavily on labor, materials, and physical tools (Jekale, 2004). While the management principles for construction projects share similarities with other industries, such as those outlined in the PMBOK Guide (PMI, 2007), construction management also has unique aspects. For instance, project managers in construction often transition between phases or specialize in particular stages of the project (PMI, 2007). This contrasts with industries like software development, where the management structure remains more consistent throughout the project.

2.1.3. Types of Project Delays

Delays in construction projects, which significantly affect both time and cost, are a critical aspect of project management. The term "delay" often refers to the extended duration or postponement of project activities (Theodore, 2009). In construction, delay could be defined as the time overrun either beyond completion date specified in a contract or beyond the date that the parties agreed upon for delivery of a project. It is a project slipping over its planned schedule. The delay in the project has an adverse effect on project success in terms of time, cost and quality (Meena. and K.

Suresh, 2015). Hence by definition a delay factor in construction is any factor that has a potential to cause a construction delay. Meena and Suresh studied the trend of delays in Indian construction projects. 35 construction projects were surveyed in the study. 31 respondents that are taking part in those 35 construction projects were asked to rate 67 delay factors that were categorized under 9 groups (project team, owner, contractor, consultant, architect, material, labor, equipment and external party related). The researchers deployed the relative importance index to identify major causes of delay. The findings of the research showed that lack of funds to finance the projects to completion, labor shortage, material shortage, lack of effective communication, lack of supervision and frequent design changes to be the major causes of delays in Indian construction project under the study (Meen and Suresh, 2018).

Delay could be defined as an act or event that extends the time required to perform the tasks under a contract. It usually shows up as additional days of work or as a delayed start of an activity (Sweis*et al.*, 2007). Projects have a variety of reasons to experience delay. An investigation to find out the reasons for the delays was conducted in Hong Kong where a questionnaire was developed on factors that were identified in previous findings. The analysis of indicated the difference in perception of the factors that was between the key stakeholders of the project. There was general agreement about the relative importance of delay factors such as unforeseen ground conditions (Kumaraswamy *et al.*, 1998). The delays can be controlled by improving productivity and factors that affect productivity are dealt with the purpose of further increasing productivity and thereby reducing delays. The conclusion of the investigation is ranking of the factors and factor categories that are considered by various project stakeholders. The areas of disparity between the stakeholders are indicated by their experiences, prejudices and ineffective communication. Thus the project scope factors can be supported by effective communications between all stakeholders.

Projects are considered delayed when their stipulated completion durations have not been achieved. The inability to complete projects on time and within budget continues to be a chronic problem worldwide and is worsening (Ahmed *et al.*, 2002). According to Ashley *et al.* (2008) the trend of cost overrun is common worldwide and that it is more severe in developing countries. The subject of completion of project is therefore a universal concern that affects all parties to a construction project. It is thus in the interest of the project management as an emerging profession to address all the factors that affect completion of construction project. Construction projects worldwide often face challenges related to delays, impacting project timelines, budgets, and overall success. Ramya et al. (2015) emphasize that construction project delays can result in time and cost overruns, affecting project outcomes significantly. Zack (2003) defines delay as an event that requires more time than specified in the contract for project completion, highlighting the importance of adhering to project schedules.

Majid (2006) underscores the critical nature of project timelines, indicating that delays signify the inability to complete project work according to the original schedule. Understanding the root causes of delay is essential for effective project management and ensuring timely project delivery. Delays can be categorized as critical or non-critical, excusable or non-excusable, necessitating proactive measures to mitigate their impact (Ramya *et al*., 2015). The study by Ramya *et al*. (2015) identifies various causes of construction project delays, emphasizing the importance of early identification and management of these factors to prevent time and cost overruns. Effective planning and risk management strategies play a pivotal role in addressing delay factors before they escalate.

Sanders and Eagle (2001) define delay as an event that causes extended time to complete all or part of a project. Delay in construction is a global phenomenon (Sambasivan and Soon, 2007) affecting not only construction industry but also the overall economy of the country as well (Faradi and El-Sayegh, 2006). Delay involves multiple complex issues all of which are invariably of critical importance to the parties to construction contract. These issues concern entitlement to recover cost of delay or the necessity to extend the project with the consequential entitlement to recovery costs for adjustment to the contract schedules. Questions arise as to the causes of delay and the assigning of fault often evolves in to disputes and litigation (Bolton, 1990). Braimah (2008) stated that delayed completion of any project is generally caused by the actions or inactions of the project parties including the contractors, consultants, owner or other (example the act of God).

Al-Momani (2000) conducted a quantitative analysis of construction delays by examining the records of 130 public building projects constructed in Jordan during the period of 1990-1997. The researcher presented regression models of the relationship between actual and planned project duration for different types of building facilities. The analysis also included the reported frequencies of time extensions for the different causes of delays. The researcher concluded that the main causes of delay in construction projects relate to designers, user changes, weather, site conditions, late deliveries, economic conditions, and increase in quantities (Al-Momani, 2000). According to Abdalla *et al.* (2002) projects encounter massive delays and thereby overshoot the initial time and cost estimates which in turn result in extensive delays providing a platform for claims and disputes. A survey done with the objective of finding the most important reasons for delays as per the traditional contracts indicate that contractors and consultants agreed that owner interference, inadequate contractor experience, financing and payments, labor productivity, slow decision making, improper planning, and subcontractors are among the top ten most important factors.

Le-Hoai, L *et al.*, (2008) studied problems related to delays and cost overruns in Vietnam large construction projects and they identified that the cause for construction delays and cost overruns in overall context are poor site management and supervision, poor project management assistance, financial difficulties of owner, financial difficulties of contractor and design changes are the five most frequent, severe and important causes (Le-Hoai, *et al*., 2008). Trauner, Theodore J (2009) in his book of "Construction delays: documenting causes, winning claims, and recovering costs" briefly explains types of construction delays and the necessity of having a knowledge of these delay types to delay analysts. According to him before any discussion of delay analysis can begin, a clear understanding of the general types of delays is necessary. According to Braimah (2008), delays can be classified based on several factors: critical vs. non-critical, excusable vs. non-excusable, compensable vs. non-compensable, and concurrent vs. non-concurrent.

I. Critical vs. Non-Critical Delays

Critical Delays

Critical Delays are delays that affect the overall completion time of the project because they involve activities on the critical path, tasks that must be completed on time to avoid delaying the entire project. For example, a delay in obtaining structural steel during the erection phase would cause a critical delay, pushing back the project completion date (Trauner & Theodore, 2005). These delays often entitle the contractor to a time extension, and may lead to compensation claims due to the impact on the schedule (Callahan et al., 1992).

Non-critical Delays

Non-Critical Delays, on the other hand, occur on tasks that are not on the critical path and do not affect the overall project completion date. Although these delays do not cause a delay in the final project completion, they can still result in increased costs, such as additional labor or extended equipment rentals. In such cases, contractors may be entitled to compensation for incurred costs, even though they are not entitled to a time extension (Leary & Bramble, 1988).

The distinction between critical and non-critical delays is a crucial concept in construction project management. Critical delays affect the overall project timeline because they involve tasks that are on the critical path and have no slack time. As such, they often require immediate attention and may lead to project-wide delays. Conversely, non-critical delays involve tasks off the critical path and do not impact the project's final completion date, but they can still lead to cost increases or resource management issues. In both cases, contractors and owners must carefully evaluate the causes and consequences of these delays to determine appropriate time extensions or compensation (Callahan *et al*., 1992; Trauner & Theodore, 2005; Leary & Bramble, 1988).

II. Excusable vs. Non-Excusable Delays

Excusable Delays

These are caused by unforeseeable, uncontrollable events such as natural disasters, labor strikes, or errors in design. Typically, excusable delays entitle contractors to a time extension (Trauner & Theodore, 2009). Excusable delays are not attributable to the actions or inactions of contractor, and basically include unforeseen events. These events are out of the contractor's control and are without negligence or fault on contractor's part. According to general provisions in public agency specifications, delays resulting from the subsequent events would be considered excusable. These are general labour strikes, fires, floods, acts of God, owner- directed changes, omissions and errors in the plans and specifications, differing site conditions or concealed conditions, unusually severe weather, intervention by outside agencies and lack of action by government bodies, such as building inspection. Excusable delays can be further classified into compensable delays and non- compensable delays. Whether a delay is compensable or not it depends primarily on the agreement of the contract. In most cases, a contract specifies the kinds of delays that are non-compensable, in which the contractor does not attain any additional money but can be allowed a time extension (Kaming *et al*. 1997).

Non-Excusable Delays

These delays result from factors within the contractor's control, such as inadequate manpower or failure to meet deadlines. In such cases, the contractor is not entitled to a time extension, and the project owner may seek damages for the delay (Trauner & Theodore, 2009). Moreover, non-excusable delays often result in the project owner seeking damages to recover the costs associated with the delay. These damages can include increased overhead costs, additional labor or material costs, extended financing costs, and lost revenue or profits due to the delayed project completion. Many construction contracts include provisions for liquidated damages, which set a predetermined amount of money the contractor must pay for each day the project is delayed beyond the agreed completion date. Liquidated damages are intended to compensate the owner for the inconvenience and financial impacts caused by the delay, while also serving as an incentive for the contractor to adhere to the project schedule (Trauner & Theodore, 2009).

In summary, non-excusable delays are caused by factors within the contractor's control and result from poor management or failure to meet obligations. As a consequence, the contractor is not entitled to a time extension, and the project owner may seek damages, including liquidated damages, for the financial impact of the delay. This underscores the importance of careful project planning, resource management, and adherence to schedules to avoid the risk of non-excusable delays.

III. Compensable vs. Non-Compensable Delays

Compensable Delays

These delays, which are excusable, allow the contractor to receive both a time extension and compensation for additional costs incurred. Compensable delay is a type of delay over which the client (or client's representative) has control. Basically, in compensable delay the contractor will be eligible to additional reimbursement for the cost of delay and additional time for contract performance as well. If the owner causes delay like change in scope of work, impeded site access, late supply of client's materials or information, failure to provide timely and review shop drawings and differing site conditions; the contractor will be granted for additional time and money, this type of delay for which the innocent party is eligible for extension of time and additional reimbursement for the resulting costs. For example, delays caused by late material supply from the owner may be compensable (Theodore, 2009). The contractor is entitled due to time of the owner to offer all necessary details and instruction. For instance, where the employer or owner causes a delay, if the agreement does not include a provision acquitting the employer from liability for delays, the contractor is eligible to both time extension and compensatory damages. Construction contract agreements do not usually need the contractor to apply all the performance time given by the agreement. Distinguishing this, courts held owners liable for delaying contractors even though the project was done within the contractually agreed time because the contractor is barred from attaining an early finish. Thus, finishing on time does not necessarily prevent the recovery damages of delay where a reasonable as-planned schedule would then have yielded early completion (Alkass et al., 1996).

Non-Compensable Delays

In these cases, even if the delay is excusable, the contractor is not entitled to compensation. Only time extensions may be granted (Trauner & Theodore, 2009). Non-compensable delays are caused by an unforeseen event or incident beyond the control of the contractor and the client. As a result, both parties can incur losses in term of cost. The contractor admits his time overrun costs for taking more time in the project while the client absorbs its additional cost in the form of liquidated damages by giving additional time to the contractor and extending the contract. Causes for this type of delay cannot be controlled by any party to take the responsibility of extra cost resulting from it. These causes of delays include events such as force major; act of public enemy; war, acts of another contractor; strike, acts of God; unusual weather, fires, actions of government in its supreme capacity. In this situation, the contractor is usually eligible to extension of time but not eligible to any additional financial compensation for delay damages from the owner. Liquidated damages are set as an amount of money stated in the contract agreement by an agency to compensate the party for unexcused interruption in the performance of the contract. The aim of the liquidated damages clause is to establish, in advance, a practical reasonable evaluation of the damages that would be incurred by the party if there is a breach of contract or an unexcused delay (Kaming *et al*. 1997).

IV. Concurrent vs. Non-Concurrent Delays

Concurrent Delays

Concurrent delays are delays that occur, at least to some degree, during the same period of time. In construction, the term concurrent delay refers to the situation when non- excusable delay and an excusable compensable delay occur during overlapping time periods or at the same time. These occur when two or more delays overlap. In such cases, the contractor may be entitled to a time extension and, in some instances, compensation for the delays attributable to the project owner (Alkass *et al*., 1996). For example, if both a weather-related delay and a site access denial occur simultaneously, the contractor may recover damages for the weather-related delay but not for the access denial. Concurrent delay generates complex legal issues about assessing responsibility for overall delayed project. The analysis of concurrent delays could be further complicated if: (i) the delay periods are different lengths, (ii) the delay periods are not totally concurrent, and (iii) the delay periods are periods that have different influence on the type and number of work activities that are affected and the severity of the impacts upon the affected work activities are different for each of the delays (Yogeswaran *et al*., 1998).

Non-concurrent delay

A non-concurrent delay occurs when two or more delays happen at different times without overlapping. Unlike concurrent delays, where delays overlap during the same period, non-concurrent delays are attributed to distinct events that occur separately in the project timeline (Alkass *et al*., 1996). For example, a contractor may face a weather-related delay during one phase of construction, and later encounter a delay due to material shortages. These delays do not occur simultaneously, and their impacts on the overall project schedule are analyzed independently. Non-concurrent delays typically lead to separate assessments for time extensions and compensation, with each delay treated individually based on its cause and duration (Yogeswaran et al., 1998).

2.1.4. Factors Affecting Construction Duration

Construction duration is a critical success factor in construction projects, alongside cost and quality. Several studies have identified a range of factors that influence project timelines, highlighting the complex interaction between internal and external variables. Chan and

Kumaraswamy (2002) categorized these factors into four main groups: project scope, complexity, environment, and management attributes. Project Scope includes factors such as construction cost, gross floor area, building type, procurement systems, and any variations that occur during the project, all of which can impact the duration of construction. Project Complexity encompasses challenges related to client attributes, site conditions, the buildability of the design, and the need for effective coordination and quality management. The Project Environment considers external factors like physical conditions, economic influences, socio-political dynamics, and industrial relations, all of which can have significant effects on construction timelines. Finally, Management Attributes focus on the role of the client and design team in managing the project, including decision-making communication, organizational structure, human resource management, and overall productivity. Each of these categories plays a critical role in determining how long a construction project will take to complete.

Previous research highlights the causes of delays in various phases of construction, particularly in developing economies. For example, surveys in Hong Kong (Chan & Kumaraswamy, 1997) and Malaysia (Sambasivan & Soon, 2007) identified key delay factors such as poor site management, insufficient planning, lack of experience, and material shortages. Studies in Saudi Arabia (Assaf & Al-Hejji, 2006) further identified contractor and client-related delays, such as poor communication, financing issues, and design changes initiated by the client. Additionally, issues like slow decision-making and changes in orders were common causes of delay across regions. Le-Hoai et al. (2008) and Apolot et al. (2012), have also highlighted delays due to factors like design errors, inadequate financial management, political instability, and insufficient project monitoring. In particular, delays in payment, changes in scope, and political instability were frequently cited as critical in public sector construction projects. Research by Aibinu and Jagboro (2002) in Nigeria and Tumi *et al*. (2009) in Libya revealed that delays due to improper planning, ineffective communication, and financial difficulties were prevalent in their respective regions. In contrast, studies in Egypt (Abdl-Razek *et al*., 2008) pointed to constraints in financing and delays in contractor payments as major contributors to project delays. The literature consistently emphasizes the importance of addressing both internal (e.g., contractor management, design quality) and external (e.g., political, economic conditions) factors to mitigate construction delays. Efforts to improve construction efficiency, through better planning, enhanced client management, and timely financial management, can significantly reduce time overruns and improve project outcomes. As the construction industry continues to grow, the challenges of managing time, cost, and quality will remain central to project success and the broader economic impact of construction activities.

2.2. Empirical Literature Review

In the specific context of the Debre Markos Air Field construction project, the discrepancy between the current progress rate of 35% and the intended 100% completion by July 17, 2024, underscores the urgency of identifying and addressing delay causes. By synthesizing the existing literature on construction project delays and their implications, this research will be provide insights into the specific factors contributing to the delays in the Debre Markos Air Field project.

The literature review underscores the significance of comprehending the causes of delay in construction projects, as timely completion is essential for achieving project objectives and maximizing societal benefits. By integrating existing knowledge on delay factors and their effects, this study seeks to develop targeted strategies and policies to mitigate delays in the Debre Markos Air Field construction project and future construction endeavors in Ethiopia Literature Review for the Research Proposal on Causes of Delay in Debre Markos Air Field Construction. Construction delays are a pervasive issue in the construction industry globally, with significant implications for project costs, timelines, and overall success. In Ethiopia, the problem of construction delays is particularly pronounced due to various contextual and systemic factors. This literature review aims to explore the determinant factors causing delays in construction projects in Ethiopia, focusing specifically on the case study of the Debre Markos Airfield Construction project.

Construction delays are categorized into various types including time overruns, cost overruns, and performance issues. According to Al-Momani (2000), construction delays can be attributed to factors such as poor project management, unforeseen conditions, and contractor-related issues. In the Ethiopian context, additional complexities such as regulatory constraints, resource availability, and socio-economic conditions often exacerbate these delays. Effective project management and planning are crucial for the timely completion of construction projects.

According to Fagbenie and Olawole (2017), inadequate planning and poor project management are leading causes of delays in developing countries, including Ethiopia.

Political instability and social unrest can disrupt construction projects. A study by Asfaw and Belayneh (2019) found that political uncertainty and social conflicts in Ethiopia have led to delays in various infrastructure projects. Workforce-related issues, including labor shortages, skill deficiencies, and labor disputes, are common in construction delays. According to Gichuru and Njihia (2016), inadequate skilled labor and labor unrest can hinder project progress. Financial issues are a significant determinant of construction delays. As highlighted by Memon et al. (2011), budget overruns and funding shortfalls can severely impact project timelines. Procurement delays and supply chain inefficiencies often contribute to project delays. A study by Osei-Tutu *et al.* (2012) indicates that delays in the procurement of materials and equipment, coupled with logistical challenges, can significantly affect construction schedules.

One of the most delayed construction projects in Ethiopia; the Addis Ababa 40/60 housing project was studied by Molaye and Endale in separate studies. The former let 99 respondents representing client, contractors and consultants participate in his survey. In his study 20 major causes of delay were identified based on a Relative Importance Index from a list of 70 possible causes of delay. The findings of his research indicated that delivery of materials by the client, difficulties in financing projects by contactors, improper contractor selection, slow decision making by the client and obsolete technology used by contractors were some of the most dominant delay factors. The researcher added that for the top 20 delay factors a number of another root causes were identified for their occurrence. The cumulative effects of those varieties of causes for the incidence of major delay factors contributed a great role on the project timely completion failure and the project is delayed by more than 150%. From the investigated major causes of delay, client sourced and contractor sourced delay factors were the major bottlenecks of progress. The researcher also implied the impacts of the delay of the projects. According to Mollaye, cost-overrun, time-overrun, increased unemployment rate, client loses time value of money, the government mistrusted by the people and reduce the quality of construction were some of the most severe effects of delay (Molaye, 2020).

The later, Endale, let 80 respondents participate representing client, consultant and contractor firms and identified ten major causes of delay from a list of 45 common causes of delay based on a Relative Importance Index. Those ten major causes of delay were late material supply, financial difficulties faced by contactors, problems related to utilities supply, equipment unavailability, delayed payments by contractors, poor site management, ineffective planning, late design review and approval and slow decision-making processes (Endale, 2016).

Abdurezak and Neway (2019) carried out a research on Causes of Delay in Public Building Construction Projects: A Case of Addis Abeba Administration, Ethiopia and revealed the top ten factors that cause construction delays in the public building construction projects in Addis Ababa. These are: difficulty in project financing, poor project management system, delay in issuance of designs and working drawings, shortage of availability of imported construction materials and goods on market, design errors and complexity of designs, delay in progress payments for completed works, late start and resource mobilization to site, financing problems, inaccurate site investigation report and price inflation (Abdurezak Mohammed and NewaySeifu, 2019).

Abdo (2006) conducted a research on delays in public building construction projects and their consequences in Ethiopia. 52 public building projects constructed by local contractors in the years between 1995 and 2005 were surveyed in the study. In the study a questionnaire survey was used to collect data on delays, and 62 responses from contractors, consultants, public owners and construction professionals were analyzed using mean score method. The researcher grouped 80 causes of delay into six categories which included design related, management related, construction related, finance related, code related, and force majeure related causes of delay. Of these groups of delay causes, design related causes of delay were to be the most frequent ones followed by management related delay causes. The study also lists 10 critical causes of delay in public building construction projects in Ethiopia which included scarcity of material in the market, late material supply, delayed payments to contractors, unrealistic performance schedule, change in subsurface conditions, client's finance shortage, adverse weather condition, less emphasis to planning, material and labor price escalation, and variations (Abdo, 2006).

Robel also conducted a delay analysis on Addis Ababa Light Railway Transit construction project. In his study 20 respondents were asked to fill questioners and of which only 14 were able to complete filling the questioner. The study concludes that financial problem, managerial problems and local subcontractors‟ limited skill to have the highest contribution in the project delay (Robel, 2015).

2.3. Conceptual Framework of the Study

The conceptual framework provides a structured approach for analyzing construction project delays. By categorizing determinants into internal and external factors, examining their interactions, and assessing their effect on project outcomes, the framework offers a comprehensive perspective on the complexities of construction delays. Applying this framework to the Debre Markos Airfield project helps in identifying specific challenges and developing targeted strategies to mitigate delays and improve project performance. It shows the relevant effect of causes of delay regarding to contractor, consultant, client and external factor. The conceptual framework of the study adopts that of Assaf and Hejji (2005) concepts. As per them construction project delay factors can be classified based on the cause groups of the delay factors. For the purpose of this study the factors were rather regrouped into six groups, based on the responsible stakeholder the factor belongs to. These are:

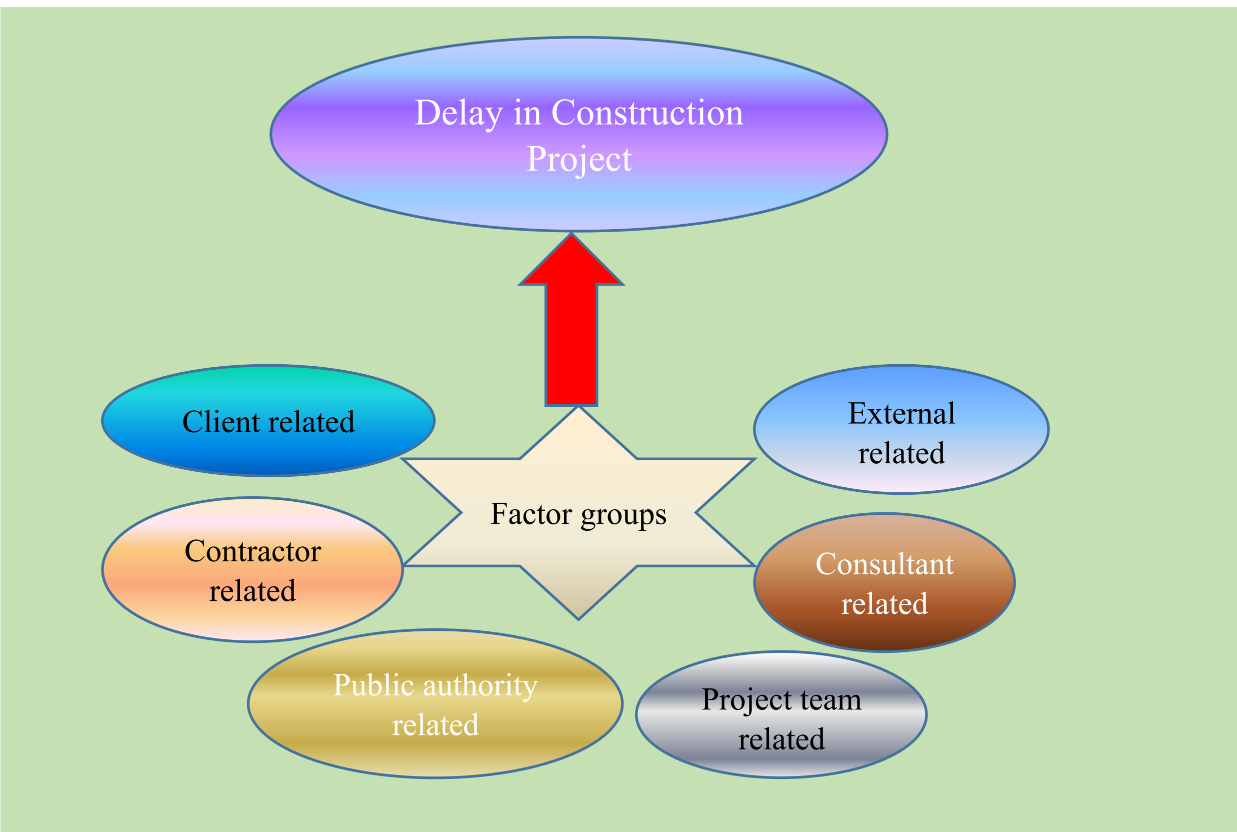


Figure 2.1: Conceptual Framework of the study (Adapted from (Assaf and Hejji, 2005).

CHAPTER THREE

RESEARCH METHODOLOGY

This chapter presents description of the study area, research design, source and types of data, methods of data analysis and model specification, and description of variables to study the determinant factors of causing project delay in case of Debre Markos airfield construction project. It also discusses the statistical tools and necessary diagnostic tests.

3.1 Description of the Study Area

Debre Markos town is located about 300km from the capital Addis Ababa in the North West Direction. The proposed Debre Markos airport is located the Amhara Regional state, East Gojam in Gozamn Wereda. The project site is about 14 km (air distance) from Debre Markos town in the West Direction.

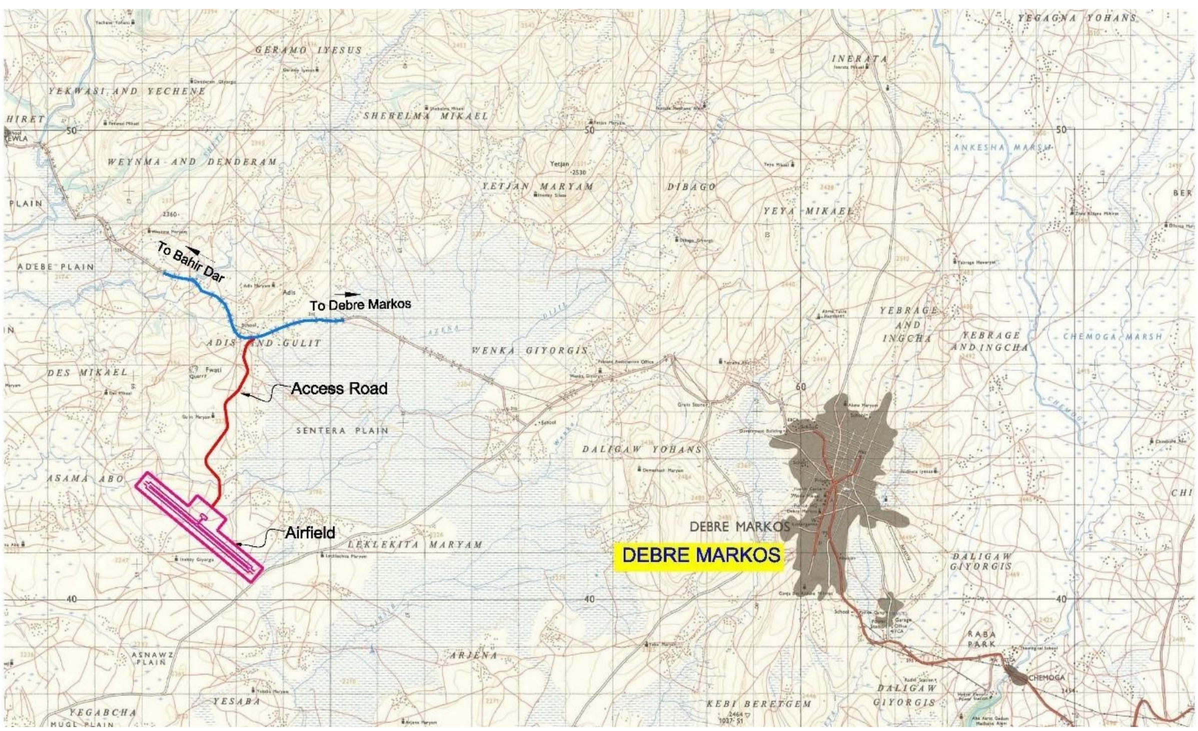


Figure 1.1: Location Map

Near the project area, the Debre Markos Meteorology Station is identified to have a likely influence on project area. Recent eleven years' data (2011 to 2021) such as daily heaviest rainfall, monthly rainfall, means monthly maximum and minimum temperature is obtained from Ethiopian Meteorological Services Agency that has been registered at this station. As inferred from this Met-Station data, the main rainy seasons are in months of May through September, and the rest receive light shower. The mean annual rainfall is 1320mm whereas the mean annual temperature is 16°C. Based on this information and the physiographic (i.e. average elevation around 2230m a.s.l), this suggests that the project area is located in 'Weina Dega' climatic Zone. (NMSA, 2006-2021).

3.2 Research Design and Approach

Research design is the design for fulfilling research objectives and answering research questions. The study's research design strategy and approach are based on the objectives of the study. To accomplish the objectives of the study both descriptive and explanatory research strategy and both quantitative and qualitative research approach are used to describe and examine the determinant factors causing project delay in case of Debre Markos airfield construction project. The descriptive design would be in use for determining the frequency, mean and relative importance index with which an event occurs or relationships between variables. The descriptive design provides a detailed picture of the situation and detail description of the findings about the indicators of delay factors and its effect on project delay as perceived by the clients, contractors and consultants of the project. And the explanatory design is used for analyzing the effect relationships between delay factors such as client related, public authority related, project team related, contractor related, consultant related, and external factors on project delay. And also explanatory type of research is applied since it enriched and supported the previous theories through comparing the findings with research questions (Mohd R. *et al,* 2022).

3.3 Type and Sources of Data

The study employed a one-time quantitative and qualitative data type for analysis, such types of data is important for the values of one or more than one variable are collected for several sample units at the same points in time (one time shoot), just the researcher collects the data from the respondents directly in a particular time. The source of data for this study was primary data sources for the achievement of the objectives. The primary sources are obtained from clients, contractors and consultants of the project. Secondary data sources that support this work are obtained from documents found at the head offices of the stakeholders, library books, newspapers on business, magazines on business, books, published and unpublished materials, and annual reports of the project and other related materials.

3.4. Methods of Data Collection

To collect the primary data from the respondents, structured questionnaires were used. The questionnaires were administered to the respondents to acquire their opinions and find out their knowledge concerning delay in airfield construction project, based on their work experiences and judgment. The questionnaire survey was designed based on the common delay factors identified from the literature review carried out as well as the objective of the study. A total of 46 identified factors that influence delay in construction projects that are categorized into six major groups were investigated in this study. These groups include the client-related, public authority related, project team related, contractor-related, consultant-related, and external factor-related delays. The questionnaire design comprises of two sections that include the general organization information and the factors that influence construction delays. Furthermore, these factors were rated in this study based on the Likert's scale of 5 ordinal measures from 1 to 5 according to the level of agreement and contribution (Allen and Seaman, 2007).

3.5. Target Population

The target population of this study consists of a total of 120 respondents, including 39 clients, 54 contractors, and 27 consultants involved in the airfield construction project. The population was partitioned into three strata: clients, contractors, and consultants. These strata are mutually exclusive and collectively exhaustive, ensuring that every population element is assigned to only one stratum and no elements are omitted. The questionnaire was distributed to engineers and other professionals who were familiar with the specific construction projects during the specified time. Since the total population is lower than 200, the entire population was surveyed, as recommended for populations of this size (Creswell, 2014).

3.6. Method of Data Analysis

After the required data has been collected through questionnaire, the data management (including converting, coding, editing and putting in to statistical formats) were conducted in order to obtain the expected output. For this purpose, this study used different statistical toolkits such as Excel and SPSS to analyze the data in line with the objectives of the study. For the purpose of data analysis, the study employed both descriptive and econometric methods of data analysis. First, the variables are described using simple statistical measurements like percents, frequencies, graphs, mean, and relative importance of index to identify the major causing factors of project delay in study site. Secondly, the econometric part of the study used a correlation analysis and multiple linear regression to analyze the effects of client related, public authority related, project team related, contractor related, consultant related and external factors on project delay of airfield construction project.

3.7. Model specification

The model specification shows the functional relationship between the dependent and independent variables. In order to show the effect of client related, public authority related, project team related, contractor related, consultant related and external factors on project delay of airfield construction project, multiple linear regression estimated using Ordinary Least Square (OLS) method is applied. Hence, in the study there are one dependent variable and more than two independent variables. Accordingly, the study specified the model using multiple linear regression OLS model. Following Gujarati (2004), the multiple linear regression analyses model is specified as follows:

$$Pd = \alpha + \beta_1 cl + \beta_2 pa + \beta_3 pt + \beta_4 co + \beta_5 cs + \beta_6 ex + \epsilon i \, (1)$$

Where: Pd = project delay

cl= client related factors

pa= public authority related factors

pt= project team related factors

co= contractor related factors

cs= consultant related factors

ex= external related factors

α is the intercept parameters to be estimated

β_i is the parameter to be estimated

ϵi = Disturbance terms

3.8. Operational Definition of Variables

Dependent Variable

Project delay: A general delay in the project, indicating that the project is behind schedule across multiple phases or activities, resulting in missed deadlines or extensions of the project timeline.

Independent Variables

Client related: Factors related to the client's actions, decisions, and commitments that impact project timelines, such as changes in scope, delays in approvals, or late payments.

Public authority related: Factors stemming from government or regulatory bodies, including delays in permits, changes in laws, or political instability, that affect project progress.

Project team related: Factors associated with the project team's performance, such as inadequate planning, poor communication, or lack of expertise, leading to delays or inefficiencies.

Contractor related: Factors arising from the contractor's performance, including financing issues, construction errors, poor site management, or delays from sub-contractors, which cause project delays.

Consultant related: Factors related to the consultant's performance, such as delays in approvals, poor supervision, or inadequate expertise, which affect the project's timeline and quality.

External factor related: External influences beyond the control of the project team, including weather, supply chain disruptions, legal disputes, or community issues that result in project delays.

3.9. Reliability Test and Relative Importance Index

3.9.1. Reliability Test

This study has been conducted reliability and validity test. The reliability test is an important instrument to measure the degree of consistency of an attribute which is supposed to measure. Reliability can be equated with the stability, consistency, or dependability of a measuring tool. Cronbach's alpha is one of the most commonly accepted measures of reliability. It measures the internal consistency of the items in a scale. It indicates that the extent to which the items in a questionnaire are related to each other. It also indicates that whether a scale is one-dimensional or multidimensional. The normal range of Cronbach's coefficient alpha value ranges between 0-1 and the higher values reflects a higher degree of internal consistency, different authors accept different values of this test in order to achieve internal reliability, but the most commonly accepted value is 0.70 as it should be equal to or higher than to reach internal reliability.

3.9.2. Relative Importance Index

In an effort to achieve the objective of the study, a Relative Importance Index (RII) was selected as a suitable analytical method (Akadiri, 2011). This was used to analyze the ratings received through the questionnaires and establish a mean rating point that represents the rating for each group contributors. Each calculation was carried out using RII formula given as follows:

$$RII = \frac{\Sigma W}{AN}$$

Where W, represents the rating given to each factor by the respondents. For factors that cause delay for example, 5 is for very high contributing factor, 4 is for high contributing factor, 3 is for average contributing factor, 2 is for low contributing factor and 1 is for very low contributing factor. A is the highest weight (5 for this study) and N represents the total number of samples. The interpretations of the RII value is based on the following table as suggested by (Akadiri, 2011).

RII value	Rate	Importance level
From 0.8 to 1	**Very High**	**(VH)**
From 0.6 to 0.8	**High**	**(H)**
From 0.4 to 0.6	**Average**	**(A)**
From 0.2 to 0.4	**Low**	**(L)**
From 0 to 0.2	**Very Low**	**(VL)**

3.10. Ethical issues

Ethical issues were considered in this research. In the first step, the study informs participants about the nature of the research and the activities in order to obtain their consent. The researcher made clear to participants that their consent may be withdrawn and they may elect to discontinue the activities at any time. Researcher reveals, the rights, privacy, dignity, and sensitivities of participants shall be respected so that their integrity to the research process was being achieved. Hence, the study participants were reassured of confidentiality by explaining to them, their name and other identifier of their status were not documented in the questionnaires. Moreover, the researcher was given orientation for them about the procedure of data collection and data management.

CHAPTER FOUR

RESULTS AND DISCUSSION

This chapter presents the results of the study rigorously and focused on presentation, interpretation and discussion of data collected through questionnaires using descriptive methods of data analysis.

4.1. Response Rate

A total of 120 questionnaires were distributed in person to all the target respondents as part of this census survey. Out of the 120 questionnaires, 100 (83.33%) were completed, returned, and deemed valid, which is considered excellent. A total of 20 questionnaires were recorded as invalid due to incomplete responses or non-return. This response rate is deemed acceptable for the rigorous analysis and reporting of the study's findings, as presented in Table 4.1.

Table 4.1: Response rate of respondents

Target respondents	Sample size	Response rate	Non-response rate
Clients	39	30	9
Contractors	54	50	4
Consultants	27	20	7

Source: own survey, 2024

4.2. Background Information of the Respondent

The respondents were categorized mainly into three groups, namely clients, contractors, and consultants which are implementing agencies and financiers. Table 4.2 presents the respondents in category, the number of participants and their rates in percentages. As indicated in the Table 4.2, out of the total 100 fully responded respondents, 50% of them were contractors, making up the largest group, followed by clients at 30%, and consultants at 20%. This distribution reflects the importance of operational insights, with contractors providing the majority of responses, likely due to their direct involvement in project execution. Clients also contribute a strategic perspective, influencing decision-making and project outcomes. Also, consultants offer specialized expertise and advice, complementing the operational and client-driven views. The sample is well balanced and provides reliable results and drawing of conclusions. Moreover, most of the respondents that took part in the survey are highly familiar with the projects of construction of airfield in the study area and this added to the quality of the feedback and the findings of the study.

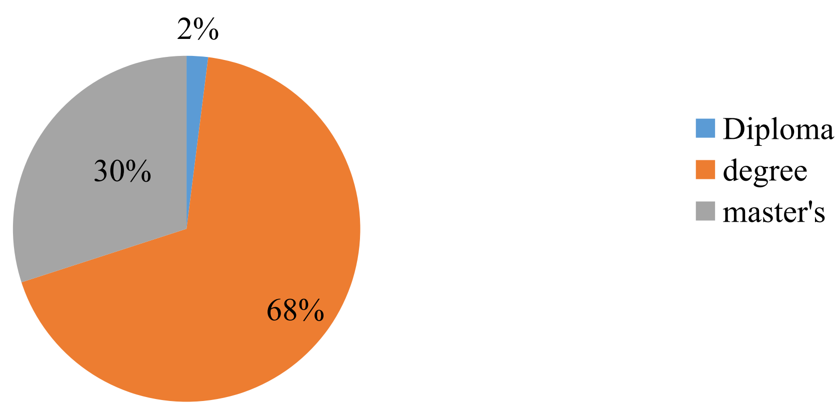
Table 4.2: Respondents of the study

Respondents in Category	Participants in number	Responses in percentage
Clients	30	30.0
Contractors	50	50.0
Consultants	20	20.0
Total	100	100

Source: own survey, 2024

Figure 4.1 presents the educational level of the respondents. The results show that the majority of respondents (68%) hold a degree, with 30% holding a master's degree and only 2% having a diploma. This suggests that most participants are well-educated, which could positively impact project management by enhancing understanding of complex issues, strategic planning, and risk mitigation. Therefore, the respondents can understand the project process and implementation and may help in addressing issues related with project delays through better decision-making and problem-solving. Moreover, most of the respondents that took part in the survey are highly educated professionals in the construction of airfield in the study area and this added to the quality of the feedback and the findings of the study.

Figure 4.1: Education Level of the respondnets



Source: own survey, 2024

Table 4.3 presents the experience level of respondents and the result shows that the distribution of work experience among respondents indicates a broad range of professional backgrounds, with 37% having 11-15 years of experience, 25% with 6-10 years, and 21% having 16-20 years of experience. Only 13% have 1-5 years of experience, and 4% have over 20 years. This diversity suggests that the respondents bring a mix of both practical experience and newer perspectives to the project implementation. In relation to project delays, those with more years of experience (11 years or more) are likely to be more familiar with common challenges and risk factors, potentially identifying and addressing issues before they cause significant delays. Moreover, most of the respondents that took part in the survey are highly experienced professionals in the construction industry and this added to the quality of the feedback and the findings of the study.

Table 4.3: Experience of the respondents

Work experience		Frequency	Percent
	1-5 years	13	13.0
	6-10 years	25	25.0
	11 -15 years	37	37.0
	16-20 years	21	21.0
	Greater than 20 years	4	4.0
	Total	100	100.0

Source: own survey, 2024

Table 4.4 reports the respondents' general opinion on their current project's state. In the context of the Debre Markos Airfield construction project, the identified project delay indicators reflect significant concerns regarding project performance, as highlighted by the high rankings of their Relative Importance Index (RII). The first and most critical delay indicator is the failure to deliver project outputs to the owners on time, with an RII of 0.946, ranking it as the most severe issue with a "Very high" level of agreement. This suggests that timely delivery is a crucial challenge in the project, potentially leading to operational setbacks and cost overruns. The second indicator, that projects are incurring more costs than budgeted (RII of 0.940), also ranks very high, indicating a serious concern regarding financial management and the need for tighter cost control. The issue of unnecessary project extensions (RII of 0.876) further complicates the timeline, implying inefficient scheduling and resource allocation. Additionally, the suspension of project work (RII of 0.874) points to disruptions that are likely slowing progress, whether due to financial, logistical, or regulatory factors. Lastly, the overall delay in the implementation of the project (RII of 0.914) reinforces the systemic nature of the delays, suggesting that these issues are widespread across various phases of the construction process.

Overall, these responses highlight a systemic issue within the Airfield construction project, where both time and cost overruns are prevalent, often resulting from poor project planning, scope changes, inadequate risk management, or external factors that disrupt the project flow, ultimately leading to delays and financial strain, that need to be addressed to ensure the successful and timely completion. Hence, the majority of respondents agree that time and cost overruns are the most serious issues in the airfield construction projects in the study area.

Table 4.4: Respondents' general opinion on their current project's state

No.	**Project delay indicators**	**RII**	**RII Ranking**	**Level of Agreement**
1	Project outputs are not delivered to the owners on time	0.946	1	Very high
2	Projects are unnecessarily extended	0.876	4	Very high
3	Projects are incurring more costs than the budget	0.940	2	Very high
4	Suspension of project work	0.874	5	Very high
5	Overall the project implemented in the study area is delayed	0.914	3	Very high

Source: own survey, 2024

4.3. Data Reliability Test

Cronbach's alpha is used in this study to assess the internal consistency of the research instrument, which is the developed questionnaire. Cornbrash's α (alpha) is a coefficient of reliability used to measure the internal consistency of a test or scale; it resulted as a number between 0 and 1. As the result approaches to 1 the more is the internal consistency of the items, which means all the items measure the same variable. The result of the coefficient alpha for this study's instrument as presented in Table 4.5 were found to be as indication of acceptability of the scale for further analysis since all the six groups of factors related to project construction delay (client related, public authority related, project team related, contractor related, consultant related and external factor related) causes of project delay measures and effect of project delay item measures, which is cause of delay. The result shows that, the test value of the reliability test has proved the questionnaire designed to collect the desired data was reliable. The alpha values for all variables are greater than or equal to the cut point of 0.70 (Molaye, 2020). Overall, the total scale reliability of 0.788 for this study suggests the survey is generally consistent, and it can be concluded that the measurements can be applied for analyses with acceptable reliability. This implies that 78.8% of the answers provided by the respondents regarding the different factors that causes of delays have an excellent reliabilities.

Table 4.5: Data reliability test

Factors	Number of questions	Cronbach's Alpha test value
Client related	5	.800
Public authority's related	8	.802
Project team's related	6	.721
Contractor's related	10	.724
Consultant's related	6	.787
External factors related	11	.688
Reliability of the total scale	**46**	**.788**

Source: own survey, 2024

4.4. Analysis of the factors that influence Airfield construction project delays

As part of the aim of this study, 46 factors that influence project delays in Debre Markos Airfield construction project have been identified, evaluated and categorized into six major groups before discussing the results of the analysis here. These factors are ranked in each category based on Relative Importance Index (RII) and Mean Values. Moreover, in an effort to establish the level of contribution of the different delay factors, the RII rankings are classified based on the RII classification table.

4.4.1. Analysis of delay factors related to clients

Table 4.6 presents the results of the survey analysis of delay factors related to clients. The client-related causes of delay in construction projects in Debre Markos air field are significant, with several factors identified as having a very high level of contribution. The highest-ranked cause is the change of orders by the client during construction (RII = 0.940), which disrupts the project flow and leads to delays in both scheduling and resource allocation. Closely following is the delay in progress payments by the client (RII = 0.924), which can halt work if contractors lack the financial liquidity to continue. The suspension of work by the client (RII = 0.842) is another major cause, often stemming from disputes or changes in client priorities, which halts progress and affects the entire project timeline. Slow decision-making by the client (RII = 0.760) and the right of issue (RII = 0.798) are ranked lower but still have a high impact on delays, as they lead to inefficiencies in project coordination and prolonged decision cycles. Overall, the client-related factors, particularly changes in orders and delayed payments, contribute significantly to project delays, highlighting the critical role of client management and timely decision-making in ensuring smooth project progress.

Table 4.6: Delay factors related to clients

No.	Clients related causes of delay	RII	RII Ranking	Level of contribution
1	Change of orders by client during construction	0.940	1	Very high
2	Delay in progress payment by client	0.924	2	Very high
3	Slow decision making process by client	0.760	5	High
4	Suspension of work by the client	0.842	3	Very high
5	Right of issue	0.798	4	High

Source: own survey, 2024

4.4.2. Analysis of delay factors related to public authority

Table 4.7 presents the results of the survey analysis of delay factors related to public authority. The public authority related factors contributing to delays in the Debre Merkos Airfied construction project reveal a range of issues with varying levels of impact. The most significant factor is war during the construction of the project (RII = 0.900), which has a very high level of contribution due to its disruptive nature, causing widespread damage, resource shortages, and halting of project activities. Escalated inflation (RII = 0.858) and economic change (RII = 0.766) are ranked as average contributors, indicating that fluctuations in the economy, including rising material costs and market instability, also hinder project progress but not to the same degree as war or bureaucratic inefficiencies. Other important factors that causes of delay include difficulty in obtaining permits from public authorities (RII = 0.724) and changes in government regulations and laws (RII = 0.770), which can cause delays through extended approval processes and adjustments to new regulatory frameworks. Political instability (RII = 0.718).Another very high-ranking factor is inefficient bureaucracy at customs offices (RII = 0.540), which significantly slows down the import of materials and equipment, causing delays in project timelines, and shortage of labor (RII = 0.522) are also noted as high or average contributors, showing that factors like a lack of skilled labor and unstable political environments can add further complications to construction projects. Overall, these public authority related factors, particularly those related to political and economic instability, play a significant role in causing delays, affecting project schedules, and contributing to unpredictable challenges during construction.

Table 4.7: Delay factors related to public authority

No.	Public authority related causes of delay	RII	RII Ranking	Level of contribution
1	Escalated Inflation	0.858	2	Very high
2	Economic change	0.766	4	High
3	Difficulty in obtaining permits from public authorities	0.724	5	High
4	Changes in government regulations and laws	0.770	3	High
5	Political instability within the country	0.718	6	High
6	War at the time of the construction of the project	0.900	1	Very high
7	Inefficient bureaucracy at customs offices	0.540	7	Average
8	Shortage of labors	0.522	8	Average

Source: own survey, 2024

4.4.3. Analysis of delay factors related to project team

Table 4.8 presents the results of the survey analysis of delay factors related to public authority. The project-related causes of delay in construction projects show that several factors significantly impact project timelines. The top-ranked cause, improper project planning and scheduling (RII = 0.950), is identified as having a very high level of contribution, highlighting the importance of thorough and realistic planning to ensure projects stay on track. This is closely followed by short and unrealistic contract duration (RII = 0.900), which creates pressure on the project team and can lead to rushed work, ultimately causing delays. Poorly defined scope of work (RII = 0.840) is another major contributor, as unclear project requirements can lead to misunderstandings, scope creep, and rework, all of which extend project timelines. The complexity of project design (RII = 0.816) also ranks high, as intricate designs often require more time for development, approvals, and execution. Inaccuracy in project cost estimation **(**RII = 0.776) is a high-ranking cause of delays as underestimating costs can result in financial shortages, pausing work until additional funds are secured. Lastly, incompetent project teams (RII = 0.562) are an average contributor to delays, as lack of experience or inefficiency within the team can cause slower decision-making, errors, and rework. Overall, the very high-ranking factors, such as planning issues, unrealistic timelines, and scope definition, indicate that effective project management and clear communication are essential in preventing delays.

Table 4.8: Delay factors related to project team

No.	Project team related causes of delay	RII	RII Ranking	Level of contribution
1	Poorly defined scope of work	0.840	3	Very high
2	Improper project planning and scheduling	0.950	1	Very high
3	Short and unrealistic contract duration	0.900	2	Very high
4	Inaccuracy in project cost estimation	0.776	5	High
5	Complexity of project design	0.81	4	Very high

		6		
6	Incompetent project team	0.56 2	6	Average

Source: own survey, 2024

4.4.4. Analysis of delay factors related to contractors

Table 4.9 presents the results of the survey analysis of delay factors related to contractor. The contractor-related causes of delay in the Debre Merkos Airfied construction project reveal a mix of high and very high contributors, highlighting the significant role contractor's play in project timelines. The most prominent cause is rework for mistakes in construction (RII = 0.872), which can result in significant delays as mistakes require correction, often causing disruptions to the schedule. Another high-ranking factor is poor site management and supervision (RII = 0.816), which can lead to inefficiencies, miscommunications, and safety issues that extend project timelines. Inappropriate construction methods (RII = 0.796) and obsolete technology used by contractors (RII = 0.738) also contribute significantly, as these factors can slow down progress, increase costs, and lead to mistakes that require rework. Poor cash flow management (RII = 0.802) is another major issue, as financial difficulties can halt work when contractors are unable to pay workers, purchase materials, or meet other project obligations. On the other hand, difficulties in financing the project (RII = 0.668) and delays in subcontractors' work (RII = 0.626) are rated as very high contributors, showing that lack of funding and issues with subcontractors can severely disrupt project schedules. Additionally, factors like inadequate contractor experience (RII = 0.612) and fraud practices by contractors (RII = 0.720) are significant contributors, affecting the quality and integrity of the work. Lastly, poor project planning (RII = 0.750) also ranks as a very high factor, underlining the importance of clear, well-thought-out plans for timely project execution. Overall, these causes underscore the need for better contractor management, effective planning, and adequate financial resources to minimize delays in construction projects.

Table 4.9: Delay factors related to contractors

No.	Contractor's related causes of delay	RII	RII Ranking	Level of contribution
1	Rework for Mistakes in construction	0.872	1	Very High
2	Difficulties in financing project by contractor	0.668	8	High
3	Inadequate contractor experience	0.612	10	High
4	Inappropriate construction methods	0.796	4	High
5	Poor site management and supervision	0.816	2	Very High
6	Obsolete technology used by contractor	0.738	6	High
7	Delays in sub-contractors work	0.626	9	High
8	Fraud practices by contractor	0.720	7	High
9	Poor project planning	0.750	5	High
10	Poor cash flow management by the contractor	0.802	3	Very High

Source: own survey, 2024

4.4.5. Analysis of delay factors related to consultants

In Table 4.10, the results of survey analysis of factors of consultant related delays are presented. The consultant-related causes of delay involving consultants in the Debre Markos Airfield construction project reflect several key issues that significantly impact project timelines. The top-ranked cause is delay in approving payment certificates by the consultant (RII = 0.772), which can cause major financial disruptions; delaying payments to contractors and subcontractors, and in turn halting progress on-site. Inadequate consultant experience (RII =

0.690) follows closely, suggesting that insufficient expertise or knowledge among consultants can lead to poor decision-making, mismanagement, and delayed responses to issues. Weak supervision by consultants (RII = 0.689) also contributes to delays, as a lack of effective oversight can result in subpar quality control, safety hazards, and inefficiencies during construction. Similarly, delay in approving shop drawings and sample materials (RII = 0.654) shows how the slow review and approval process can cause bottlenecks, particularly when time-sensitive materials or designs need consultant approval before proceeding. Poor contract management by the consultant (RII = 0.608) further exacerbates delays, as ineffective contract oversight can lead to disputes, misunderstandings, and failure to enforce project terms. Lastly, malpractice or unethical practices by consultants (RII = 0.646) also plays a role in delaying projects, as dishonest actions can disrupt progress and damage the working relationship between clients, contractors, and other stakeholders. Overall, these factors highlight the crucial role of consultants in ensuring that construction projects are well-managed, properly supervised, and free from financial and ethical issues that can lead to costly delays.

Table 4.10: Delay factors related to consultants

No.	Consultant's related causes of delay	RII	RII Ranking	Level of contribution
1	Inadequate consultant experience	0.690	2	High
2	Delay in approving shop drawings and sample materials by consultant	0.654	4	High
3	Poor contract management by consultant	0.608	6	High
4	Weak supervision by consultant	0.689	3	High
5	Delay in approving payment certificate by consultant	0.772	1	High
6	Malpractice (unethical practices) by consultant	0.646	5	High

Source: own survey, 2024

4.4.6. Analysis of delay factors related to external parties

Table 4.11 presents the results of the survey analysis of delay factors related to contractor. The external factor-related causes of delay in the Debre Markos Airfield construction project reflect a mix of logistical, legal, and external factors, with significant contributions from various issues.

The top-ranked cause, lack of availability of construction material near the site (RII = 0.870), is a very high contributor, highlighting the logistical challenges faced by contractors when sourcing materials, which can lead to delays in procurement and construction progress. Another very high-ranking factor is unavailability of utilities (road, water, electricity supply, etc.) at the site (RII = 0.540), which severely impacts the ability to carry out construction work, as essential infrastructure needs to be in place before work can proceed. Unrelated public authorities' interference in the process (RII = 0.794) is another significant issue, showing how external interference from government bodies or organizations not directly involved in the project can disrupt progress and cause delays. Unforeseen climate conditions (RII = 0.802), though classified as an average contributor, also affects the construction schedule, particularly in regions with harsh weather patterns that can halt or slow down work. Other notable high-ranking causes include legal disputes between various parties (RII = 0.742), delay in material delivery (RII = 0.642), and changes in material types and specifications during construction (RII = 0.638), all of which contribute to delays by introducing uncertainties and additional requirements. Issues such as inefficient labor (RII = 0.764) and problems with neighborhoods (RII = 0.656) also play significant roles in slowing down progress, often through workforce inefficiencies or conflicts with the surrounding community. Overall, these causes highlight the multifaceted challenges in construction projects, where delays can arise not only from internal project management issues but also from external factors, legal disputes, and infrastructural deficiencies.

Table 4.11: Delay factors related to external parties

No.	External factors related causes of delay	RII	RII Ranking	Level of contribution
1	Legal disputes between various parties	0.742	5	High
2	Delay in material delivery	0.642	7	High
3	Changes in material types and specifications during construction	0.638	8	High
4	Problems with neighborhoods	0.656	6	High
5	Unforeseen climate conditions	0.802	2	Very high
6	Inefficient labor	0.764	4	High

7	Unavailability of utilities (road, water, electric supply, etc.) at the site	0.540	10	Average
8	Shortage of fuel	0.564	9	Average
9	Unrelated public authorities interference in the process	0.794	3	High
10	Lack of availability of construction material near to the site	0.870	1	Very high

Source: own survey, 2024

4.4.7. Ranking of the ten most significant factors that causes construction delays

Table 4.12 reports the ten most significant factors causing delays in construction projects in the Debre Markos Air Field construction project span across various stakeholders, including the project team, contractors, clients, consultants, public authorities, and external factors. The most critical factor is improper planning and scheduling of the project (RII = 0.950), ranked first under the project team's responsibility, highlighting how inadequate planning can lead to significant delays, as it affects every phase of the project. Close behind is war during construction (RII = 0.900), ranked third under public authority-related factors, underscoring the severe impact that political instability and conflict can have on project timelines. Rework for mistakes in construction (RII = 0.872), a contractor-related issue, ranks fourth, showing how errors on-site can disrupt progress and lead to significant delays in completion. Escalated inflation (RII = 0.858), a public authority-related factor, ranks sixth, reflecting how economic fluctuations, especially rising material and labor costs, can create delays and budget overruns. External factors such as unforeseen climate conditions (RII = 0.802) and lack of availability of construction materials near the site **(**RII = 0.870), ranked eighth and fifth respectively, also contribute significantly to delays, as weather conditions and logistical challenges in sourcing materials can halt work or extend timelines.

Client-related issues, particularly the change of orders by the client during construction (RII = 0.940), ranked second, also play a critical role in disrupting the construction schedule, as mid-project changes require adjustments to plans and resources. Delay in approving shop drawings and sample materials by the consultant (RII = 0.772) and poor cash flow management by the contractor (RII = 0.802) round out the top ten, both contributing to delays through inefficiencies in approval processes and financial management. Overall, these factors reflect the complex interplay between planning, external conditions, stakeholder management, and economic influences, all of which must be carefully managed to avoid project delays in the construction of Debre Markos Airfield construction project.

Table 4.12: Combined Delay factors (Ten most significant factors causing delays)

No.	Ten most significant factors causing delays	RII	RII Ranking	Level of contribution
1	Improper planning and scheduling of project	0.950	1	Project team's related
2	War at the time of the construction of the project	0.900	3	Public authority's related
3	Rework for Mistakes in construction	0.872	4	Contractor's related
4	Escalated Inflation	0.858	6	Public authority's related
5	Unforeseen climate conditions	0.802	8	External factors related
6	Poor site management and supervision	0.816	7	Contractor's related
7	Lack of availability of construction material near to the site	0.870	5	External factors related
8	Change of orders by client during construction	0.940	2	Client related
9	Delay in approving shop drawings and sample materials by consultant	0.772	10	Consultant's related
10	Poor cash flow management by the	0.80	8	Contractor's related

contractor	2	

Source: own survey, 2024

4.5. Correlation Analysis

The Pearson correlation analysis in Table 4.13 reveals significant interrelationships between various factors contributing to project delays in the Debre Markos Air feild construction project. The primary objective of correlation analysis is to measure the strength or degree of linear association. In this part of the analysis, the study used bivariate correlation to measure the relationship between the dependent variables (customer satisfaction) and independent variables (convenience, reliability, easy to use, fulfilment and security of ATM banking service). The value ranges from 1 to -1 where 1 indicates a strong positive correlation and a -1 indicates a strong negative correlation and a zero indicates lack of relationship between the two variables. The closer the correlation tends to zero the weaker it becomes. For the rest of the values is a small correlation for value 0.1 to 0.29, medium correlation of 0.3 to 0.49, and high correlation for 0.50 to 1.0.

The results indicate a positive and significant relationship between client-related, public authority-related, project team-related, contractor-related, consultant-related, external factor-related, and project delays, all at the 1% significance level ($p<0.01$). The highest correlation (0.875**) is observed with project team-related delays, highlighting issues such as coordination and communication within the team as major contributors. Contractor-related delays (0.819**) and public authority-related delays (0.857**) also show strong correlations, pointing to contractor performance and bureaucratic inefficiencies as key factors. External factors (0.813**) such as weather and economic conditions also significantly influence delays. Client-related delays (0.597**) and consultant-related delays (0.674**) have moderate correlations, suggesting that changes in scope, decision delays, or miscommunication with consultants also impact project timelines. All correlations are statistically significant ($p<0.01$), suggesting that the identified factors are strongly and consistently linked to project delays.

Table 4.13: Correlation

		Project Delay
Client related	Pearson Correlation	.597**
	Sig. (2-tailed)	.000

Public authority related	Pearson Correlation	.857**
	Sig. (2-tailed)	.000
Project team related	Pearson Correlation	.875**
	Sig. (2-tailed)	.000
Contractor related	Pearson Correlation	.819**
	Sig. (2-tailed)	.000
External factor related	Pearson Correlation	.813**
	Sig. (2-tailed)	.000
Consultant related	Pearson Correlation	.674**
	Sig. (2-tailed)	.000
	N	100

**. Correlation is significant at the 0.01 level (2-tailed).

Source: own computation, 2024

4.6. Multiple Regression Analysis

In this study, multiple regression analysis using the ordinary least squares method was applied to identify the factors influencing the delay in the construction of the Debre Markos Airfield project. The results are presented in Tables 4.14 through 4.16.The study conducted several post-estimation tests to assess the reliability of the model, including tests for overall significance, multicollinearity, heteroskedasticity, and normality. The results from these tests indicate that there are no serious issues with the model. Specifically, the tests for multicollinearity and heteroskedasticity showed no significant problems, and the normality test confirmed that the residuals are approximately normally distributed. As a result, the data fits the model reasonably well, allowing for the interpretation of the results with confidence. Therefore, the findings are considered reliable and robust.

Table 4.14 reveals that the regression model has a very strong fit. The R^2 value of 0.889 indicates that approximately 89% of the variance in the dependent variable, project delay, is explained by the independent variables in the model, which include Client, Public Authority, Project Team, Consultant, Contractor, and External-related Factors. This suggests a high level of explanatory power, meaning that the independent variables collectively account for most of the variability in project delay. In Table 4.14, the F-statistic of 124.17(p =0.000) indicate that the independent variables (Client, Public Authority, Project Team, Consultant, Contractor, and External-related Factors) together significantly explain the variation in project delay in the construction of Debre Markos Airfield project. This means the model as a whole is effective in predicting project delays.

The regression results in Table 4.14 reveal the significant determinants of project delay in the Debre Markos Airfield construction project. Among the independent variables, Client-related factors, Public authority-related factors, Project team-related factors, Contractor-related factors, and External factors all have a statistically significant effect on project delay, with p-values well below the 5% threshold, and Consultant-related factors have a statistically significant effect on project delay at 10% level of significance, indicating that these factors are key contributors to delays in the project. These results highlight that Client, Public Authority, Project Team, Contractor, consultant and External related factors are the most significant drivers of delays in the construction of the Debre Markos Airfield.

Table 4.14: Linear regression

Project delay	**Coef.**	**St.Err.**	**t-value**	**p-value**
Client related	.141	.046	3.08	.003***
Public authority related	.284	.065	4.36	.000***
Project team related	.243	.077	3.15	.002***
Contractor related	.213	.068	3.13	.002***
Consultant related	.087	.052	1.66	.100*
External related	.216	.063	3.45	.001***
Constant	.252	.16	1.57	.120
R-squared	0.889	Number of obs	100	
F-test	124.168	Prob > F	0.000	

**** p<.01, ** p<.05, * p<.1*

Source: Own estimation, 2024

4.6.1. Hypothesis Testing

Six hypotheses were formulated to operationalize and clearly articulate the problem under consideration. The hypothesis test results in Table 4.15 indicate that all the factors tested have a statistically significant effect on the delay of the Debre Markos Airfield construction project. Specifically, client-related, public authority-related, project team-related, contractor-related, and external-related factors have p-values less than 5%, confirming their significant effect on project delays. In addition, consultant related factors have a significant effect on project delays at 10% level of significance. Therefore, all hypotheses are accepted.

Table 4.15: Hypothesis Test

Hypothesis	Statement of hypothesis	P-value	Decision
HA1	Client related factors has a significant effect on the delay of airfield construction project	.003	Accepted
HA2	Public authority related factors has a significant effect on the delay of airfield construction project	.000	Accepted
HA3	Project team related factors has a significant effect on the delay of airfield construction project	.002	Accepted
HA4	Contractor related factors has a significant effect on the delay of airfield construction project	.002	Accepted
HA5	Consultant related factors has a significant effect on the delay of airfield construction project	.100	Accepted
HA6	External factor related factors has a significant effect on the delay of airfield construction project	.001	Accepted

Source: own estimation, 2024

4.6.2. Post estimation tests

4.6.2.1. Multicollinearity Test

In this study, the Variance Inflation Factor (VIF) test was used to assess the potential presence of multicollinearity among the independent variables. The decision rule is based on the mean VIF value of all predictor variables in the regression model. According to Gujarati (2004), if the mean VIF is less than 10, it is generally accepted that multicollinearity is not a serious issue. The results of the study show that the mean VIF value is 2.87, which is well below the threshold of 10. Therefore, this confirms that there is no significant multicollinearity problem among the predictor variables. The detailed results are presented in Table 4.16.

Table 4.16: Multicollinearity Test

Variables	**VIF**	**1/VIF**
Client related	1.50	0.665040
Pubic authority related	3.44	0.290324
Project team related	4.46	0.224445
Contractor related	2.98	0.335210
Consultant related	1.99	0.502257
External factor	2.86	0.349507
Mean VIF	**2.87**	

Source: own estimation, 2024

4.6.2.2. Heteroskedasticity Test

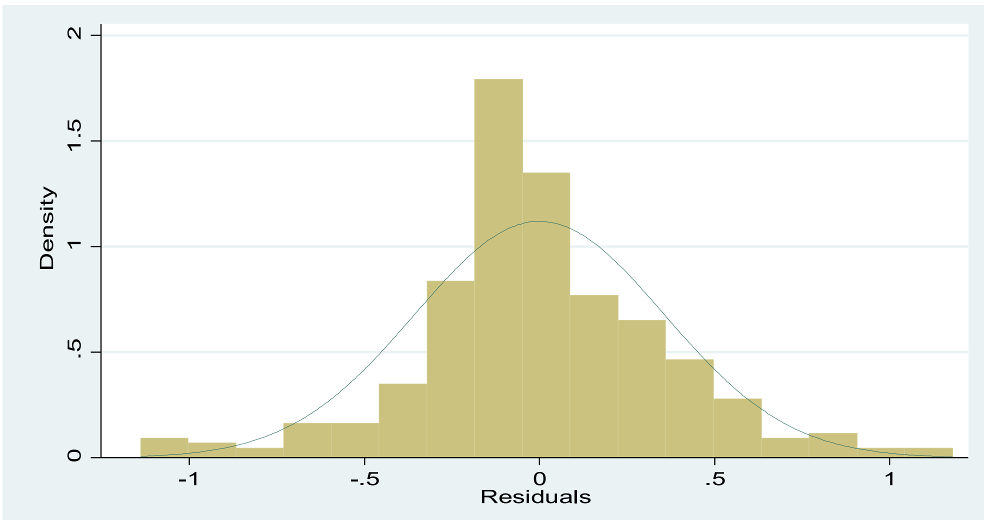
The Breusch-Pagan or Cook-Weisberg test for heteroskedasticity was conducted to examine whether heteroskedasticity is a problem in this study. The results indicate that there is no significant heteroskedasticity issue, as the null hypothesis was not rejected, with a p-value of 0.5109 (Prob > chi^2 = 0.5109). Therefore, the test confirms that the regression results are both consistent and valid, with no evidence of heteroskedasticity in the model. The detailed test results are presented below.

```
. hettest

Breusch-Pagan / Cook-Weisberg test for heteroskedasticity
         Ho: Constant variance
         Variables: fitted values of delay

         chi2(1)      =     0.43
         Prob > chi2  =   0.5109
```

4.6.2.3. Normality Test

A normality test of the residuals was conducted to assess the predictive accuracy of the model. The test was performed with the null hypothesis of non-normality against the alternative hypothesis of normality. To check this assumption, a histogram was used, which is presented in Figure 4.2 below. The histogram shows that the residuals from the model are approximately normally distributed, indicating that the model fits the data well and that the assumption of normality holds.

Figure 4.2: Normality test



Source: own computation, 2024

4.7. Discussion of Regression Results

This section discusses the findings of the statistical analysis in relation to the previous researches. The results of the study show that Client-related, Public authority-related, Project team-related, Contractor-related, Consultant related and External-related factors are all significant contributors to project delay of Debre Markos Airfield. Specifically, client-related factors have a significant positive effect on project delay, with an unstandardized coefficient of 0.141 ($p = 0.003$), meaning that for each unit increase in client-related issues, project delay increases by 0.141 units, indicating that client-related factors, such as changes in project orders, delays in decision-making or payments, and suspension of work, are significant contributors to delays in the construction project. These issues disrupt the construction process, directly impacting the timeline and causing overall project delays. This result is similar with the works of

Koshe and Jha (2016), Mohammed (2019), Fashina et al. (2021), Habtemariam (2022), Demissew and Abiy (2023), Tola (2024) and Shedaga *et al*. (2024).

There is a positive relationship between public authority-related factors and project delay, as these factors significantly contribute to delays in construction. The unstandardized coefficient of 0.284 ($p < 0.000$) indicates that for every unit increase in public authority-related issues such as delays in permits, regulatory challenges, or changes in laws and inflation increases project delay by 0.284 units. This highlights the critical role that government and regulatory bodies play in either facilitating or hindering the timely completion of construction projects. This result is similar with the works of Koshe and Jha (2016), Mohammed (2019), Fashina *et al*. (2021), Habtemariam (2022), Demissew and Abiy (2023), Tola (2024) and Shedaga *et al*. (2024).

The positive relationship between project team-related factors and project delay is evident in the significant impact these factors have on the overall timeline. With an unstandardized coefficient of 0.244 ($p = 0.002$), this suggests that for every unit increase in project team-related issues such as poor communication, lack of coordination, inaccurate planning, or resource shortages increases project delay by 0.244 units. In other words, inefficiencies, errors, or mismanagement within the project team can lead to setbacks, rework, and delays, making the team's performance a crucial determinant of the overall project timeline. The more challenges the project team faces in terms of planning, execution, or communication, the more likely the project will experience delays. This result is similar with the works of Koshe and Jha (2016), Mohammed (2019), Fashina et al. (2021), Habtemariam (2022), Demissew and Abiy (2023), Tola (2024) and Shedaga et al. (2024).

The positive relationship between contractor-related factors and project delay is evident from the unstandardized coefficient of 0.212 ($p = 0.002$), indicating that issues related to the contractor's performance significantly contribute to project delays. For each unit increase in contractor-related problems, such as slow work pace, insufficient labor, poor-quality construction, or financial difficulties, project delays increase by 0.212 units. In other words, if the contractor faces challenges such as delays in work completion, resource shortages, or low-quality output, the project is likely to experience setbacks, making the contractor's performance a critical determinant of whether the project is completed on time. These factors highlight the essential role of the contractor in ensuring the timely execution of a construction project. This result is similar with the works ofKoshe and Jha (2016), Mohammed (2019), Fashina et al. (2021), Habtemariam (2022), Demissew and Abiy (2023), Tola (2024) and Shedaga et al. (2024).

The positive relationship between consultant-related factors and project delay is indicated by the unstandardized coefficient of 0.087 ($p = 0.100$), meaning that issues related to the consultant such as inadequate advice, delays in providing necessary documentation, or poor decision-making contribute to project delays at 10% level of significance. This suggests that, despite being smaller in magnitude than other factors (such as client or contractor-related issues), consultant-related delays still have a meaningful influence on the project implementation timeline. The statistical significance implies that these factors whether related to slow approvals, poor technical advice, or delays in issuing necessary documents are not random and do, in fact, contribute to delays in the construction process. Therefore, consultant-related factors are important contributors to the overall project delay, and their role should not be overlooked when addressing causes of delays. This result is similar with the works of Koshe and Jha (2016), Mohammed (2019), Fashina et al. (2021), Habtemariam (2022), Demissew and Abiy (2023), Tola (2024) and Shedaga et al. (2024).

Lastly, external-related factors exhibit a positive relationship with project delay due to the significant impact that factors such as unforeseen environmental conditions, political events, economic shifts, and external logistical issues can have on the construction process. These factors are often beyond the control of the project stakeholders, making them difficult to predict or mitigate. The unstandardized coefficient of 0.215 ($p = 0.001$) indicates that for each unit increase in external-related issues, such as supply chain disruptions, legal disputes, or unexpected weather conditions, the project delay increases by 0.215 units. This confirms that external influences such as unnecessary public authority's interference in the process, political instability, unforeseen climate conditions, legal disputes, and shortages of critical materials or labor are substantial contributors to delays in the construction process. The strength and significance of this relationship underscore the importance of accounting for and preparing for these unpredictable external variables during project planning and execution. This result is similar with the works of Koshe and Jha (2016), Mohammed (2019), Fashina *et al*. (2021), Habtemariam (2022), Demissew and Abiy (2023), Tola (2024) and Shedaga *et al*. (2024).

CHAPTER FIVE

CONCLUSION AND POLICY RECOMMENDATIONS

This chapter provides conclusions and recommendations of the research undertaken in the study. For clarity purposes the conclusions were made based on the research objectives of the study. The general explanations of the findings were discussed and recommendations were drawn from the conclusions of the research. Finally, the study shows some limitation of the study and provides directions for future researches.

5.1. Conclusion

This study examined the significant factors influencing construction project delays in the context of the Debre Markos Airfield construction project. Primary data were collected from 30 clients, 50 contractors, and 20 consultants through structured questionnaires administered in person. Both descriptive and econometric methods were used for data analysis, and the internal consistency of the factors influencing project delays was tested using Cronbach's alpha. Various post-estimation tests were also conducted to assess the reliability and validity of the regression model. The study's findings can be summarized as follows:

First, the descriptive analysis revealed that the most critical delays in the Debre Markos Airfield project stem from failures to deliver on time, cost overruns, unnecessary project extensions, and work suspensions. These issues point to systemic problems in planning, scheduling, and financial management, underscoring the need for better project coordination to ensure timely and cost-effective completion.

Second, the study identified the top delay factors, which involve multiple stakeholders. The most significant contributors include improper planning and scheduling by the project team, war during construction, and client-related changes, such as modifications in orders. Other key factors are rework due to mistakes made by contractors, escalated inflation affecting material and labor costs, and delays in approving shop drawings and materials by consultants. Additionally, external factors, such as unforeseen climate conditions, material shortages, and poor cash flow management by contractors, also significantly disrupt the project timeline.

Third, the correlation analysis confirmed a strong and statistically significant relationship between various factors such as client-related, public authority-related, project team-related, contractor-related, consultant-related, and external-related with project delays in the Debre Markos Airfield construction project.

Finally, regression analysis showed that all these factors such as client-related, public authority-related, project team-related, contractor-related, consultant-related, and external-related factors significantly contributes to project delays. Specifically, client-related factors like changes in orders and decision delays, public authority-related factors such as regulatory hurdles and inflation, contractor-related issues like poor performance and resource shortages, consultant-related delays such as slow approvals, and external factors like weather disruptions and legal disputes all play a substantial role in delaying the project.

5.2. Policy Recommendations

The findings of this study underscore the importance of addressing key factors that contribute to construction project delays at the Debre Markos Airfield. The following policy recommendations are forwarded for clients, contractors, and consultants to help mitigate these delays and improve project performance:

- Clients should streamline decision-making, fast-track approvals, and minimize scope changes during construction to avoid disruptions and delays. Clear communication and realistic project definitions are key to reducing rework and managing change orders efficiently.
- Contractors must focus on robust planning, timely resource allocation, and effective cash flow management. Strong quality control processes and workforce training will help minimize errors and rework, preventing delays.

- Consultants should expedite approvals for shop drawings, materials, and design changes while providing proactive technical advice. Clear communication and timely interventions can prevent delays in decision-making and design execution.
- Project Teams must ensure effective coordination and communication across all stakeholders to avoid misunderstandings and delays.
- Public Authorities should streamline permitting and approval processes to reduce bureaucratic delays and ensure timely project progression.
- External Factors can be mitigated through contingency planning, flexible scheduling, and proactive risk management to address unpredictable events such as weather, economic shifts, or supply chain disruptions.

By implementing these strategies, all stakeholders can reduce delays, improve project outcomes, and enhance the efficiency of the construction process.

5.3. Area for Future Research

This study, however, it is important to note that this research is focused on a single construction project in one district, so future studies should aim to expand the scope by considering multiple projects across different regions and sectors for more generalizable findings. Future research could also explore several areas to further improve construction project outcomes. First, investigating the impact of technological advancements like Building Information Modeling (BIM) and advanced project management tools on reducing delays could offer valuable insights. Additionally, studying the long-term effects of delays on project outcomes, such as financial implications and operational efficiency, would deepen understanding of delay consequences. These areas could provide actionable strategies for enhancing project efficiency and reducing delays in future construction endeavors.

REFERENCES

A.A Aibinu, G.O Jagboro, (2002). The effects of construction delays on project delivery in Nigerian construction industry.*International Journal of Project Management, 20* (8): 593-599.

Abdl-Razek, M. E., Salem, O. M., & Khalil, M. (2008). Causes of delay in construction projects in Egypt. *International Journal of Project Management, 26*(3), 245-254.

AbdoAbatemam, (2006).Delays in public building construction projects and their consequences.MSc thesis, Addis Ababa Institute of Technology.

Abdurezak Mohammed Kuhil and NewaySeifu, (2019). Causes of Delay in Public Building Construction Projects: A Case of Addis Abeba Administration, Ethiopia. *Asian Journal of Managerial Science.*

Abebe, S., and Kote, S. (2018).*Regulatory Challenges and Environmental Compliance in Ethiopian Construction Projects*. Journal of Construction Management, 15(3), 45-58.

Africa, J. K., and Sachs, N. A. (2016). Book Review: Biophilic design: The theory, science and practice of bringing buildings to life. *HERD: Health Environments Research & Design Journal*, *9*(2), 176.

Aibinu, A. A., & Jagboro, G. O. (2002). The effects of construction delays on project delivery in Nigeria. *International Journal of Project Management, 20*(8), 567-574.

Aibinu, A. A., and Jagboro, G. O. (2002).The effects of construction delays on project delivery in Nigerian construction industry.*International journal of project management*, *20*(8), 593-599.

Alex Casteel Nancy L. Bridie. (2021). Describing Populations and Samples in Doctoral Student Research, *International Journal of Doctorial studies*, Grand Canyon University, Phoenix, AZ, USA.

Alkass, S. (n.d.). *Concurrent delays in construction projects*. Retrieved from [website URL].

Alkass, S., Mazerolle, M., & Harris, J. (1996). A simulation model for the management of construction project delays. *Construction Management and Economics*, 14(5), 471-482.

Allen, I.E., and Seaman, C.A., (2007). Likert scales and data analyses. Qual. Prog.

Al-Momani, A. H. (2000). Construction Delay: a Quantitative Analysis. *Journal of Project Management, journals.sagepub.com*

Al-Momani, A. H. (2000). *Construction Delay: A Quantitative Analysis*. International Journal of Project Management, 18(1), 51-59.

Al-Najjar, J. M. (2008). Factors influencing time and cost overruns on construction projects in the Gaza Strip.Master thesis, Islamic University, Gaza.

Ar. Meena. V and Ar. K. Suresh Babu. (2015). Study on Time Delay Analysis for Construction Project Delay Analysis, *International Journal of Engineering Research & Technology (IJERT), www.ijert.org.*

Asfaw, A., and Belayneh, T. (2019).*Political Instability and Its Impact on Construction Projects in Ethiopia*. Ethiopian Journal of Development Studies, 17(2), 34-50.

Assaf, S. A., & Al-Hejji, S. (2006). Causes of delay in large construction projects. *International Journal of Project Management, 24*(4), 349-357.

Assaf, S. and Al-Heiji, K. (2006).Causes of Delays in Large Construction Projects.*International Journal of Project Management.* 24. 349 -357

Bennett, J. (2003). *Construction Project Management: A Practical Guide for Building and Electrical Contractors*. Wiley-Blackwell.

Bolton, J. (1990). „Type of Claims‟, Construction and Disruption Claims, Course Manual, Portman Inter Continental.

BorhanGhasemzadeh. (2014). Investigating Causes of Delays in Iranian Construction Industry According to Project Delivery Methods. MSc Thesis, Eastern Mediterranean University.

Braimah, N. (2008). Delays in construction projects: Causes and classification. *Journal of Construction Engineering and Management, 134*(4), 331-340.

BraimahNuhu. (2008). Factors Influencing the Selection of Delay Analysis Methodologies.*International Journal of Project Management.*

Callahan, M., Murphy, J., & Dierks, W. (1992). *Project management and construction delays: An overview*. ASCE Publications.

Chan, D. W. M., & Kumaraswamy, M. M. (1997). A comparative study of causes of time overruns in Hong Kong construction projects. *International Journal of Project Management, 15*(1), 55-63.

Chan, D. W. M., & Kumaraswamy, M. M. (2002). A study of the factors affecting the construction duration in Hong Kong. *Construction Management and Economics, 20*(4), 317-327.

Chan, D. W. M., & Kumaraswamy, M. M. (2002). A study of the factors affecting construction duration in Hong Kong. *Construction Management and Economics*, 20(5), 437–449.

Chartered Institute of Building. (2002). *Construction Project Management: A Practical Guide to the Successful Management of Complex Construction Projects*. Wiley-Blackwell.

Cobb, A. (2012). *The Project Management Lifecycle: A Complete Guide to the Critical Stages of Managing a Project*. Wiley.

Construction Projects. In *Proc. Conf. on the Research in Communication, Computation, Electrical Science and Structures (NCRACCESS-2015)* (pp. 47-53).

Creswell, J. W. (2014). Research design: Qualitative, quantitative, and mixed methods approaches *(4th ed.). SAGE Publications.*

Debre Markos City Communication Office. (2023). *Regional Infrastructure Development: The Role of Debre Markos Airfield*. Debre Markos City Government.

Demissew, A., & Abiy, F. (2023). Causes and Impacts of Delays in Ethiopian Public Construction Projects (Case on Debre Markos University Construction Projects). *Advances in Civil Engineering*, *2023*(1), 6577676.

Divya, R., and Ramya, S. (2015). Causes, Effects and Minimization of Delays in

Ethiopian Airports. (2024). *Debre Markos Airfield Construction Progress Report*. Ethiopian Airports Authority. Retrieved from www.ethiopianairports.com.

Ethiopian Construction Works Corporation. (2024). *Project Completion Report for Debre Markos Airfield*. Ethiopian Construction Works Corporation.

Ethiopian Ministry of Transport. (2022). *Infrastructure Development Strategy and Transportation Plan in Ethiopia: Focus on Regional Connectivity*. Ministry of Transport of Ethiopia. Retrieved from www.mot.gov.et.

Fashina, A. A., Omar, M. A., Sheikh, A. A., & Fakunle, F. F. (2021). Exploring the significant factors that influence delays in construction projects in Hargeisa. *Heliyon*, *7*(4).

Gould, F. E., & Joyce, N. (2003). *Construction Project Management: Principles and Practice*. Prentice Hall.

Habtemariam, S. (2022). *Factors Contributing the Dealy of Construction Projects: The Case of Plan International* (Thesis, ST. MARY'S UNIVERSITY).

Jekale, S. (2004). *Construction Project Management: Principles and Practice*. Pearson Education.

Kaming, P., Olomolaiye, P. O., & Holt, G. D. (1997). Factors influencing construction time and cost in Indonesia. *Construction Management and Economics*, 15(1), 15-26.

Koshe, W., & Jha, K. N. (2016). Investigating causes of construction delay in Ethiopian construction industries. *Journal of Civil, Construction and Environmental Engineering*, *1*(1), 18-29.

Leary, M. R., & Bramble, B. (1988). *Construction Delay Claims*. Wiley.

Leary, M., & Bramble, B. (1988). *Construction delays: Understanding them and managing them*. McGraw-Hill.

Le-Hoai, Long and Lee, Young and Lee, Jun-Yong. (2008). Delay and Cost Overruns in Vietnam Large Construction Projects: A Comparison with Other Selected Countries. *KSCE Journal of Civil Engineering.*

Lock, D. (2007). *Project Management: A Practical Handbook*. Routledge.

Maylor, H. (1999). *Project Management*. Pearson Education.

Mohammed, K. (2019). *Assessment on Factors that Cause Project Delay: The Case of Addis Ababa Islamic Affairs Supreme Council* (Thesis, St. Mary's University).

MollayeTakeleAbebe. (2020). Study on Investigating Causes and Effects of Delay in Addis Ababa 40/60 Housing Construction: A Case Study on Some Selected Project Sites, MSc thesis, Addis Ababa Institute of Technology.

NesruSeraniDusso and TadeleWodajeBayeh. (2020). The Causes and Effects of Delay of Building Construction in Ethiopia, Southern Nation Nationalities of People Region in Gurage Zone (Case of Wolkite Town). International Institute for Science, Technology and Education (IISTE) E-Journal.

Peter Neary. (2009). Trade costs and foreign direct investment.International Review of Economics & Finance.*18*(2).207-218.

PMI (Project Management Institute). (2007). *A Guide to the Project Management Body of Knowledge (PMBOK® Guide)* (4th ed.). PMI.

PMI (Project Management Institute). (2017). *A Guide to the Project Management Body of Knowledge (PMBOK® Guide)* (6th ed.). PMI.

Sambasivan, M., & Soon, Y. W. (2007). Causes and effects of delays in Malaysian construction industry. *International Journal of Project Management, 25*(5), 517-526.

Shedaga, T., Sahle, M., & Mekonen, E. (2024). Determinants of Construction Project Delay and Its Effect on Project Beneficiaries: Evidence from Gurage Zone, Ethiopia.

Theodore, M. (2009). *Construction Delays: Understanding the Types and Causes of Delays in Construction Projects*. Wiley.

Tola, E. (2024). Assessment of Causes and Effects of Delay in the Case of Arba Rakati-Michata Road Project. *Engineering Future Sustainability*, *1*(3).

Trauner, J., & Theodore, A. (2005). *Construction delays: Understanding them and managing them*. McGraw-Hill Professional Publishing.

Trauner, T. A., & Theodore, M. (2005). *Construction delays: Causes and remedies*. Wiley.

Trauner, T. A., & Theodore, M. (2009). *Construction Delay Claims and Avoidance*. Wiley.

Tsegaye, T. (2017). *Managing Construction Projects: Complexity and Coordination in Construction*. Oxford University Press.

Tumi, S., Abd El-Rahman, M., & Mabrouk, N. (2009). Factors contributing to delays in construction projects in Libya. *Journal of Construction Engineering and Management, 135*(9), 1-11.

Wellman, P. (2011). *Project Management: A Strategic Approach*. McGraw-Hill.

World Bank. (2020). *Ethiopia: Infrastructure and Economic Development*. The World Bank Group. Retrieved from www.worldbank.org.

Yogeswaran, V., Preece, C., & Smith, R. (1996). A study of the impact of concurrent delays on construction projects. *International Journal of Project Management*, 14(4), 251-257.

APPENDIX

Questionnaire

Debre Markos University

College of Business and Economics

Department of Management: Post graduate program

This questionnaire is designed specifically to carry out a research to assess the determinant factors causing project delay in case of Debre Markos airfield construction project, Ethiopia. This questionnaire aims to gather insights from stakeholders involved in the Debre Markos air field construction project. Your response will help identify key factors contributing to project delay. Here I kindly request you to attempt all the questions in the questionnaire to meet the aim of the study. Whatever information is provided it will be treated with utmost confidentiality and strictly will be used for academic purpose only.

General Instructions

- Your participation is voluntary.
- You are kindly requested to give genuine responses.
- You don't need to write your identification like name and cell phone.
- Please simply tick (✓) on the appropriate box or give an explanation to open ended questions

I thank you in advance *for your kind cooperation!!!*

Section 1: respondent information

1. Name (optional)……………………………………….
2. Gender……………………………………………..

3. Education…………………………………….
4. Position ………………………………………………
5. Year of experience………………………………

6.what is the current status of debre markos air field construction project?

………………………………………………………………………..

Section 2: project delay and determinant factors

The following factors are expected to have a contribution for the delay of Debre Markos air field construction project implementation. Based on your Observation, please rate the degree of contribution of each factor.

Section	No	Delay factors	Very low (1)	Low (2)	Average (3)	High (4)	Very high (5)
Client's Related Delay Factors	1	Change of orders by client during construction					
	2	Delay in progress payment by client					
	3	Slow decision making process by client					
	4	Suspension of work by the client					
	5	Right of issue					
Public Authority's Related Delay Factors	6	Escalated Inflation					
	7	Economic change					
	8	Difficulty in obtaining permits from public authorities					
	9	Changes in government regulations and laws					
	10	Political instability within the country					
	11	War at the time of the construction of the project					
	12	Inefficient bureaucracy at customs offices					
	13	Shortage of labors					
Project Team's Related	14	Poorly defined scope of work					
	15	Improper project planning and scheduling					
	16	Short and unrealistic contract duration					
	17	Inaccuracy in project cost estimation					
	18	Complexity of project design					
	19	Incompetent project team					
Contractor's Related	20	Rework for Mistakes in construction					
	21	Difficulties in financing project by					

		contractor					
	22	Inadequate contractor experience					
	23	Inappropriate construction methods					
	24	Poor site management and supervision					
	25	Obsolete technology used by contractor					
	26	Delays in sub-contractors work					
	27	Fraud practices by contractor					
	28	Poor project planning					
	29	Poor cash flow management by the contractor					
Consultant's Related	30	Inadequate consultant experience					
	31	Delay in approving shop drawings and sample materials by consultant					
	32	Poor contract management by consultant					
	33	Weak supervision by consultant					
	34	Delay in approving payment certificate by consultant					
	35	Malpractice (unethical practices) by consultant					
External Parties Related	36	Legal disputes between various parties					
	37	Delay in material delivery					
	38	Changes in material types and specifications during construction					
	39	Problems with neighborhoods					
	40	Unforeseen climate conditions					
	41	Inefficient labor					
	42	Unavailability of utilities (road, water, electric supply, etc.) at the site					
	43	Shortage of fuel					
	44	Unrelated public authorities interference in the process					
	45	Lack of availability of construction material near to the site					
Project Delay Indicators	1	Project outputs are not delivered to the owners on time					
	2	Projects are unnecessarily extended					
	3	Projects are incurring more costs than the budget					
	4	Suspension of project work					
	5	Overall the project implemented in the study area is delayed					

Thanks for your cooperation!!!

```
. reg projectdelay clientrelated publicauthorityrelated projectteamrelated contractorrelated c
> lrelated
```

Source	SS	df	MS
Model	47.3282171	6	7.88803619
Residual	5.90804185	93	.063527332
Total	53.236259	99	.53773999

Number of obs	=	100
F(6, 93)	=	124.17
Prob > F	=	0.0000
R-squared	=	0.8890
Adj R-squared	=	0.8819
Root MSE	=	.25205

projectdelay	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
clientrelated	.1409387	.0457741	3.08	0.003	.0500403	.231837
publicauthorityrelated	.2840307	.0650894	4.36	0.000	.154776	.4132853
projectteamrelated	.2433933	.0773478	3.15	0.002	.089796	.3969907
contractorrelated	.2129035	.0681188	3.13	0.002	.0776331	.3481739
consultantrelated	.0867153	.0521409	1.66	0.100	-.0168262	.1902567
externalrelated	.2155342	.0625515	3.45	0.001	.0913194	.339749
_cons	.2518428	.1602747	1.57	0.120	-.066431	.5701166

```
. vif
```

Variable	VIF	1/VIF
projecttea~d	4.46	0.224445
publicauth~d	3.44	0.290324
contractor~d	2.98	0.335210
externalre~d	2.86	0.349507
consultant~d	1.99	0.502257
clientrela~d	1.50	0.665040
Mean VIF	2.87	

```
. hettest

Breusch-Pagan / Cook-Weisberg test for heteroskedasticity
         Ho: Constant variance
         Variables: fitted values of delay

         chi2(1)      =     0.43
         Prob > chi2  =   0.5109
```