

ADDIS ABABA UNIVERSITY



COLLEGE OF BUSINESS AND ECONOMICS SCHOOL OF COMMERCE

Factors Affecting the Quality of Large-Scale Infrastructure Project: *The Case of Addis Ababa Bole International Airport Expansion Project.*

MA Final Year Project Work

By: Girum Worke

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

JUNE, 2024

ADDIS ABABA, ETHIOPIA

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Project.***

By: Girum Worke

Advisor: Dr. Solomon Markos

**A Project Work Submitted to the School of Commerce in Partial
Fulfillment of the
Requirements for the Degree of Master of Science in Project
management (MAPM)**

June, 2024

Addis Ababa, Ethiopia

DECLARATION

I solemnly affirm that the project work titled “Factors affecting the Quality of large-scale infrastructure project. *The case of Addis Ababa Bole International Airport Expansion Project*” is the result of my own research conducted under the mentorship of Dr. Solomon Markos. This project work is an original work and has not been presented for the attainment of any degree or diploma in any other university or academic establishment.

Researcher name

Signature

Date

Girum Worke

CERTIFICATE

This is to certify that the project work titled “Factors affecting the Quality of large-scale infrastructure project. *The case of Addis Ababa Bole International Airport Expansion Project*” submitted to AAUSOC for the award of the degree of Master of Art in Project Management (MA), is a record of original research work carried out by Mr. Girum Worke under our guidance and supervision. Therefore, we hereby declare that no part of this project work has been submitted to any other university or institution for the award of any degree or diploma.

Advisor: Dr. Solomon Markos Sign. _____ Date: _____

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External Examiner: Dr. Shikur Ahmed Sign. _____ Date: _____

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ACKNOWLEDGMENTS

I extend my heartfelt thanks to everyone who contributed to the success of this research. I am particularly indebted to my academic advisor, Dr. Solomon Markos, whose insightful suggestions played a crucial role in both the execution of my project and the composition of this research.

My sincere appreciation is also directed toward the team members involved in the Addis Ababa Bole International Airport expansion project for their valuable and informative feedback.

Lastly, I express my gratitude to the Addis Ababa University School of Commerce for providing an environment conducive to scholarly research.

Girum Worke

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ABSTRACT

This research paper aims to investigate the factors influencing the quality of large-scale infrastructure construction projects at Addis Ababa Bole International Airport during its expansion. The study utilized both descriptive and explanatory research design with quantitative approach. The target population includes 85 stakeholders such as contractors, consultants, and clients. Descriptive and inferential statistics were used for data analysis, with a focus on summarizing and exploring relationships between variables. Data analysis uncovered three key determinants of quality in large-scale infrastructure projects: labor performance, contract administration, and project management practices. Notably, project management practices emerged as the most influential factor on project quality, with labor performance and contract administration also playing significant roles. The research offers practical recommendations for advancing the quality of large infrastructure endeavors such as the Addis Ababa Bole International Airport expansion, as well as the broader Ethiopian construction sector. This study enriches the body of knowledge in construction quality management and delivers pertinent insights for industry professionals and decision-makers.

Key Words: *Quality management, Large-scale infrastructure projects, Addis Ababa Bole International Airport expansion project*

CHAPTER ONE

INTRODUCTION

1.1. Background of the study

Quality in a construction projects is a paramount goal for all involved parties (Ofori, 2006). It encompasses meeting predefined specifications and standards agreed upon by stakeholders. Quality is further defined as the comprehensive set of features and attributes within the production process that impact its capability to meet stated requirements or suitability (Aoieong et al., 2002). Nevertheless, achieving this standard has proven to be exceptionally challenging in practice, as noted by Jha and Iyer (2005).

Large-scale infrastructure projects play a crucial role in driving economic growth, improving quality of life, and enhancing overall societal development (Smith, 2020). However, the successful delivery of such projects is often challenged by various factors that can significantly impact their quality and effectiveness. Understanding and addressing these factors is essential to ensure the successful completion of large-scale infrastructure projects.

Despite their importance, the successful delivery of large-scale infrastructure projects is fraught with difficulties. The industry is notorious for cost overruns, delays, and quality issues that stem from a variety of sources (Flyvbjerg et al., 2003). For instance, the intricate interdependencies between different project elements necessitate meticulous planning and coordination, which are essential for maintaining quality standards (Zidane et al., 2016). Moreover, the longtime horizons associated with such projects often introduce uncertainties that can be difficult to manage, thereby impacting the ultimate quality of the project (Cantarelli et al., 2010).

Effective quality management is indispensable throughout the lifecycle of construction projects, from their inception to completion. The embodiment of a quality project, however, is significantly determined during the design and construction phases, where the foundation for future performance is laid (Chan, et al., 2004). In spite of the central role of quality management, actualizing high-quality outcomes poses an ongoing quandary, as prevailing practices often fall short of the theoretical frameworks and standards (Kazaz and Ulubeyli, 2009). It is within this context that the current study situates itself, seeking to bridge the gap between the theoretical

paradigms of quality management and the empirical realities observed in the field, particularly within the African construction environment.

The Addis Ababa Bole International Airport Expansion Project stands as a symbol of progress, embodying Ethiopia's dedication to modernizing transportation infrastructure and meeting escalating air traffic demands. However, the journey towards successful project completion is often riddled with challenges that can jeopardize the quality and effectiveness of the infrastructure in question.

The expansion of Addis Ababa Bole International Airport, a flagship project with immense strategic importance, serves as a microcosm of the complexities and obstacles inherent in executing large-scale infrastructure endeavors. From initial planning stages to final implementation and operational phases, infrastructure projects of this magnitude are subject to a multitude of internal and external factors that can shape their outcomes and long-term viability. Issues such as budget constraints, unforeseen delays, technical complexities, stakeholder conflicts, and regulatory hurdles can all exert significant pressure on project teams, potentially compromising the quality and success of the venture.

This study aims to examine the factors that affect the quality of large-scale infrastructure projects, using the Addis Ababa Bole International Airport expansion project as a case study. By examining the Addis Ababa Bole International Airport Expansion Project through the lens of quality management and project execution, this study endeavor aims to unravel the intricacies of large-scale infrastructure development. Through a comprehensive examination of the factors influencing project quality, this study seeks to shed light on the underlying dynamics that impact the success or failure of such critical initiatives. By delving deep into the challenges and opportunities presented by the airport expansion project, valuable lessons can be learned and best practices identified to guide future infrastructure projects towards seamless execution and optimal performance.

1.2. Problem Statement

Ensuring and meeting acceptable quality standards in construction projects has been a persistent challenge, with performance-related issues often cited as the primary cause of project failures. However, there are various contributing factors at play. Long, Jha, and Iyer (2004) identified a

range of issues affecting quality in large-scale infrastructure construction projects in developed countries, including inexperienced designers and contractors, inadequate estimating and change management, social and technological challenges, site-related issues, and the use of inappropriate procedures and tools. Cheung (2004) categorized project performance into communication, client satisfaction, cost, time, quality, and safety and health. These categories offer a comprehensive framework for assessing project performance and identifying areas in need of improvement

This research is motivated by direct observations of quality-related issues in the Addis Ababa Bole International Airport Expansion Project. Echoing the insights of Majid (2006), the seamless execution of a construction venture is contingent on its completion within the set timeframe, strict adherence to the budget, conformance to predefined specifications, and fulfillment of stakeholders' expectations. The airport Expansion Project is encountering critical issues related to quality, a concern highlighted by the Project Manager, Mr. Farid. He has identified a range of factors that could potentially affect the project quality. Among these, he specifically highlighted three critical factors that might contribute to the challenges faced in maintaining quality. These factors include the quality of the labor force, the effectiveness of contract administration, and the efficiency of project management practices.

Large-scale infrastructure projects, like the expansion of Addis Ababa Bole International Airport, often confront a multitude of challenges that impact the overall quality of the project. Despite substantial investments and efforts, these endeavors frequently encounter issues related to the Quality of Labor, Contract Administration, and Project Management Practices. Given the project vast scale, distinctive features, and complex nature, it necessitates a workforce that is not only skilled but also experienced. Secondly, contract administration is integral to the project success, as it ensures the fulfillment of project standards and specifications. Inefficiencies in this area, such as inadequate monitoring, insufficient documentation, and ineffective dispute resolution processes, pose threats to the quality of the project. Lastly, the area of project management practices comes to light. Robust management practices are indispensable to the orchestration of project operations, risk management, and the attainment of quality benchmarks. Understanding the underlying factors that contribute to quality concerns is crucial for ensuring the successful execution and sustainability of large-scale infrastructure construction projects.

Labor quality emerges as a first factor for examination. This study delves into the skills, training, and proficiency of the construction workforce engaged in the project, examining their compliance with safety standards and regulations. Through this examination, the study seeks to unveil how labor quality influences the overall project quality. The study additionally evaluate the Contract Administration practices employed during the project. Lastly, project management practices within the Addis Ababa Bole International Airport Expansion Project will undergo evaluation. The effectiveness of project planning, scheduling, coordination, and communication will be examined to ascertain whether these actions promoted quality construction.

Over a comprehensive analysis of these factors, this study provides a valuable insight into the determinants of quality in large-scale infrastructure projects. The resulting findings aim to enhance construction standards within the Ethiopian Airports Group (EAG) and the broader construction landscape of Ethiopia. Moreover, the study will serve as valuable resource for project managers, contractors, and other stakeholders involved in forthcoming construction ventures in the nation.

The theoretical knowledge gap that this research aims to fill lies in the limited understanding of the specific factors that affect the quality of large-scale infrastructure projects in developing countries, particularly in the context of the Addis Ababa Bole International Airport Expansion Project. While there is extensive literature on project management and quality control in general, there is a dearth of research that focuses on the unique challenges and opportunities presented by large-scale infrastructure projects in developing contexts.

In the study region, a lack of research on airports construction quality has been noted, prompting this research to delve into this uncharted territory. This study will contribute to the body of knowledge by investigating the specific factors that influence the quality of large-scale infrastructure projects, with a focus on the Addis Ababa Bole International Airport Expansion Project as a case study. Through examining the project quality management practices and adherence to standards, this research aims to identify areas for improvement and develop recommendations.

1.3. Research Questions

1. How does the skillset and competency levels of the labor force engaged in the project impact the resulting quality of Addis Ababa Bole International Airport Expansion Project?

2. How does the contract administration, encompassing compliance monitoring, documentation accuracy, and conflict resolution practices, influence the quality of Addis Ababa Bole International Airport Expansion Project?
3. How does the project management practice employed by the Ethiopian Airport Group contribute to or detract from the achievement of quality benchmarks in the Addis Ababa Bole International Airport Expansion Project?

1.4. Objectives of the Study

1.4.1. General Objective

The main objective of the study is to examine the factors that affecting the quality of large-scale infrastructure projects in Addis Ababa Bole International Airports Expansion Projects.

1.4.2. Specific Objectives

- To analyze the effect of the labor force performance on the quality of Addis Ababa Bole International Airport Expansion Project.
- To evaluate the influence of contract administration on the quality of the Addis Ababa Bole International Airport Expansion Project.
- To assess the effect of project management practice implemented by the Ethiopian Airports Group on the quality of the Addis Ababa Bole International Airport Expansion Project.

1.5. Scope of the Study

The study focuses on the factors affecting the quality of large-scale infrastructure projects, specifically focusing on the Addis Ababa Bole International Airport expansion. The scope of the study limited to three principal factors: labor performance, contract administration, and project management practices, as they are posited to have a considerable impact on project quality.

The study evaluates the quality of the project across several dimensions: performance quality, conformance quality, reliability quality, aesthetic quality, and time quality. These dimensions serve as a multifaceted lens through which the quality of the project can be assessed, considering not only the functionality and durability of the construction but also its adherence to set timelines and aesthetic standards.

The independent variables under investigation are labor performance, contract administration, and project management practices, which will be measured using questionnaire survey, personal observation, document review and performance metrics.

The study utilized an explanatory research design to analyze the information gathered through questioner surveys, personal observation and document review. The study uses descriptive statistics, cross-tabulation, and inferential statistics to identify the relationships between the variables.

The study adopted quantitative methodologies for a comprehensive data collection and analysis. Quantitative insights will be derived from structured questionnaires employing a five-point Likert scale.

The scope of the investigation is focused on the Ethiopian Airports Group, with a particular focus on the Bole International Airport expansion initiative. The research encompasses a demographic of 85 individuals who are closely associated with the construction project, including but not limited to contractors, consultants, clients, and subcontractors. The geographical locus of the study is situated in Addis Ababa, the capital city of Ethiopia.

1.6. Significance of the study

This research study aims to deepen the understanding of the key factors that influence the quality of large infrastructure projects, particularly focusing on the Addis Ababa Bole International Airport Expansion Project. By identifying potential solutions and strategies to address challenges and improve quality outcomes in infrastructure projects, this study will contribute practical insights for project managers and stakeholders. Through its findings and analysis, the research will enrich the existing body of knowledge on infrastructure project management and quality assurance, potentially informing future projects in the field.

This study holds a significant implication for project management practices and policy decisions in the realm of large-scale infrastructure projects. By shedding light on the complexities of the Addis Ababa Bole International Airport Expansion Project, it offers valuable lessons and recommendations for project stakeholders, policymakers, and industry professionals. Understanding and addressing the factors that impact project quality are essential for ensuring the

successful execution and functionality of large-scale infrastructure projects, making this research endeavor highly relevant and impactful.

1.7. Limitation of the study

Scope of the Study and generalizability: The research focuses specifically on the Addis Ababa Bole International Airport Expansion Project. While findings may provide valuable insights, they may not be directly generalizable to other types of large-scale infrastructure projects or those in different geographical or cultural contexts.

Data Availability and Collection: The study's conclusions will depend heavily on the data gathered from questionnaires, and document reviews. Limited access to sensitive or proprietary information could restrict a full understanding of project dynamics. The study relies on primary data collected through questionnaires from 85 respondents. This may introduce some biases or errors in the data, such as non-response bias.

Changes in the Project Environment: Infrastructure projects are dynamic, with changes potentially occurring in the project environment during the study period. Such changes could impact the relevance of the findings over time.

1.8. Organization of the Study

The study is structured into five chapters. Chapter one provides introduction, an overview of the background, research questions, problem statement, study objectives, significance of the study and the scope of the study. Chapter two delves into a review of relevant literature, discussing theoretical and conceptual frameworks. Chapter three details the study site, research design, data sources, population, and data collection and analysis methods. Chapter four presents the results of data analysis, interpretation of findings, and a summary. Finally, chapter five concludes the study by summarizing findings, discussing conclusions and recommendations, suggesting areas for further research, and contributing to knowledge.

1.9. Definition of key terms

Quality: In the context of construction project management, quality refers to the degree to which a project meets or exceeds the defined criteria, standards, and requirements set forth by

stakeholders. It encompasses the totality of characteristics of a project that bear on its ability to satisfy stated or implied needs (International Organization for Standardization, ISO 9000).

Construction: comprehensive suite of activities involved in land development, including clearing, dredging, excavating, and grading. It extends to the erection of buildings, structures, and other real property types such as bridges, dams, and roads.

Large-Scale Infrastructure Project: A large-scale infrastructure project is a significant, capital-intensive investment initiative that typically involves the development or improvement of facilities, structures, and systems that are vital to a country's economy and the welfare of its society. These projects are complex due to their scope, size, cost, and the long-term implications for stakeholders (Brookes and Locatelli, 2015).

Addis Ababa Bole International Airport Expansion Project: This refers to the specific infrastructure development project aimed at expanding the capacity and facilities of Addis Ababa's principal airport to accommodate growing passenger and cargo traffic, thereby positioning it as a major hub for air transport in Africa.

Project Management: The field of construction project management is a specialized area that involves the strategic planning, coordination, application of resources, leadership, and oversight to accomplish particular objectives. A construction project is a finite endeavor, characterized by a clear start and finish, designed to achieve singular objectives with the aim of initiating positive transformations or enhancing value, as outlined by the Project Management Institute (PMI).

Stakeholders: Stakeholders in a construction project include individuals or organizations with a vested interest in the project's outcome. This includes but is not limited to the project owner, investors, contractors, subcontractors, consultants, government entities, and the community at large.

Construction Materials: Construction materials refer to the substances, components, and elements used in the building and construction process. The quality and properties of these materials directly influence the structural integrity and longevity of the infrastructure (Ashby, 2013).

Contract Administration: This is the management of contracts made with customers, vendors, partners, or employees. It involves negotiation of terms and conditions in contracts and ensuring compliance with the terms and conditions, as well as documenting and agreeing on any changes that may arise during its implementation (Lewicki, Barry, & Saunders, 2010).

Labor Performance: Labor performance in construction refers to the efficiency and effectiveness of the workforce involved in a project. It includes the skill level, productivity, and overall output quality of the labor force (Thomas et al., 2002).

Performance Quality: It evaluates how effectively the completed infrastructure fulfills its intended functions. It considers technical performance, operational efficiency, and the ability to meet user needs and requirements.

Conformance Quality: Conformance quality measures the extent to which the project's execution aligns with predetermined standards and specifications. This includes adherence to design documents, building codes, regulations, and industry quality benchmarks.

Reliability Quality: It assesses the dependability and consistency of the infrastructure over time. It examines the durability, longevity, and ability of the construction and its components to maintain performance under various conditions.

Aesthetic Quality: Aesthetic quality focuses on the visual and experiential aspects of the infrastructure. It encompasses design appeal, finish, and the overall impression that the project creates for users and stakeholders.

Time Quality: It evaluates the project's success in meeting set deadline constraints.

Fitness for Purpose: Fitness for purpose pertains to a project's ability to fulfill the function or purpose for which it was designed. This includes conforming to performance specifications and being suitable for the conditions in which it is intended to operate (Cherns and Bryant, 1984).

CHAPTER TWO

REVIEW OF RELATED LITERATURE

2.1. Introduction

This chapter presents a comprehensive literature review on quality determinants in large-scale infrastructure construction projects. It synthesizes theoretical perspectives and empirical findings, addressing challenges in ensuring quality and factors influencing quality outcomes. By examining secondary sources, including academic journals and industry reports, it aims to collect prevailing wisdom and debates on construction project quality. The review aligns with research objectives, emphasizing core concepts and practices. It explores theoretical frameworks, practical case studies, and real-world applications, offering a balanced view of quality management. Special attention is given to internal and external factors impacting quality, with a focus on global perspectives. The review also tracks the evolution of quality standards and management practices over time, highlighting industry advancements. By providing a foundational understanding of key themes, the chapter sets the stage for analyzing the Addis Ababa Bole International Airport Expansion Project within the broader scholarly context and identifies research gaps to be addressed.

2.2. Theoretical Related Literature Review

2.2.1. Global review of quality in large scale construction project

The theoretical foundations of quality management in large-scale construction projects have been extensively discussed in global literature. This section of the literature review examines the theoretical frameworks that have shaped our understanding of what constitutes quality in construction and how it can be achieved and measured.

Quality in construction projects is a multifaceted concept that encompasses various dimensions to ensure project success and stakeholder satisfaction. Researchers have identified several key dimensions of quality that are essential for achieving project objectives and meeting client expectations. The dimension of performance quality in construction refers to how well the completed infrastructure functions and meets the intended use requirements. Chan and Kumaraswamy (1997) focus on the significance of aligning project outcomes with stakeholders'

expectations to achieve high performance quality. They argue that performance quality is not solely the absence of defects but also the fulfillment of functional and operational requirements. The dimension of conformance quality is concerned with the degree to which construction processes adhere to set standards and specifications. Juran and Godfrey (1999) emphasize that conformance to design specifications is a fundamental pillar of quality management in construction. Their research suggests that strict compliance with technical parameters is essential for the project to satisfy the original design intentions and regulatory criteria. The reliability of a construction project revolves around its duration and the persistence of its performance over time. Love et al. (2000) have investigated the impact of defects and the need for rework on the reliability of construction projects. They highlight the role of quality assurance systems in minimizing the incidence of rework, thereby enhancing the project's reliability. Aesthetic quality pertains to the visual and experiential aspects of the built environment. As noted by Shen et al. (2007), aesthetic considerations are increasingly becoming a benchmark for evaluating project success, as they contribute to the user's perception of quality and the project's overall value. Time quality in construction projects focuses on the punctuality of project completion. According to Koushki et al. (2005), time quality is an essential component of overall project quality, with on-time delivery being indicative of effective project management and operational efficiency.

Quality management within construction has traditionally been guided by a range of theories, from Total Quality Management (TQM) to Six Sigma, Lean Construction, and the ISO 9000 family of standards. TQM, which emphasizes customer satisfaction, continuous improvement, and a holistic approach to quality, has been a significant influence on the industry's approach to quality (Deming, 1986; Juran, 1988). Six Sigma's focus on reducing defects and variability in processes (Pyzdek & Keller, 2003), Lean Construction's elimination of waste and maximization of value (Koskela, 1992), and ISO's standardized quality benchmarks (International Organization for Standardization, 2015) have all contributed to the multiplicity of approaches to managing quality in construction projects.

The complexity and scale of large infrastructure projects require a tailored approach to quality management. Love et al. (2010) argue that the unique characteristics of these projects, including their one-off nature, long duration, and involvement of multiple disciplines and stakeholders,

necessitate a comprehensive and flexible approach to quality management that goes beyond traditional models.

The definition of quality in the context of large-scale projects often extends to stakeholder satisfaction, where quality is not only measured by the adherence to technical specifications but also by the project's ability to meet or exceed the diverse expectations of its stakeholders (Ofori, 2006). The stakeholder theory of quality management (Freeman, 1984) asserts that understanding and managing the needs and influences of all stakeholders is crucial to achieving high-quality outcomes.

The impact of organizational culture on quality outcomes in construction projects has gathered attention, with researchers like Schein (2010) exploring the underlying values, norms, and practices that shape quality perceptions and behaviors within project teams. This cultural approach to quality suggests that the collective understanding of quality within the project team and the broader organizational environment can significantly impact project success.

In an effort to address issues pertaining to quality within the construction industry, a wealth of research has been conducted across various global contexts. Chua et al. (1999) have made significant contributions to this field by developing a hierarchical model that delineates the factors contributing to the success of construction projects, with a specific focus on quality objectives. Their model identifies four principal aspects impacting quality in construction: project characteristics, contractual arrangements, the roles of project participants, and the dynamics of interactive processes.

Building on this foundation, Arditi and Gunaydin (1998) have unearthed that a dedicated commitment to continuous quality improvement from management, leadership that champions high process quality, comprehensive quality training for all personnel, efficient teamwork to address quality at the corporate level, and effective collaboration among project stakeholders are quintessential factors influencing process quality.

Further expanding this knowledge base, Pheng (2004) has utilized case studies to underscore the importance of job satisfaction among employees as a key contributor to enhanced quality outcomes in construction projects. This underscores the human element in the construction process and its impact on the overall quality of the project.

Complementing these insights, Bubshait and Al-Atiq (1999) have highlighted the critical role that a contractor's quality assurance system plays in maintaining consistent quality standards. Their observations suggest that such systems are crucial not only for preventing issues but also for mitigating the recurrence of such problems.

To these established findings, one might add the increasing importance of technological innovation and sustainability practices in enhancing quality within the construction industry. The integration of advanced construction methodologies, such as Building Information Modeling (BIM), and the adoption of green construction practices have been recognized for their potential to improve quality control and ensure that projects are not only efficient and aesthetically pleasing but also environmentally responsible and sustainable in the long term.

2.2.2. Factors that affect quality of large-scale construction projects

The multifaceted nature of construction quality issues has been the subject of extensive research and debate. Quality within construction is understood to be contingent upon organizational characteristics, adherence to prescribed workflows, compliance with architectural drawings and specifications, all while adhering to defined schedule and budgets. The skills of the labor force, effective contract administration best project management practices also play determinative roles in project outcomes.

Chua et al. (1999) assert that for economically advanced nations, challenges in management practices are the primary contributors to quality issues in construction projects. These issues encompass a broad array of managerial facets, including project planning, stakeholder coordination, and the overseeing of project execution.

In contrast, the factors affecting construction quality in developing countries possess unique dimensions. As noted by Adenuga and Afolarin (2013), consequential factors include site layout, the skillset and experience of on-site staff, design document characteristics, equipment and material quality, labor management systems, and the promptness of owners in decision-making. Specifically, they point to the miscommunication of design requirements, poor labor skills and oversight, ambiguous project designs, and issues relating to the availability of skilled labor and materials as pivotal in affecting the quality of public housing projects.

Building on this, Ali and Wen (2011) identified workmanship as a significant factor influencing construction quality. They pointed to several contributing factors to poor workmanship, such as inadequate project management, the complex roles of subcontractors, labor inexperience and incompetence, communication barriers, inappropriate equipment, adverse weather conditions, and constraints on time and budget. To mitigate these issues and improve workmanship quality, they recommend rigorous supervision, enhanced training and education for labor, clear communication across involved parties, robust construction management, effective manpower management, and thoughtful design planning.

The skill levels, training, and experience of the workforce are integral to achieving desired quality standards. The human resource strategies adopted, such as continuous training and development, play a role in bolstering labor performance and thereby augmenting project quality (Hwang & Ng, 2013). Theories of motivation such as Maslow's hierarchy of needs, Herzberg's two-factor theory, and McClelland's theory of needs have been applied to understand what drives construction labor performance (Maslow, 1943; Herzberg, 1966; McClelland, 1961). The human capital theory posits that investment in labor through education and training enhances productivity and quality (Becker, 1962). Moreover, the impact of construction labor performance on project quality is linked to the skill level, experience, and the health and safety practices observed on-site, as these directly affect the execution of tasks and adherence to quality standards (Hwang & Ng, 2013).

Contract administration is integral to project execution, ensuring that the provisions of a contract are implemented in compliance with the contractual terms agreed upon by the parties involved. Agency theory, which examines the relationship between principals (clients) and agents (contractors), provides a framework for understanding contract administration, particularly the inherent challenges and risks such as moral hazard and adverse selection (Eisenhardt, 1989). Effective contract administration is theorized to prevent disputes, manage changes, ensure clear communication, and uphold the quality of deliverables through robust documentation and monitoring practices (Lewicki et al., 2010).

Project management strategies are vital for the successful delivery of large-scale infrastructure projects. Shenhar et al. (2001) posited that the choice of an appropriate project management style can significantly affect the outcome of a project. They suggested that matching management styles to the specific phase and complexity of the project is imperative. Tailored strategies, which address

the unique challenges of each project stage, from initiation through to completion, are essential for maintaining quality standards. Succar (2009) supported this view, emphasizing the importance of strategic agility and the ability to adapt to changing conditions without compromising on quality.

Furthermore, the integration of advanced project management tools and techniques has been shown to directly impact the quality of infrastructure projects. In their study, Love et al. (2010) highlighted the effectiveness of Building Information Modeling (BIM) in improving quality control throughout the construction process. By providing a digital representation of the physical and functional characteristics of the project, BIM enables better decision-making, which enhances overall project quality. Similarly, Doloji (2009) identified effective resource allocation, facilitated by project management software, as a key element in maintaining quality, particularly when it comes to managing costs and schedules which, if not properly controlled, can negatively affect the quality of the final deliverable.

Managerial factors are pivotal in project quality outcomes. The competence of project managers, decision-making processes, and communication channels significantly influence quality. Leadership styles adopted by project managers, such as transformational or transactional leadership, can impact team motivation and attention to quality details (Müller & Turner, 2010). Additionally, strategic planning, effective resource allocation, and stakeholder engagement are crucial managerial aspects that are theorized to drive quality in large-scale construction projects (Shenhar et al., 2001).

Expanding upon these studies, additional research underscores the importance of integrating new technological tools and processes, such as Building Information Modeling (BIM), to improve communication, coordination, and documentation, thereby enhancing the overall quality (Succar, 2009). Furthermore, the adoption of sustainable construction practices, which emphasize the environmental impact, resource efficiency, and social responsibility, is increasingly recognized as a vital component of quality management in construction projects (Kibert, 2016).

2.2.3. The availability of labor and the quality of construction projects

Availability of labor and its influence on the quality of construction projects is a critical aspect of project management. As Chan (2010) asserts, labor plays a crucial role in determining the quality of a project, with experienced and competent workers being key contributors to superior quality

outcomes. Competence is not just the ability to perform a job but encompasses a combination of knowledge, skills, abilities, and other attributes that contribute to job performance (Chan A.P. and Tam C.M., 2000). However, the construction industry, particularly in developing countries, faces challenges with labor availability and quality. Low wages and limited job opportunities can lead to a situation where highly qualified labor is often bypassed in favor of minimizing contract costs. This can have a detrimental effect on project quality, as less experienced workers may lack the competencies necessary to meet the required standards (Chan, 2010).

A multitude of factors influence labor performance, including motivation, skills, physical fatigue, the scarcity of experienced labor, education levels, age, competitive environment, loyalty, and personal issues (Cooke, B. and Williams P., 2003). These factors can significantly impact project productivity and, ultimately, the quality of the finished construction project.

The role of contractors and their involvement in supervising labor, particularly when work is subcontracted, cannot be overstated. Common issues on construction sites, such as a lack of information, overlapping activities, and insufficient coordination, can result in rework, increased costs, and compromised quality. Effective coordination by site staff can lead to more efficient work and timely project completion (Fisk, 1997).

Pheng and Chuan (2006) highlighted that human factors are vital in project performance. Errors and ambiguities in specifications can lead to reduced productivity, as laborers may be unsure of their tasks, causing delays or stoppages until they receive clearer instructions. Thomas et al. (1999) quantified the loss of productivity due to work changes at around 30%, stressing the importance of stable work conditions for maintaining efficiency. Moreover, site inspections by supervisors play an essential part in maintaining labor productivity and ensuring quality. For instance, concrete casting cannot proceed without prior inspection of formwork and steelwork. Any discrepancy from specifications and drawings can lead to a demand for rework, which not only affects labor productivity but also project timelines (Zakeri et al., 1996). Supervisor absenteeism can halt work entirely, especially for critical activities requiring their presence, leading to delays in inspections and the commencement of subsequent tasks.

Expanding upon this, recent literature has emphasized the importance of labor engagement and well-being as factors that can positively influence performance and quality outcomes (Chan et al., 2012). Furthermore, technology's role in supplementing labor performance, through tools such as

wearable devices for monitoring health and fatigue, and augmented reality for training, provides a new dimension to managing labor performance in construction projects (Wang et al., 2018).

The availability and quality of labor are central to the success of construction projects. Effective management practices, including clear communication, adequate supervision, and attention to worker wellbeing, are instrumental in overcoming challenges and ensuring that projects meet their specified quality standards.

2.2.4. Contract Administration and Quality of Construction Projects

Contract administration plays a fundamental role in the construction industry as a vital component of project management, and its influence on project quality is well-documented in scholarly literature. The facets of contract administration, including compliance monitoring, documentation accuracy, and conflict resolution, are critical to maintaining and assuring quality through the various stages of a large-scale infrastructure construction project. In the context of the construction quality of large-scale projects, studies have shown that contract administration has a direct correlation with project performance. Alinaitwe et al. (2007) emphasize that the management of contracts, including the enforcement of causes related to quality control, plays a pivotal role in achieving the desired construction quality. Furthermore, Lu et al. (2015) highlight that the level of meticulousness in contract administration can be a determining factor in the project's adherence to quality benchmarks and overall success.

Compliance monitoring involves the regular and systematic review of project activities to ensure that they align with contractual agreements, specifications, and regulatory requirements. According to Xue et al. (2010), effective compliance monitoring can significantly enhance the likelihood of project success by promptly identifying and addressing deviations from the established quality standards. It ensures that the project conforms to the agreed-upon technical and performance criteria, which is essential for the final quality of the infrastructure.

The accuracy of documentation, including the detailed records of plans, specifications, changes, and project progress, is another cornerstone of contract administration. As noted by Yakubu and Sun (2010), precise and up-to-date documentation is a critical tool for communication among stakeholders and serves as a legal record that can help resolve disputes. Accurate documentation

ensures that all parties have a mutual understanding of the project requirements, which is vital for maintaining quality standards.

Conflict resolution practices are key to preventing and managing disputes that can arise from contractual obligations. Cheung and Suen (2002) argue that effective conflict resolution mechanisms are instrumental in maintaining a collaborative working environment and ensuring the project's progress is not hampered by unresolved issues, thereby safeguarding quality outcomes.

Regarding the Addis Ababa Bole International Airport expansion project, the quality of construction is directly influenced by the contract administration processes in place. The complex nature of such large-scale projects, with multiple contractors and stakeholders, necessitates robust contract administration to navigate the intricate web of contractual relationships (Chan et al., 2011).

It is evident that contract administration serves not only as a governance tool but also as a quality assurance mechanism, which is crucial for the successful completion of construction projects. As such, the effectiveness of contract administration practices is a determinant of the final quality of projects like the Addis Ababa Bole International Airport expansion.

2.2.5. Project Management Strategy and Quality of Construction Projects

Scholars have investigated the influence of various project management frameworks on construction quality. The Project Management Body of Knowledge (PMBOK), developed by the Project Management Institute (PMI), outlines a standardized set of practices that include quality management as one of its core knowledge areas (PMI, 2017). These practices are designed to ensure that projects meet the quality objectives set by stakeholders. The application of PMBOK's principles is posited to enhance consistency and foster a culture of quality throughout the project lifecycle (Kerzner, 2018).

Quality management processes, such as Quality Planning, Quality Assurance, and Quality Control, are integral components of project management that directly impact construction quality. Quality Planning involves identifying which quality standards are relevant to the project and determining how to satisfy them. Quality Assurance ensures that the use of the system is effective, and Quality

Control monitors project results to confirm that quality standards are being met (Juran & Godfrey, 1999).

Effective communication and decision-making are fundamental components of a robust project management strategy, deeply influencing the quality of construction projects. A key tenet of project success, as Müller & Turner (2010) assert, is the clarity of communication channels throughout the project's lifecycle. They argue that efficient communication not only ensures that all stakeholders have a clear understanding of project goals, expectations, and progress but also fosters a collaborative environment conducive to high-quality outcomes. Similarly, Zidane et al. (2016) highlight that communication efficacy directly correlates with the quality of decision-making, as timely and accurate information flow is critical for making informed decisions that uphold quality standards.

Additionally, the establishment of clear goals is integral to the strategic framework of project management. As outlined by Cooke & Williams (2003), clear goals provide direction, foster team alignment, and serve as benchmarks for measuring project performance. They emphasize that goal clarity allows for the development of specific quality metrics against which project deliverables can be assessed. Kerzner (2018) complements this perspective by suggesting that clearly defined goals are essential for strategic decision-making, ensuring that each choice made by the project team advances the project towards its quality objectives. The interplay between communication, decision-making, and goal clarity within project management strategy, therefore, plays a pivotal role in steering construction projects toward successful, quality-driven completions.

Leadership within project management is crucial for quality outcomes. A project leader's competence and style, such as transformational or transactional leadership, are theorized to influence the project team's commitment to quality objectives (Yang, Huang, & Wu, 2011). Effective leaders are able to inspire and motivate their teams to focus on quality, fostering an environment where high standards are pursued consistently.

Engaging stakeholders effectively is also another strategy that plays a pivotal role in ensuring project quality. The literature suggests that active involvement of stakeholders in the project management process can lead to better alignment of the project deliverables with stakeholders' quality expectations (Olander & Landin, 2005).

Risk management strategy, such as the identification, analysis, and mitigation of potential risks, are theorized to have a significant effect on project quality. Risk management ensures that potential issues that could affect quality are addressed proactively, rather than reactively, which has been shown to correlate with higher quality construction outcomes (Smith, 1999).

Sustainable project management practices, which incorporate environmental, social, and economic considerations, are increasingly recognized as important for long-term quality. These practices aim to minimize the environmental footprint of construction projects while ensuring social and economic benefits, translating to a broader definition of quality that extends beyond the immediate construction process (Kibert, 2016).

2.3. Review of Empirical Studies

Empirical studies have consistently identified a variety of factors that influence the success of large-scale construction projects. Toor and Ogunlana (2008) conducted a survey-based study that revealed factors such as project feasibility, clear goals and objectives, competent project teams, effective communication, and stakeholder involvement as critical to project success.

Research by Love et al. (2010) utilized performance data to analyze the impact of rework on construction quality and project performance. Their findings emphasized the need for improved initial design processes and better project information management to reduce rework and enhance quality.

Focusing on large-scale infrastructure projects, empirical research by Doli (2009) examined the complexities of managing such projects, including the challenges posed by their scale, the number of stakeholders involved, and the need for advanced project management capabilities. This study highlighted that the successful management of large-scale projects requires a blend of traditional and innovative management practices to navigate the unique challenges they present.

Studies focusing on labor performance, such as the work by Arditi and Mochtar (2000), have empirically examined the relationship between labor productivity and project outcomes. Their research found that factors like workforce experience, motivation, and the provision of training significantly impact productivity, which in turn affects project quality. In addition, empirical studies on labor performance often focus on the direct correlation between workforce skills, work conditions, and the resulting quality of construction. Enshassi et al. (2007) conducted a survey that

identified significant factors affecting labor productivity, including the lack of skilled workers, poor motivation, and inadequate training. Similarly, a study by Jarkas and Bitar (2012) empirically demonstrated the influence of motivational factors on the productivity of construction workers, indicating a direct impact on project timelines and quality outcomes.

Chan et al. (2001) studied the role of contract administration in project outcomes through a series of case studies. Their findings underscored the importance of effective contract management practices, including timely administration and transparent communication, in mitigating risks and enhancing project quality. The effective administration of contracts is a critical factor in project success, as it encompasses the processes that ensure compliance with contractual terms and the quality of the final deliverable. A study by Bajaj et al. (1997) on contract administration efficiency posited that timely and accurate contract documentation, effective change order management, and dispute resolution mechanisms are essential for maintaining project quality. Chan et al. (2004) analyzed the critical success factors in contract administration from the perspective of contractors and found that clear contract terms, effective communication, and proper documentation had a significant impact on the quality of the project.

Empirical research by Olander (2007) highlighted the impact of stakeholder management on project success. The study concluded that proactive stakeholder engagement and efficient decision-making processes can lead to smoother project execution and higher satisfaction with the project's quality.

Project management practices are empirically linked to the success and quality of infrastructure projects. The influence of project management methodologies, such as Agile and Lean, on project outcomes has been the subject of extensive research. Papke-Shields et al. (2010) studied the relationship between project management practices and project success and found that well-defined project processes and effective risk management were among the top factors that lead to higher project quality. Furthermore, Zou et al. (2010) conducted a survey-based study that highlighted the importance of integrated project management practices, including stakeholder management and quality control, in enhancing project performance.

Specific to the Addis Ababa Bole International Airport Expansion Project, empirical studies such as those by Admassu (2016) have investigated the direct factors impacting the project. These studies often concentrate on local challenges, such as resource allocation, logistical hurdles,

regulatory compliance, and the socio-economic environment of Ethiopia, offering a contextualized understanding of the project's quality factors.

In synthesizing these empirical studies, it becomes evident that the factors affecting large-scale infrastructure projects interplay to shape project outcomes. The competence and well-being of labor, effectiveness of contract administration, and the application of robust project management practices are all empirically demonstrated to be critical to the success and quality of large-scale infrastructure projects. These factors serve as key indicators for project planners and managers to monitor and optimize in pursuit of project quality and success.

Furthermore, the challenges and problems outlined by various researchers are largely consistent, though there exist variations that reflect the particular practical contexts of their studies. Notably, an area that has received less attention in existing literature is the quality of large-scale infrastructure construction projects within the specific context of the Ethiopian construction industry. This gap in research represents an opportunity to explore and understand the unique quality standards and related challenges faced in the Ethiopian construction sector. Addressing this gap, the current study aims to contextualize the factors affecting large scale infrastructure project quality within the framework of Ethiopian construction practices. It endeavors to apply these factors to the operations of the Ethiopian Airport Group, with a special focus on the Addis Ababa Bole International Airport expansion project.

For the purpose of this study, the influencing factors are benchmarked to the Ethiopian context and categorized accordingly. These categories include labor performance, contract administration, and project management practices. This categorization allows for a structured investigation into each factor's impact on the quality of construction projects, thereby providing a tailored analysis that is relevant to the Ethiopian construction sector's current conditions and standards.

2.4. Research Gaps

While there is a substantial body of research exploring the numerous factors affecting large-scale infrastructure projects globally, there appears to be a notable research gap when it comes to the specific context of such projects within Ethiopia, particularly in relation to the Addis Ababa Bole International Airport expansion project. Existing research predominantly focuses on the construction industry in developed countries or regions with different socio-economic dynamics

from Ethiopia. There is a scarcity of empirical data and contextual analysis that reflects the unique challenges faced by the Ethiopian construction sector, including local labor market conditions, regulatory frameworks, and material sourcing issues.

The standards and practices that drive project quality in Ethiopia may differ from international norms due to various factors including local regulations, cultural practices, and economic constraints. Limited research has been conducted to understand how these localized standards influence the management and outcomes of construction projects in Ethiopia. The Ethiopian construction industry's characteristics, such as the availability of skilled labor, the capacity of local contractors, and the effectiveness of project management practices, have not been comprehensively studied in relation to their impact on project quality, particularly for infrastructure projects of the magnitude of the Addis Ababa Bole International Airport expansion.

In the Ethiopian context, stakeholder engagement and decision-making processes for large-scale projects may follow unique patterns that affect project delivery. There is a lack of in-depth studies examining these dynamics and their implications for project quality.

The role of contract administration in the Ethiopian construction industry and its influence on project quality are areas that have not been extensively studied. Given the complexities of large-scale projects, insights into local contract management practices could be valuable for improving project outcomes.

There is a need for empirical research that provides evidence-based insights into the specific factors affecting the quality of large-scale infrastructure projects like the Addis Ababa Bole International Airport expansion. Gathering and analyzing data from this project could fill the research gap and contribute to the body of knowledge on project quality in Ethiopia and similar developing country contexts. This research endeavor aims to bridge these gaps by focusing on the Addis Ababa Bole International Airport expansion project as a case study. Through empirical analysis, it seeks to contribute to a deeper understanding of the factors that influence project quality in the Ethiopian construction industry and to develop recommendations that could be applicable to similar large-scale infrastructure projects in developing countries.

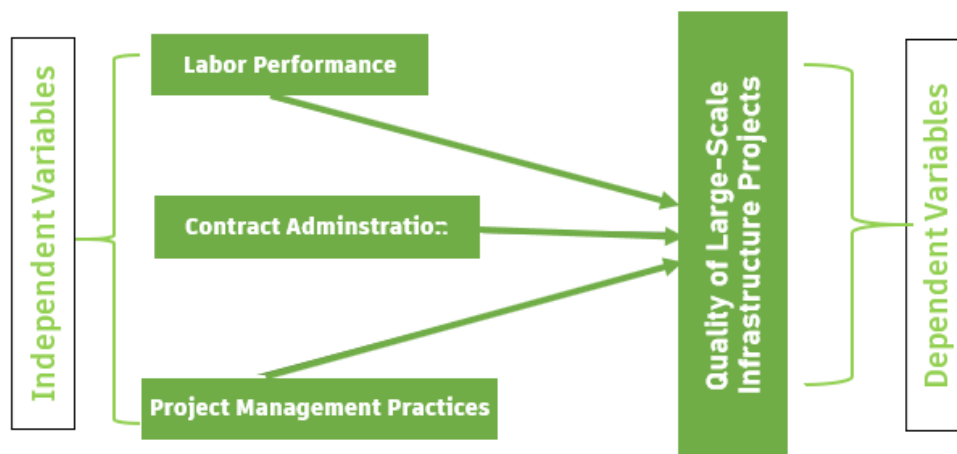
2.5. Conceptual Framework

A conceptual framework serves as a roadmap for a research study, offering a clear narrative that outlines the relationships among the variables identified within the problem statement, objectives, and research questions. In academic research, it operates as an essential tool that not only guides the direction of the inquiry but also clarifies the theoretical underpinnings of the relationships being examined (Ravitch & Riggan, 2012).

In this research, the conceptual framework will provide a succinct yet comprehensive overview of the subject matter being investigated. It will outline how each variable, independent and dependent, interacts within the scope of the study, informed by the research objectives and questions posed (Maxwell, 2013).

The main purpose of the study is to examine the factors affecting the quality of large-scale infrastructure construction projects. The primary dependent variable in this study is the Quality of large-scale infrastructure Construction Project. This refers to the extent to which the project meets defined standards and specifications, achieves its goals within the projected timescale and satisfies stakeholder requirements. Independent variables are the factors that are presumed to influence the quality of the project. Each independent variable may have a direct or indirect impact on the project's quality outcomes. Labor Performance, Contract Administration, and Project Management Practice are the independent variables.

Figure 1: Conceptual Framework of the study



The conceptual framework serves as the basis for generating specific, testable hypotheses that are essential for empirical investigation. Overall, the study hypothesis is presented as follows:

H1: Labor Performance has a positive and significant effect on the Quality of the Project.

H2: Contract Administration has a positive and significant effect on the Quality of the Project.

H3: Project Management Practice has a positive and significant effect on Quality of the Project.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1. Study Site

The study site is Addis Ababa Bole International Airport. It is located in the Bole Addis Ababa, Ethiopia. Haile Selassie I International Airport was the former name of the airport. It serves as the primary hub for Ethiopian Airlines, which offers nonstop service to Asia, Europe, North America, and South America in addition to destinations within Ethiopia and across the African continent. The Ethiopian Aviation Academy is based out of the airport as well. With over six million passengers served annually with airlines from throughout Africa, the Middle East, and Europe, the airport is the busiest in the nation and among the busiest and best in Africa.

Passengers from different countries prefer to use Ethiopian Airlines, and as a result, the number of passengers or demand is increasing day by day. In order to facilitate and cope up with the vastly increasing number of passenger's airport expansion project is crucial among other things. The current airport was built in 2003 with a 20-year passenger capacity in mind, however after only ten years, it reached its limit. Therefore, to facilitate for the coming 20 years, Ethiopian Airport Group (EAG) initiated a project called "The Construction of Addis Ababa Bole International Airport Terminal 1 and 2 Expansion and New VIP Terminal" in 2015 G.C. the project started on January 2015 and today, the project is almost completed.

3.2. Study Design

This study utilized both descriptive and explanatory research design to analyze the collected data. Descriptive research is a scientific method which aims to describe characteristics of the population or phenomenon being studied. Descriptive research used to identify patterns or trends in a situation but not to determine a clear cause-and-effect relationship. Explanatory research is a research methodology that delves into the underlying reasons behind an occurrence when there is insufficient information available. According to Tegan George & Julia Merkus (2021), explanatory research helps improve understanding of a particular topic, investigates the mechanisms or reasons behind a specific phenomenon, and aids in predicting future events.

3.3. Study Approach

This study adopted a quantitative research method to gain a comprehensive understanding of the factors influencing the quality of large-scale infrastructure projects at the Ethiopian Airports Group (EAG). Quantitative data is systematically collected through structured questionnaires, ensuring meticulous data gathering. The collected data undergo rigorous analysis using descriptive statistics, inferential statistics, cross-tabulation tables, and percentages. Through quantitative methods, this study aims to offer a holistic and nuanced understanding of the factors influencing the quality of large-scale infrastructure projects at the Ethiopian Airports Group.

3.4. Source of Data

Both primary and secondary data sources are utilized. Primary data collection method utilizes a structured questionnaire to gather data directly from project managers and selected stakeholders. This approach allows targeted data collection from key individuals involved in the projects, providing insights from those directly engaged in the activities. The questionnaires are designed to elicit specific information relevant to the research objectives, ensuring consistency in data collection. Project managers and stakeholders identified as crucial sources of information are approached to participate in the data collection process. Secondary data collection sources are reports, journals, and other published materials related to the project or relevant to the research topic. Secondary data sources offer valuable context, background information, and supplementary data that can enrich the analysis and provide a broader perspective. Relevant reports, academic journals, industry publications, and official documents are identified and reviewed to extract pertinent information. Information obtained from secondary data sources are critically analyzed to complement and validate the findings from the primary data collection process. Through combining both primary and secondary data sources in the research process, a more comprehensive and robust datasets are constructed. The use of structured questionnaires for primary data collection ensures direct insights from key stakeholders, while secondary sources enrich the analysis with additional context and background information gathered from reports and journals.

3.5. Target population of the Study

The target population for this study includes a total of 85 individuals who hold top management positions in the construction company, subcontractors, as well as employees from contractor side,

consultants, and project owners or clients within the Ethiopian Airport Group (EAG). The study specifically focusses on respondents who are actively involved in the Addis Ababa Bole International Airport Expansion Project. This diverse group of stakeholders are selected to provide a comprehensive perspective on the factors affecting the quality of the airport expansion project and to gather insights from key decision-makers and participants involved in the project planning, execution, and oversight. By targeting individuals with direct involvement in the project, the study captured a range of perspectives and experiences related to the project quality outcomes.

In addition, given the small size of the total population, this study adopted a census approach to encompass all individuals who hold top management positions and relevant to the project.

Characteristics of the Population:

- Total number of stakeholders who hold top management in this project: 85
- Demographic Breakdown;
 - Clients: The owner of the project, Ethiopian Airport Group, specifically the construction department responsible for the project.
 - Consultants: DAR Al-Handasah, an international consulting company based in Beirut, serves as the consultant for the project.
 - Contractors: The contractor for the project is the Chinese construction firm called China Communication Construction Company (CCCC).

3.6. Methods of Data Collection

This Study utilized both primary and secondary data collection methods to effectively investigate the factors affecting the quality of Addis Ababa Bole International Airport Expansion projects within the Ethiopian Airport Group (EAG). Primary data, obtained through field research, collected using a well-structured questionnaire developed based on the initial identification of key factors affecting project quality. The questionnaire aimed to gather insights on various aspects including the respondent's role in construction, their experience in the industry, and the influence of factors such as labor performance, contract administration and project management practice.

The questionnaires are distributed to stakeholders directly involved in construction projects at Addis Ababa Bole International Airport, including contractors, clients/owners, and consultants.

By targeting these specific groups, the study aims to capture a diverse range of perspectives and experiences related to the quality of construction projects within the airport group.

In addition to primary data collection, secondary data are gathered through a comprehensive review of relevant literature. This secondary data provided valuable insights and background information to support and enrich the findings obtained through primary data collection. By combining both primary and secondary data sources, the research gained a holistic understanding of the factors affecting the quality of large-scale infrastructure projects.

3.7. Method of Data Analysis

This study adopted an explanatory research design complemented by a quantitative methodology for data collection and analysis. Through using this method, the research yielded a multifaceted perspective on the factors impacting the quality of large-scale infrastructure projects within the Ethiopian Airport Group.

This study employed both descriptive and inferential statistics for data analysis. Descriptive statistics, such as frequencies, percentages, mean, and standard deviation, are employed to summarize and characterize the quantitative data obtained from the questionnaires. These statistical methods helped organize, condense, and present the raw data effectively using numerical values, tables, charts, and graphs (Texas State, 2005). Upon receiving completed questionnaires from participants, each are assigned reference numbers and grouped for analysis. This systematic approach assists researchers in understanding the distribution of data points and drawing meaningful insights from the collected information. Inferential statistics, such as correlation and regression analysis, are conducted to investigate relationships between variables. The analyzed data are presented in tables and charts to facilitate interpretation and comprehension.

3.8. Reliability and validity analysis

3.8.1. Reliability test

Reliability is concerned with the consistency of the measurements obtained and their freedom from error, thereby ensuring dependable results are yielded consistently across the study. Reliability is operationally defined as the internal consistency of a scale, which measures how homogeneously the items on the scale reflect the construct they are supposed to measure. In this study, the

reliability of the variables within the research instrument are determined using Cronbach's alpha. This statistical coefficient is widely used to assess the internal consistency of a scale. Zikmund (2010) suggests that a Cronbach's alpha coefficient ranging from 0.6 to 0.7 is indicative of fair reliability. This high level of reliability signifies that the collected data is consistent and can be confidently utilized for subsequent analyses, which will include regression analysis to distinguish the relationships among the variables.

Table 1: Reliability Test for Variables

No	Variables	Cronbach's alpha	Status
1	Labor Performance	0.781	Acceptable
2	Contract Administration	0.729	Acceptable
3	Project Management Practice	0.709	Acceptable
4	Quality of the project	0.701	Acceptable

The above table 1 shows that, the Cronbach's Alpha values of independent and dependent variables are greater than the threshold value of 0.7. Therefore, all variables have acceptable reliability.

3.8.2. Validity Test

Validity refers to the extent to which the methods utilized for data collection accurately measure the intended variables. According to Saunders (2003), it is essential for ensuring that the research findings are reflective of reality. To ensure the content validity of the study, the input and verification from experts and officials involved in the Addis Ababa Bole International Airport Expansion Project are pursued. Additionally, pilot testing of questionnaires was conducted to obtain feedback from the respondent on validity and responses were collected and questionnaire were adjusted with the consultation of this thesis advisor.

3.9. Ethical Considerations

Ethical considerations are important in this research study. Prior to engaging participants, informed consent is diligently sought, ensuring that individuals fully understand the purpose of the study, their role in it, and the potential implications of their participation. This process involved providing

clear and comprehensive information about the research objectives, procedures, and expected outcomes, allowing participants to make an informed decision about their involvement.

Furthermore, stringent measures also implemented to safeguard the confidentiality of all data collected during the study. This includes securely storing all information in compliance with data protection regulations and ensuring that only authorized personnel have access to the data. Any personal or sensitive information obtained from participants anonymized to protect their identities and maintain their privacy.

CHAPTER FOUR DATA ANALYSIS, INTERPRATION AND DISCUSSION

4.1. Introduction

This chapter outlines the various approaches, techniques, and processes adopted to examine, depict, and analyze the data gathered through questioner survey. This includes an in-depth discussion on the analysis of quantitative data, the utilization of cross-tabulation tables, percentage calculations, and specific statistical tests employed to determine the factors affecting the quality of large-scale infrastructure construction projects and specifically focusing on Addis Ababa Bole International Airport Expansion Project.

4.2. Response Rate

An examination of the response rate was carried out to ascertain the number of participants who completed and returned the questionnaires. As shown in Table 2, data from 77 respondents was collected and deemed valid for use. These respondents constituted approximately 90% of the total population.

The study achieved a response rate of 90%, which was taken as outstanding. This response rate far exceeds the minimum threshold of 30-50% suggested by Mugenda and Mugenda (2003) for generalizing the characteristics of a study problem based on the views of a subset of respondents in the target population.

Therefore, the study deemed the 90% response rate as suitable for analyzing the influencing factors of large-scale infrastructure construction project quality in the selected Addis Ababa Bole International Airport. This high response rate indicates that the data collected is representative of the views of the target population and that the findings of the study can be generalized to the wider population of interest.

Table 2: Response rate

Population	Valid Response	Response Rate (%)
85	77	90%

4.3. Demographic Information of Respondents

Table 3: Demographic Information of Respondents

Demographic characteristics		Frequency	Percentage
Gender	Male	51	66
	Female	26	34
Age	21-30	20	26
	31-40	30	39
	41-50	21	27.3
	51 and above	6	7.8
Education	Secondary school	0	0
	Diploma	0	0
	Degree	53	68.8
	Masters and above	27	31.2
Work experience	Below 3 years	6	7.8
	3-6 years	12	15.6
	6-9 years	25	32.5
	Above 9 years	34	44.2

The above table 3 illustrates the demographic information of respondent. As shown in the table above, there is a diverse age range of participants and this significantly enriches the study quality and relevance. It ensures broader generalizability of the findings, embraces a wider spectrum of life experiences, and captures varied perspectives. This diversity allows for the identification of age-related patterns and trends, adds depth to cross-generational understanding, and increases the inclusivity of the research. Moreover, it mitigates age-related bias, thereby enhancing the reliability and applicability of the results. In addition, the survey population is composed of highly educated respondents and highly educated respondents offer several advantages, including increased response quality, reduced bias, greater generalizability, and deeper insights. They are more likely to provide thoughtful, well-reasoned responses, and to be aware of potential biases, which contribute to more reliable, valid, and insightful research findings. Furthermore, the survey

participants are predominantly individuals with considerable experience. This experienced cohort brings numerous benefits to the research, such as specialized expertise, informed responses, dependable data, and enhanced representativeness. Their contributions are likely to yield profound insights and viewpoints, thereby bolstering the credibility and authenticity of the research outcomes

4.4. Descriptive Statistics

Descriptive statistics encompass the techniques used to summarize, represent, and simplify data in a meaningful way, making it more accessible and understandable. Given that raw data, particularly in large quantities, can be dense and difficult to analyze directly, descriptive statistics provide essential tools for data interpretation. These tools include measures of central tendency like mean and median, measures of spread such as range and standard deviation, and graphical representations like histograms and box plots. By applying descriptive statistics, researchers can distill large datasets into concise, insightful summaries, which serve as a foundation for further statistical analysis and allow for clearer communication of the data's key features and trends.

Within the scope of this study, three key elements have been identified as influential in determining the quality of large-scale infrastructure projects, specifically within the Ethiopian Airport Group Addis Ababa Bole International Airport expansion project. These influential factors are the performance of laborers, contract administration, and project management practices. Together, these factors make up a comprehensive model consisting of 37 distinct items that collectively aim to measure and explain how each element contributes to the overall quality of construction within the context of the airport expansion project.

To assess the participants' attitudes towards the discussed variables, the study utilized descriptive statistical methods, specifically calculating the mean and standard deviation of responses. The mean provides an average value, reflecting the agreement level within the respondent regarding their agreement or disagreement with a set of statements. According to Best (1987), the interpretation of the mean is stratified on a scale: a mean between 1.00 and 1.80 signifies strong disagreement; 1.81 to 2.60 indicates disagreement; 2.81 to 3.40 suggests a neutral stance; 3.41 to 4.20 conveys agreement; and 4.21 to 5.00 denotes strong agreement.

In addition to the mean, the standard deviation is used to measure the dispersion of responses around the mean, indicating how much consensus there is within the group. A smaller standard deviation suggests that respondents' perceptions are closely clustered around the mean, showing high agreement, whereas a larger standard deviation indicates a wider range of opinions. Typically, a standard deviation value between -2 and 2 suggests the responses are relatively close to the mean, considered more reliable, whereas values beyond this range indicate greater disparity and potentially less reliable measurements. This layered analysis allows for a detailed understanding of the respondent viewpoints, shedding light on the collective perception as well as individual variations within the responses.

4.4.1. Labors Performance and Quality of the project

To evaluate the perceptions of respondents involved in the expansion project regarding the impact of labor performance on large scale infrastructure construction projects quality, a five-point Likert scale was employed during the survey. On this scale, a score of 1 signifies 'strongly disagree,' 2 represents 'disagree,' 3 stands for 'neutral,' 4 means 'agree,' and 5 corresponds to 'strongly agree' (SA). Analytical statistics, namely the mean (M) and standard deviation (SD), were computed to ascertain both the average response and the variability within the responses. The findings from this statistical analysis are detailed in Table 6.

Table 4: Labors performance and quality of the project

Descriptive Statistics			
	N	Mean	Std. Deviation
The technical qualifications of the labor force are directly proportional to the structural quality of this project	77	2.95	0.999
On-site trainings have been provided to the labor force	77	2.04	0.342
The training provided to the labor force specifically addresses the quality standards required for this project	77	2.00	0.429

The level of competency among the workers positively affects the adherence to quality standards in this project	77	2.81	1.064
The labor force professional qualifications, such as certifications or past project experience, are aligned with the detailed specifications of this project	77	3.03	0.986
The communication between project management and the labor force effective in clarifying quality expectations and tasks	77	2.82	0.983
The project has a system in place for monitoring and evaluating labor performance in relation to quality objectives	77	2.38	0.946
Labor performance issues are frequently arisen, and addressed.	77	2.45	0.994
The cultural and verbal diversity of the workforce affect project communication and quality outcomes.	77	2.55	0.940
Grand mean		2.56	

The table 4 above shows that, the mean score for every variable falls between 2.00 and 3.03, suggesting that most respondents agree that these elements are critical to guaranteeing the project quality. The descriptive statistics that have been collected indicate a state of uncertainty about the labor force's influence on the quality of the project. Although the respondents are not entirely in agreement, they do tend to believe that the quality of the project is correlated with the technical qualifications of the labor force. On the other hand, it appears that everyone agrees that on-site training is inadequate, with most respondents feeling that it falls short of the project's quality requirements. There is not much of agreement when it comes to opinions on whether professional credentials should match project specifications or if management and labor should communicate effectively.

On the other side, there is a general disagreement about the presence of an effective system to monitor labor performance and the frequency and adequacy with which labor performance issues are addressed. Additionally, perceptions are slightly negative regarding the impact of workforce diversity on communication and quality outcomes, hinting at some concerns in this area. Across these dimensions, while there is some agreement, opinions vary significantly, as reflected in the relatively high standard deviations. This suggests that while certain labor-related factors are acknowledged as impacting project quality, views on their effectiveness and implementation are mixed. Overall, the grand mean indicates that the overall perception of the respondents, on average, lean towards neither agreeing nor disagreeing, or are slightly closer to disagreeing with the positive statements about the labor performance influencing project quality.

4.4.2. Contract administration and quality of the project

Table 5: Contract administration and quality of the project

Descriptive Statistics			
	N	Mean	Std. Deviation
Regular and thorough monitoring of contractual obligations by all parties were implemented for the project	77	2.84	0.889
Does the contracts for this project detailed and clear enough to ensure that all parties are aware of and can adhere to the quality requirements	77	3.97	0.228
The established conflict resolution mechanisms have been necessary to preserve the agreed-upon quality standards of this project	77	3.35	1.061
The contract administrators for the project have been proactive in preventing and managing potential conflicts that might affect project quality	77	2.48	1.008
The precision and thoroughness of project documentation, such as reports and compliance	77	3.42	0.978

records, played a critical role in achieving this project quality objectives			
The project contract administrators successfully enforced compliance with quality control procedures	77	2.19	0.708
The contract administration practices were sufficient enough in mitigating delays and noncompliance that could affect this project quality	77	2.30	0.828
Grand mean		2.94	

The above table 5 shows that, a mean score that is close to the midpoint of 2.48 and a reasonably low standard deviation of 0.889 show that respondents had a neutral view on the regular and thorough monitoring of contractual obligations. Contract clarity and specificity are rated higher, with a mean score of about 4, indicating agreement on their sufficiency, and a very low standard deviation of 0.228, indicating broad agreement.

On the other hand, there is a slight agreement on the effectiveness of conflict resolution mechanisms, although with a considerable spread in responses, pointing to diverse opinions. The respondents' views on the proactiveness of contract administrators and the enforcement of quality control procedures tend toward disagreement, with moderately high standard deviations highlighting varied perceptions. While there is general agreement on the importance of precise and thorough project documentation, the variability of opinions is notable. Similarly, there is a lean towards disagreement on whether contract administration practices effectively mitigated delays and noncompliance, with a moderate level of disagreement reflected in the responses. In summary, while certain aspects of contract administration like the clarity of contracts are well-regarded, other areas such as proactiveness and enforcement of quality control show less satisfactory perceptions among respondents. The overall perception of the respondent shows there is considerable room for improvement, even though there are areas of contract administration that are seen positively, as indicated by the grand mean, which is just below 2.94.

4.4.3. Project management practice and quality of the project

Table 6: Project management practice and quality of the project

Descriptive Statistics			
	N	Mean	Std. Deviation
The project management strategies in place are adequately designed to meet the project quality benchmarks	77	3.81	0.608
The project management strategies been effectively implemented to maintain the project quality benchmarks	77	2.49	0.868
The application of project management strategies ensured that the project milestones for this project are achieved on schedule	77	2.92	1.061
The project management strategy ensured quality control at all stages of this project	77	2.58	0.833
The project management team facilitated communication and coordination in a manner that directly influences the project to meet its established quality goals	77	2.91	0.920
The comprehensive quality management plan in place is regularly updated and followed by this project management team	77	2.48	0.982
The comprehensive quality management plan in place is regularly updated and followed by this project management team	77	3.83	0.801
The decision-making processes within project management were transparent, includes all stakeholders and conducive to maintaining high-quality standards	77	3.04	0.952

The communication practices between different teams and departments positively affected the quality of this project	77	2.27	0.719
The project management team used performance metrics or quality indicators effectively to guide the project towards its quality objectives	77	2.48	0.982
Grand mean		2.88	

The above table 6 shows that a varied perception among respondents regarding the effectiveness of project management strategies in reaching quality benchmarks for a particular project. Respondents largely agree that project management strategies were adequately conceptualized, as reflected by a mean score indicative of agreement and a low standard deviation that points to a consistent viewpoint across the board. Additionally, there is some consensus that the project management team successfully provided clear and attainable quality goals, with a moderate level of agreement and a low standard deviation implying uniformity in this positive assessment.

In other hand, there is visible skepticism about the actual implementation of these strategies, with the mean scores suggesting a tilt towards disagreement and moderate standard deviations indicating a range of opinions. This skepticism extends to the efficacy of the quality control throughout all project stages, the regular updating and adherence to the quality management plan, and the use of performance metrics to steer the project towards its quality objectives areas in which respondents' views were more mixed or negative. The statistics also reveal mixed sentiments on whether project milestones were met on schedule and whether decision-making processes were transparent, with slight agreements overshadowed by the variability in responses, demonstrating the diverse experiences and observations of the respondents involved in the project. The overall perception of the respondent shows there is considerable room for improvement, even though there are areas of project management strategy that are seen positively, as indicated by the grand mean, which is 2.88.

4.4.4. Quality of the project

Table 7: Quality of the project

Descriptive Statistics			
	N	Mean	Std. Deviation
The comprehensive quality planning at the outset of the project has directly contributed to its high-quality outcome	77	3.47	1.059
The project meets the intended performance requirements, such as functionality and efficiency.	77	3.16	0.919
The project closely adheres to the design specifications and construction standards.	77	2.44	0.819
The completed infrastructure performs reliably over time, as expected, such as durability of finishing materials and MEP systems	77	2.32	0.715
The project is completed within the scheduled time frame	77	1.99	0.344
Project time management was efficient and contributes positively to the overall project quality	77	2.03	0.280
The visual appeal and design aesthetics of the project align with the intended design vision	77	3.19	0.960
The effectiveness of the quality control procedures and corrective actions taken in response to quality control findings significantly influenced the final quality of the project.	77	2.22	0.737
Effective communication of the quality objectives and standards was a key driver in achieving the desired quality levels of the project	77	2.58	0.848
The project completed with a high level of workmanship	77	2.27	0.700

Stakeholders are satisfied with the overall quality of the project	77	2.79	0.922
Grand mean		2.58	

The above table 7 shows a complex picture of respondents' perceptions on the quality aspects of a project. There is a general consensus that effective quality planning at the start of the project played a key role in achieving a high-quality outcome, as indicated by a mean score leaning towards agreement. The visual appeal and design also receive a favorable sign, with respondents agreeing that the aesthetics met the intended vision, though opinions vary to some extent. However, the data also point to areas of concern, particularly with the project's adherence to specifications and the effectiveness of quality control measures, where the mean scores tend toward disagreement, suggesting some dissatisfaction.

Furthermore, a significant area of agreement among respondents is the project failure to complete within the scheduled timeframe, underscored by a low mean score and a small standard deviation which implies a broad consensus on this shortfall. The standard deviation generally indicates a mix of views, reflecting a spectrum of experiences and assessments of the project's time management efficiency, the reliability of the infrastructure over time, and the level of workmanship delivered. Communication of quality objectives and stakeholder satisfaction with the overall quality of the project garnered mixed reactions, reflecting the diversity in stakeholders' expectations and perceptions.

Overall, the statistics show that while there is some agreement on the quality planning and design aesthetics aligning with the vision, there is apparent disagreement or neutrality about the project adhering to specifications, quality control effectiveness, and level of workmanship. Notably, there is strong consensus on the project not meeting its scheduled timeframe.

The overall perception of the respondents on the project overall quality is somewhat below expectations, as indicated by the grand mean of 2.58. The average insight of the respondents does not fully convey satisfaction with the project quality, rather, it indicates that, despite the presence of some satisfying parts, there are significant areas that did not match the expected standards and need improvement.

4.5. Inferential statistics

4.5.1. Correlation analysis

Correlation analysis is a statistical method used to measure and describe the direction and strength of the relationship between variables. In this research, the Pearson correlation coefficient, symbolized by 'r', is employed to determine the association between different pairs of variables. This coefficient can vary from -1 to +1, where -1 represents a perfect negative linear correlation, +1 indicates a perfect positive linear correlation, and a value of 0 signifies the absence of any linear relationship.

This study utilizes Pearson's correlation coefficient to examine the relationships between several key variables: labor performance, contract administration, project management practices, and the overall quality of the project. Pearson's correlation coefficient 'r' is used as a parametric index to gauge the strength of the linear association between two continuous variables. As defined by Cohen (1988), an 'r' value ranging from 0.10 to 0.29 is considered to reflect a weak correlation, 0.30 to 0.49 suggests a moderate correlation, and a value from 0.50 to 1.0 denotes a strong correlation between variables. It is important to remember that a correlation, irrespective of its strength, does not imply causation. Further analysis using different statistical techniques is necessary to investigate any causal links between variables.

Table 8: Correlation analysis

Correlations					
		Labor Performance	Contract Administration	Project management Practice	Quality of the Project
Labor Performance	Pearson Correlation	1	.316**	.294**	.494**
	Sig. (2-tailed)		.005	.009	.000
	N	77	77	77	77
Contract Administration	Pearson Correlation	.316**	1	.503**	.561**
	Sig. (2-tailed)	.005		.000	.000
	N	77	77	77	77

Project management Practice	Pearson Correlation	.294**	.503**	1	.615**
	Sig. (2-tailed)	.009	.000		.000
	N	77	77	77	77
Quality of the Project	Pearson Correlation	.494**	.561**	.615**	1
	Sig. (2-tailed)	.000	.000	.000	
	N	77	77	77	77
**. Correlation is significant at the 0.01 level (2-tailed).					

The Above table 8 presents Pearson correlation coefficients, which measure the linear relationship between pairs of variables. The significance levels (p-values) indicate whether the correlations are statistically significant.

Labor Performance and Quality of the Project (r = .494): There is a moderate positive correlation between labor performance and the quality of the project, which is highly statistically significant ($p < .001$). This suggests that better labor performance is associated with higher project quality.

Labor Performance and Contract Administration (r = .316): There is a positive correlation between labor performance and contract administration, which is statistically significant ($p = .005$). This indicates that improvements in labor performance are related to better contract administration.

Labor Performance and Project Management Practice (r = .294): A positive correlation exists between labor performance and project management practice, which is also statistically significant ($p = .009$). This suggests that better labor performance is associated with more effective project management practices.

Contract Administration and Quality of the Project (r = .561): A strong positive correlation is observed between contract administration and the quality of the project, and it is highly significant ($p < .001$). This indicates that effective contract administration is closely linked to the achievement of a higher quality project.

Contract Administration and Project Management Practice ($r = .503$): There is a strong positive correlation between contract administration and project management practice, which is highly significant ($p < .001$). This suggests that effective contract administration goes hand-in-hand with robust project management practice.

Project Management Practice and Quality of the Project ($r = .615$): The strongest positive correlation in the matrix is between project management practice and the quality of the project, with a very high level of significance ($p < .001$). This suggests that the better the project management practices, the higher the quality of the project.

The above analysis suggests that there is a significant positive relationship between labor performance, contract administration, project management practices, and the overall quality of the project. The strongest relationship is between project management practices and project quality, indicating that the way a project is managed may have the most substantial influence on its success.

4.5.2. Regression Analysis

4.5.2.1. Assumption test of regression model

Thornhill & Saunders (2009) state that certain conditions must be satisfied when formulating a regression equation, including normality, homoscedasticity, and the absence of multicollinearity. To ensure that the analysis is both reliable and valid, the researcher has rigorously verified these essential prerequisites.

4.5.2.1.1. Normality test

According to Thornhill & Saunders (2009), before conducting regression analysis, it's crucial to determine the distribution of the dataset's numerical variables. A conventional approach for assessing this distribution is to create a histogram. A histogram that leans towards the left, with a longer tail extending to the right, signals a positive skew in the data. Conversely, a skew is negative if the tail stretches to the left. When the data show an even distribution on both sides of the mode, the distribution is considered symmetrical. One particular form of symmetrical distribution, depicted as a bell-shaped curve on a histogram, is known as a normal distribution. Multiple regression analysis operates under the assumption that the involved variables are normally distributed.

Figure 2: Histogram for Normality Test

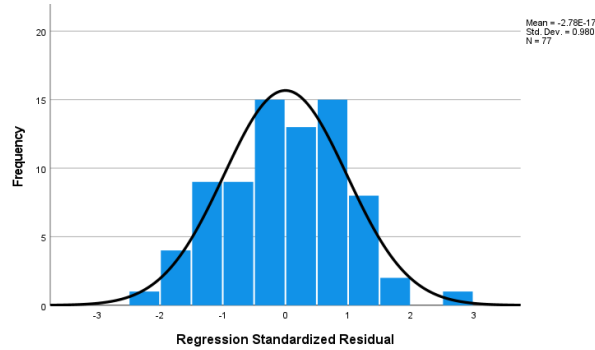


Figure 2 shows a histogram that takes the form of a bell-shaped curve, indicative of a normal distribution. The visual representation of the data through the histogram suggests that the values are distributed in a manner that is consistent with the properties of a normal distribution, albeit with some slight deviations. This moderate conformity to normality implies that the underlying conditions necessary for certain statistical analyses are met. As a result, the data can be considered appropriate and reliable for analytical purposes that assume normality, such as various parametric tests and regression analyses.

Figure 3: Normality Test Plot

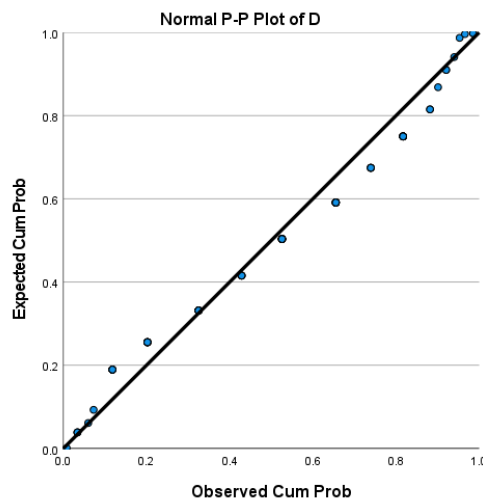


Figure 3 shows that the dataset seems to follow a normal distribution, as evidenced by its adherence to the diagonal line in the plot. The lack of any noticeable nonlinear patterns suggests that the dispersion of data points closely aligns with what one would expect from a normally distributed

set. Consequently, this adherence to normality supports the conclusion that the dataset is well-suited and adequately prepared for further analysis.

4.5.2.1.2. Multicollinearity test

In regression analysis, multicollinearity occurs when the independent or explanatory variables exhibit a high degree of correlation with each other. This strong correlation tends to dilute the individual predictive capability of each variable due to shared variance among them. Such redundancy can complicate the assessment of each independent variable's distinct contribution to the dependent variable. It may also lead to unreliable and fluctuating coefficient estimates within the regression model. Hence, identifying and addressing multicollinearity is a vital step in the development of a robust regression model.

Typically, two metrics are utilized to detect multicollinearity in regression analysis: the tolerance value and the variance inflation factor (VIF). A tolerance value that is very low (at or below 0.10) or a VIF value that is significantly high (10 or greater) signals the presence of substantial collinearity among the predictor variables.

Table 9: Multicollinearity Test

Coefficients			
Model		Collinearity Statistics	
		Tolerance	VIF
	Labor Performance	.876	1.142
	Contract Administration	.716	1.396
	Project management practice	.727	1.376
a. Dependent Variable: Quality of the project			

The above table 9 shows that the collinearity statistics for the three variables Labor Performance, Contract Administration, and Project Management Practice do not exhibit signs of multicollinearity. The tolerance levels for each of these predictors exceed the minimum benchmark of 0.10, and the VIF scores are comfortably below the cautionary level of 10. This suggests that

the predictors are sufficiently independent and each provides a unique contribution to the predictive power of the regression model concerning the Quality of the Project.

4.5.2.1.3. Homoscedasticity test

Homoscedasticity is an essential assumption in linear regression analysis, which mandates that the variance of error terms should remain constant across all levels of predictor variables. That is, the difference between actual and forecasted values of the dependent variable ought to stay relatively uniform regardless of the predictor values. Verification of this assumption typically involves plotting the standardized residuals against the predicted values. A pattern less dispersion of data points around the zero line would suggest homoscedasticity. Conversely, a discernable trend in the spread of residuals either widening or narrowing would indicate heteroscedasticity. The presence of heteroscedasticity can undermine the precision and dependability of regression coefficients, complicating the assessment of how each predictor variable separately impacts the outcome.

Figure 4: Homoscedasticity test

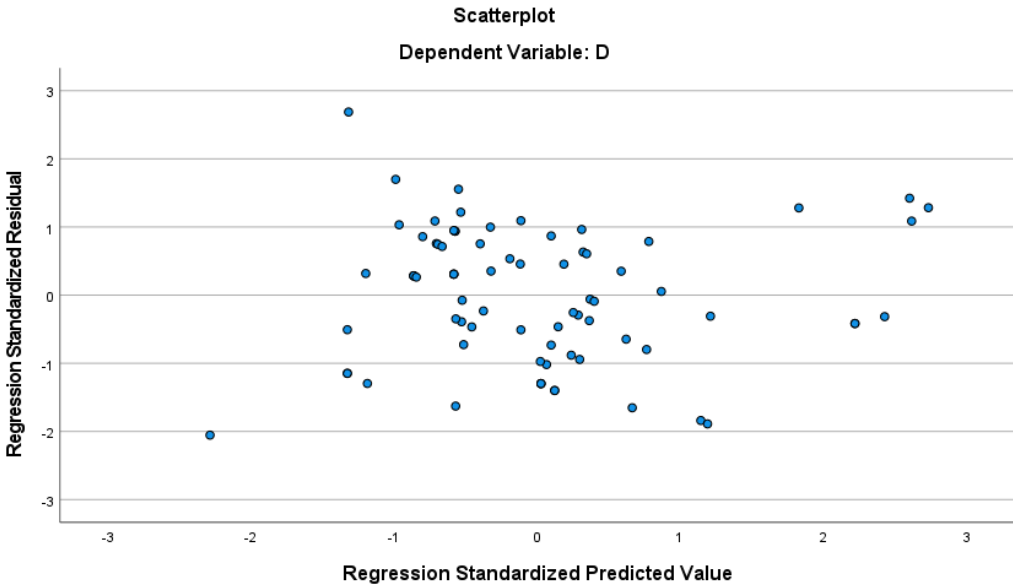


Figure 4 shows an even distribution of residual values without the formation of any distinct pattern, pointing to an absence of heteroscedasticity issues within the dataset.

Therefore, given the successful verification of key assumption tests including normality, multicollinearity, and homoscedasticity it can be conditional that there are no significant issues

with the data that would compromise the underlying assumptions required for multiple regression analysis. This leads to the conclusion that the assumptions necessary for a valid multiple regression have not been notably breached.

4.5.3. Multiple linear regression analysis

Multiple Regression Analysis is a statistical method used to understand how a dependent variable is affected by two or more independent variables. This approach expands upon the principles of linear regression, where only a single predictor variable is related to the dependent variable. In multiple regression, a more complex relationship is examined as multiple independent variables concurrently contribute to variations in the dependent variable.

4.5.3.1. Model Summary

Table 10: Model Summary

Model Summary					
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.734 ^a	.538	.519	3.121	1.485
a. Predictors: (Constant), Project management practice, Labor Performance, Contract Administration					
b. Dependent Variable: Quality of the project					

The above table 10 shows a substantial link between the "Quality of the Project" as the dependent variable and a set of independent variables, namely "Project Management Practice," "Labor Performance," and "Contract Administration." The value of R, at 0.734, reveals a high level of correlation between the model's predicted values and the actual quality of the project, implying the model's strong predictive ability. An R Square value of 0.538 means that the model accounts for approximately 53.8% of the variability in the project quality, suggesting a decent fit between the model and the observed data.

The Adjusted R Square, sitting at 0.519, provides a more nuanced estimate by adjusting for the number of predictors, indicating that just over half of the project quality variance is captured by the model. This makes the Adjusted R Square a more dependable measure of fit, particularly when

comparing models with varying numbers of predictors. The Standard Error of the Estimate is 3.121, which quantifies the typical deviation of the observed values from the predicted ones, and although there is some degree of prediction error, it's relatively modest, further attesting to the model's practical applicability. Taken together, these statistics underscore the model's statistical significance and its appropriateness for the data at hand.

4.5.3.2. ANOVA Model

Table 11: ANOVA Model

ANOVA						
Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	829.645	3	276.548	28.384	.000 ^b
	Residual	711.238	73	9.743		
	Total	1540.883	76			
a. Dependent Variable: Quality of the project						
b. Predictors: (Constant), Project Management Practice, Labor Performance, Contract Administration						

The above table 11 shows an F-statistic of 28.384, derived from dividing the Mean Square Regression by the Mean Square Residual, which signifies the model's overall fit. A high F-value in conjunction with a p-value of 0.000 indicates that the regression model is statistically significant, meaning the likelihood that these results could occur by chance is very low. Therefore, the combination of the three predictors Project Management Practice, Labor Performance, and Contract Administration provides a significant contribution to predicting the Quality of the Project. This ANOVA result validates the model's effectiveness in explaining the variability in the dependent variable and suggests that these factors are indeed important determinants of project quality.

4.5.3.3. Model Coefficient

The unstandardized coefficient, also known as the raw coefficient, represents the slope of the regression line. It shows how much the dependent variable changes for a one-unit change in the independent variable, assuming that all other independent variables remain constant.

The p-value is a measure of the statistical significance of the relationship between the independent and dependent variables. It represents the probability of obtaining the observed results if there was no relationship between the variables. A low p-value (typically less than 0.05) indicates that the relationship is statistically significant, meaning that it is unlikely to have occurred by chance.

Table 12: Model Coefficient

Coefficients						
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	-.736	3.353		-.220	.827
	Labor Performance	.383	.111	.292	3.440	.001
	Contract Administration	.416	.144	.271	2.886	.005
	Project Management Practice	.463	.110	.393	4.216	.000
a. Dependent Variable: Quality of the Project						

The above table 12 shows that the regression analysis for the "Quality of the Project" dependent variable reveals statistically significant relationships with three key predictors. The unstandardized coefficient for "Labor Performance" is 0.383, meaning that a one-unit increase in labor performance is associated with a 0.383 unit increase in project quality, assuming other variables are held constant. This association is statistically significant, with a p-value of 0.001, suggesting a strong link between labor performance and project quality. "Contract Administration" also shows a positive and significant effect, with an unstandardized coefficient of .416 and a p-value of 0.005, indicating that better contract administration practices are expected to result in improved project quality. These results are underscored by their respective "t" values, which measure the number of standard deviations away from the null hypothesis, and their "Beta" values, which reflect the predictors' impact on project quality relative to each other. "Project Management Practice" emerges as the most influential predictor with an unstandardized coefficient of 0.463. With a p-value of less than 0.001, this predictor has a highly significant and the strongest relationship with

project quality among the variables studied. The positive coefficient indicates that as project management practices improve, there is a corresponding significant increase in the quality of the project.

Therefore, the regression analysis revealed that the labor performance, contract administration and Project Management Practice are significant predictors of Quality of the project. All predictors had a positive relationship with Quality of the project, indicating that an increase in these variables would result in an improvement in Construction Quality.)

From the above model coefficient, the following multiple regression model is determined.

$$\text{Performance (P)} = \beta_0 + \beta_1\text{ES} + \beta_2\text{SF} + \beta_3\text{SI} + \beta_4\text{SE} + e$$

$$P = -0.736 + 0.383 \text{ Labor Performance} + 0.416 \text{ Contract Administration} + 0.463 \text{ project management practice} + e$$

4.6. Hypotheses Testing

The regression model was employed to evaluate the hypotheses corresponding with the aims and inquiries of the research.

H1: Labor Performance has a positive and significant effect on the Quality of the Project.

H2: Contract Administration has a positive and significant effect on the Quality of the Project.

H3: Project Management Practice has a positive and significant effect on Quality of the Project.

Table 13: Hypothesis Test Result

Hypothesis Test Result				
Hypothesis	Coefficients	P-value	Results	Remarks
H1: Labor Performance has a positive and significant effect on the Quality of the Project.	0.383	0.001	Significant	Accepted
H2: Contract Administration has a positive and significant effect on the Quality of the Project.	0.416	0.005	Significant	Accepted

H3: Project Management Practice has a positive and significant effect on Quality of the Project.	0.463	0.000	Significant	Accepted
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4.7. Results Discussion

The main objective of this research was to examining the factor affecting the quality of large-scale infrastructure project. The case of Addis Ababa Bole International Airport Expansion Project. The research aimed to explore the impact of Labor Performance, Contract Administration, and Project Management Practice on the Quality of the Project. The findings from the regression analysis indicate that all three independent variables have a statistically significant positive impact on project quality. Labor Performance, with a coefficient of 0.383, demonstrates that the effectiveness of the workforce is a substantial factor in determining the outcome of a project. Moreover, the role of Contract Administration, reflected by a coefficient of 0.416, is proven to be a critical element in guiding projects towards successful completion. Additionally, Project Management Practice, showing the highest coefficient of 0.463, is identified as the most influential factor, suggesting that the application of effective project management methodologies is paramount in achieving high-quality results. Given the low p-values associated with each variable 0.001 for Labor Performance, 0.005 for Contract Administration, and less than 0.001 for Project Management Practice the research provides strong evidence to accept the hypotheses that these factors affect project quality. Therefore, it can be confidently concluded that thus factors are indeed key contributors.

CHAPTER FIVE

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.1. Introduction

This chapter summarizes the key findings, conclusions, and recommendations of the study. Based on the analysis, interpretation, and discussion of the data, the major findings were summarized in relation to the study's objectives. Conclusions and appropriate recommendations were then drawn from these findings, specifically addressing the three objectives of the study. The conclusions and recommendations aimed to provide insights and guidance based on the evidence gathered and analyzed in the study.

5.2. Summary of Findings

- The study focused on evaluating the impact of Labor Performance, Contract Administration, and Project Management Practice on the quality of large-scale infrastructure projects, specifically examining the Addis Ababa Bole International Airport expansion project. Data were collected from 77 high-level management professionals involved in the project and analyzed using descriptive and inferential statistics.
- There is a significant and positive correlation between all three factors (Labor Performance, Contract Administration, and Project Management Practice) and the quality of the project.
- Project Management Practice was identified as the most influential factor on project quality, indicating that effective project management practices have the highest potential to enhance project outcomes.
- The regression model explains 53.8% of the variance in project quality, showcasing its substantial explanatory power.
- The model validity is supported by its adherence to statistical assumptions of normality and homoscedasticity.
- Regression analysis pinpoints Labor Performance, Contract Administration, and Project Management Practice as significant predictors of project quality. Amongst these factors, project management strategy was the most significant predictor followed by labor performance and contract administration.

5.3. Conclusions

The research examines the factor affecting the quality of large-scale infrastructure construction project at Addis Ababa Bole International Airport expansion project. Through Utilizing an explanatory survey design, the study adopted a quantitative research method to gain a comprehensive understanding. Insights into the operational successes and obstacles are provided through primary data gathered from structured questionnaire surveys answered by 85 participants actively engaged in managing the airport expansion project. From the 85 participants, the response rate was 77 which is approximately 90%. This first-hand information complements the secondary data acquired from a thorough literature review, which places the empirical findings in a wider scholarly and industry framework for comprehensive analysis and comparison.

The study identifies three critical elements labor performance, contract administration, and project management practice that significantly affect the quality of large-scale infrastructure projects. These factors are found to be integral to the overall project quality.

Utilizing an extensive range of statistical tools, including descriptive and inferential statistic such as percentages, mean, standard deviation, correlation, and regression analysis, the study provides a thorough examination of the dynamics affecting large-scale infrastructure construction project quality. The analysis concludes that these three key factors are substantial determinants of project quality, as evidenced by their significant impact on the Addis Ababa Bole International Airport expansion project. Project management strategy emerges as the most influential factor followed by labor performance and contract administration.

The findings of this research underscore the importance of enhancing labor performance, refining contract administration processes, and strengthening project management strategy to improve the quality of large-scale infrastructure projects. The improvement of these three factors will lead to a better quality of the project. These key insights provide stakeholders with data-driven guidance for strategic and operational decision-making. The study conclusion has substantial relevance for the construction sector in Ethiopia and potentially in similar contexts elsewhere, establishing a solid groundwork for subsequent inquiries in this field. This paper adds valuable knowledge to the existing literature and presents practical implications for project management, serving as an evidence-based resource for organizations aiming to better their project results.

5.4. Recommendations

Based on the findings and conclusions of this study, the following recommendations are suggested to improve the quality of large-scale infrastructure project.

5.4.1. Recommendation for large scale infrastructure construction Project

- **Project Management Practices:** Adopting robust project management practices is essential. This involves consistent monitoring, providing feedback, and conducting evaluations to promptly detect and rectify any emerging issues within the project. Through the deployment of sound project management strategies, projects can be delivered on schedule and with the desired quality.
- **Developing labor performance:** Developing the construction workforce is essential for improving project outcomes. Regular training and development programs, coupled with evaluation and certification efforts, can enhance the workforce skills and expertise. Such initiatives are likely to decrease the occurrence of mistakes and defects, limit the need for reworks, and promote adherence to established standards and specifications. The culmination of these efforts is expected to result in enhanced quality across construction projects.
- **Contract Administration:** Effective contract administration is pivotal for successful project delivery. Strengthening this aspect entails drafting contracts that are straightforward and unambiguous, fostering efficient communication and coordination among stakeholders, and resolving disputes and claims promptly. Improvements in contract administration can help avert delays and cost overruns, as well as facilitate a more proactive approach to quality concerns, thereby safeguarding project standards.

These recommendations aim to enhance workforce skills, improve project coordination, and ensure effective project management, ultimately leading to improved project quality. If implemented, could significantly improve the quality of the expansion projects at Addis Ababa Bole International Airport. They could also serve as a model for other large-scale infrastructure construction projects in the region.

5.4.2. Recommendation for Future Studies

Large-scale infrastructure construction projects, including those like the Addis Ababa Bole International Airport, involve a myriad of elements that determine the quality of the project. While this research has shed light on the factors influencing quality and the specific challenges faced in such projects, further studies are encouraged to expand upon these findings. Future research directions should broaden the existing study's scope and introduce additional lines of inquiry to enrich the comprehension of airport construction complexities. These proposed streets for investigation are intended to refine and improve the outcomes of similar infrastructure projects.

Future studies could benefit from a comparative analysis across multiple airport construction projects, delving into various components like terminals, runways, and towers to unravel the distinct quality factors and challenges each presents.

Investigating the impact of governmental policies and regulations on the quality of airport construction in Ethiopia and across Africa could provide clarity on the broader influences shaping project outcomes.

Insights from case studies on successful airport projects in other continents could offer best practices and strategies that might be adapted to enhance local project quality in Ethiopia.

Finally, formulating a quality management framework tailored for airport construction, alongside stakeholder surveys on perceptions and satisfaction, could serve as a blueprint for quality enhancement and strategic planning in future projects.

In conclusion, this research has laid the groundwork for further exploration into the quality of airport construction projects. Comparative studies could dissect various aspects of different airport projects, providing a nuanced understanding of quality determinants in each area. Exploring these research pathways offers the potential to enrich the current understanding of large-scale infrastructure construction project quality, delivering valuable information for those in the field. By blending elements of project management, quality control, and policy analysis, these studies could pave the way for interdisciplinary inquiry. The insights gained hold the promise to guide policy decisions, enhance project planning and execution strategies, and ultimately foster better project results.

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APPENDICES

Appendix I Survey Questionnaire

Survey questionnaire to be filled by participants

Dear Valued Participant,

Greetings,

My name is Girum Worke, and I am currently in my final year at Addis Ababa University's College of Business and Economics, School of Commerce, pursuing a master's degree in Project Management. I am undertaking a research study entitled "Factors affecting the Quality of large-Scale Infrastructure Project: The Case of Addis Ababa Bole International Airport Expansion Project." The focus of this study is to critically analyze the impact of labor performance, contract administration, and project management strategy on the quality of construction at the Addis Ababa Bole International Airport Expansion Project.

Your participation in this study is highly important. By sharing your honest feedback through the enclosed questionnaire, you will be contributing valuable insights that can enhance the field of construction project management. Please be assured that your responses will be treated with the utmost confidentiality and used solely for academic purposes.

Should you have any inquiries or require further clarification about the questionnaire or the study itself, do not hesitate to reach out to me. Your suggestions are also warmly welcomed and will be greatly appreciated.

I extend my deepest gratitude for your time and input, which are indispensable to the success of this research.

Sincerely,

Girum Worke

+251 931 797911

Thank you for your valuable time in advance!

Instructions

Please take a few minutes to answer the following questions to the best of your knowledge and experience. Your honest and thoughtful responses will contribute significantly to this research.

Part I. General Information (Please Tick appropriately for each question and specify where necessary).

1. Name of Organization:
2. State of respondents:
Client [] Contractor [] Consultant []
3. Gender
Male [] Female []
4. Age group
21 - 30 [] 31 – 40 [] 41– 50 [] 51 and above []
5. Level of education
Secondary school [] Diploma [] Degree [] Masters 'and above []
6. What is your Designation?
Director General [] Project Manager [] Site Engineer []
Office Engineer [] Site Supervisor []
Others (Specify).....
7. Relevant work experience (years):
 - ❖ < 3 Years []
 - ❖ 3-6 Years []
 - ❖ 6-9 years []
 - ❖ >9 Years []

Part II. Study questionnaires related to construction quality

Please read each statement carefully and show your level of agreement on the statements by putting the “X” mark in the boxes using the following 5-point Likert scales:

- ❖ Strongly Agree (SA) = 5,
- ❖ Agree (A) = 4,
- ❖ Neutral (N) = 3,
- ❖ Disagree (DA) = 2, and
- ❖ Strongly disagree (SDA) = 1.

No	Factors	SA	A	N	D	SDA
		5	4	3	2	1
Section 1: Labor Performance						
1.1	The technical qualifications of the labor force are directly proportional to the structural quality of this project					
1.2	On-site trainings have been provided to the labor force					
1.3	The training provided to the labor force specifically addresses the quality standards required for this project					
1.4	The level of competency among the workers positively affects the adherence to quality standards in this project					
1.5	The labor force professional qualifications, such as certifications or past project experience, are aligned with the detailed specifications of this project					
1.6	The communication between project management and the labor force effective in clarifying quality expectations and tasks					
1.7	The project has a system in place for monitoring and evaluating labor performance in relation to quality objectives					
1.8	Labor performance issues are frequently arisen, and addressed.					
1.9	The cultural and verbal diversity of the workforce affect project communication and quality outcomes.					
Section 2: Contract Administration						
2.1	Regular and thorough monitoring of contractual obligations by all parties were implemented for the project					
2.2	Does the contracts for this project detailed and clear enough to ensure that all parties are aware of and can adhere to the quality requirements					
2.3	The established conflict resolution mechanisms have been necessary to preserve the agreed-upon quality standards of this project					
2.4	The contract administrators for the project have been proactive in preventing and managing potential conflicts that might affect project quality					

2.5	The precision and thoroughness of project documentation, such as reports and compliance records, played a critical role in achieving this project quality objectives					
2.6	The project contract administrators successfully enforced compliance with quality control procedures					
2.7	The contract administration practices were sufficient enough in mitigating delays and noncompliance that could affect this project quality					
Section 3: Project Management Practice						
3.1	The project management strategies in place are adequately designed to meet the project quality benchmarks					
3.2	The project management strategies been effectively implemented to maintain the project quality benchmarks					
3.3	The application of project management strategies ensured that the project milestones for this project are achieved on schedule					
3.4	The project management strategy ensured quality control at all stages of this project					
3.5	The project management team facilitated communication and coordination in a manner that directly influences the project to meet its established quality goals					
3.6	The comprehensive quality management plan in place is regularly updated and followed by this project management team					
3.7	The project management team provided clear and achievable quality goals to all stakeholders involved in this project					
3.8	The decision-making processes within project management were transparent, includes all stakeholders and conducive to maintaining high-quality standards					
3.9	The communication practices between different teams and departments positively affected the quality of this project					
3.10	The project management team used performance metrics or quality indicators effectively to guide the project towards its quality objectives					
Section 4: Quality of the Project						
4.1	The comprehensive quality planning at the outset of the project has directly contributed to its high-quality outcome.					
4.2	The project meets the intended performance requirements, such as functionality and efficiency.					

4.3	The project closely adheres to the design specifications and construction standards.					
4.4	The completed infrastructure performs reliably over time, as expected, such as durability of finishing materials and MEP systems					
4.5	The project is completed within the scheduled time frame					
4.6	Project time management was efficient and contributes positively to the overall project quality					
4.7	The visual appeal and design aesthetics of the project align with the intended design vision					
4.8	The effectiveness of the quality control procedures and corrective actions taken in response to quality control findings significantly influenced the final quality of the project.					
4.9	Effective communication of the quality objectives and standards was a key driver in achieving the desired quality levels of the project					
4.10	The project completed with a high level of workmanship					
4.11	Stakeholders are satisfied with the overall quality of the project					

Thanks for Your Valued Time and Consideration