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Title: Investigating the Influence of Management Control on the Quality of 5G Network Deployment: A Case Study of EthioTelecom

A thesis submitted to the school of graduate studies of St. Mary 's University in partial fulfillment of the requirements for the Degree of masters in Project Management

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ADDIS ABEBA, ETHIOPIA

Declaration

I declare that this research project titled "Investigating the Influence of Management Control on the Quality of 5G Network Deployment: A Case Study of EthioTelecom" is my original work and has not been submitted elsewhere. All sources have been acknowledged, and any assistance received has been recognized. This project reflects my independent inquiry and analysis in the field of telecommunications management.

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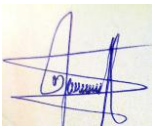
Muluadam Alemu (PhD). Internal Examiner  Date 09/02/2025

Signature

Acknowledgment

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Abstract

This study investigates the impact of management control on the quality of 5G network deployment, using EthioTelecom as a case study. It seeks to understand how effective management practices influence the successful implementation of advanced telecommunications technologies, offering insights to guide strategic decisions within EthioTelecom and similar organizations worldwide. The research is based on EthioTelecom 5G deployment initiatives, incorporating both qualitative and quantitative data to address the specific challenges of deploying cutting-edge technology in a developing country. Using a mixed-methods approach, the study includes a thorough literature review, detailed research design, and data collection through interviews, observations, document analysis, surveys, and performance metrics. Data analysis employs statistical methods and qualitative techniques to provide a comprehensive understanding of the impact of management control on project quality. The research spans the entire process from planning to implementation and evaluation, assessing effects on project quality, customer satisfaction, and overall network performance, and concludes with actionable recommendations for enhancing 5G deployment strategies. The project is set for completion by mid-November, ensuring meticulous review and finalization.

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Acronyms

5G: Five Generation

LTE: Long Term Evolution

QM: Quality Management

PQM: Project Quality Management

MC: Management Control

MCS: Management Control Systems

GSM: Global System for Mobile Communications

EDGE: Enhanced Data Rates for GSM Evolution

UMTS: Universal Mobile Telecommunication System

HSPA: High-Speed Packet Access

mMTC: Massive Machine-type Communications

eMBB: Enhanced Mobile Broadband

CN: Core Network

MIMO: Multi-input Multi-output

UMTS: Universal Mobile Telecommunications System

IOT: Internet of Thing

NR: New Radio

Chapter One

Introduction

This chapter provides an overview of the research background, problem statement, objectives, significance, scope, limitations, operational definitions, and organization of the study.

1.1. Background of the Study

The deployment of 5G networks represents a significant leap forward in telecommunications, promising faster speeds, lower latency, and improved connectivity. Globally, countries are racing to implement 5G technology to enhance economic growth, support emerging technologies, and improve the quality of life(Yang et al., 2022). Management control plays a crucial role in the successful deployment of these networks, ensuring that projects are completed on time, within budget, and to the required quality standards. The ability to effectively manage these large-scale projects is essential for maintaining competitive advantage and meeting the growing demands of the digital age(Greenberg et al., 2005).

In Africa, the adoption of 5G technology is progressing, though at a varied pace across the continent. Countries are increasingly recognizing the potential benefits of 5G for economic development, healthcare, education, and other critical sectors(Allan, 2022). Ethiopia, in particular, is making strides towards deploying 5G networks, with EthioTelecom leading the initiative. This study examines how management control mechanisms influence the quality of 5G network deployment in Ethiopia. By focusing on EthioTelecom, this research aims to provide insights into the challenges and best practices associated with large-scale telecommunications projects in a developing country context (Ethiotelecom 5G Deployment).

Effective management control is crucial for enhancing organizational performance within modern enterprises (van Harten et al., 2002). It encompasses planning and control cycles aimed at achieving desired outcomes (Karakaya et al., 2016). The definition of management control has evolved to include broader informational aspects beyond traditional financial metrics (Eswaran & Honnavalli, 2023). Ethiopia faces challenges in governance and modern management control practices, necessitating comprehensive studies.

Quality, defined as meeting consumer expectations (Petrov et al., 2018). underscores the importance of rigorous quality control processes. Ensuring quality not only satisfies consumer demands but also enhances economic viability. Estimating project budgets accurately is critical for decision-making and impacts project outcomes significantly (Araújo et al., 2019).

Ethio Telecom's initiative to deploy a 5G network aims to improve network coverage, service quality, and customer satisfaction, particularly in Addis Ababa. This project is a crucial component of Ethiopia's telecom infrastructure upgrade and is designed to align with global 5G standards, contributing to the modernization of the country's telecommunications sector.

1.2. Background of the Organization

Ethio Telecom, founded in 1894 by Emperor Menelik II, has been crucial in advancing telecommunications in Ethiopia. Initially known as the "Telephone, Telegraph and Postal Services," it represented the first steps toward modernizing communication within the country. Over time, the organization has significantly expanded, growing from modest beginnings into a vital component of Ethiopia's communication infrastructure (Ethiotelecom, 2021)

In 2010, the Ethiopian government restructured the telecommunications sector by merging various services into a single entity, renaming it Ethio Telecom. This reorganization aimed to enhance operational efficiency and improve nationwide telecom services. As a state-owned enterprise, Ethio Telecom was given the ambitious goal of expanding and enhancing telecom services to support Ethiopia's socio-economic development (Adame, 2021). The company's monopoly allowed it to focus on providing extensive coverage and developing infrastructure without the pressures of competition.

Ethio Telecom has implemented strategic initiatives that include significant investments in both urban and rural areas to ensure broad access to communication services. The launch of LTE Advanced in 2020 was a major milestone in mobile internet technology, offering faster and more reliable internet connections throughout Ethiopia. This achievement not only improved internet service quality but also established Ethio Telecom as a leader in the African telecom industry (Ethiotelecom, 1969). September 9, 2023**:** Ethio Telecom announced the official launch of its advanced 5G commercial service. As Ethiopia's sole telecom operator, the company rolled out

5G technology, began in Addis Ababa with an initial rollout of 145 sites, which later expanded to 154 sites., offering faster speeds, lower latency, and enhanced connectivity to drive the country's digital transformation.

The company's efforts to modernize its infrastructure have set the stage for the rollout of 5G technology, which promises to transform various sectors, including healthcare, education, and commerce. Ethio Telecom's dedication to innovation and its role in Ethiopia's digital transformation are evident in its ongoing investments in advanced technologies and efforts to bridge the digital divide (Ethiotelecom, 2021)

As Ethio Telecom tackles the challenges of deploying 5G networks, it faces issues such as regulatory obstacles, financial constraints, and the need for skilled personnel. Nonetheless, its established presence, government backing, and strategic vision equip it to overcome these challenges and lead Ethiopia into a new era of connectivity and technological progress (Kenechi et al., 2022)

1.3. Statement of the Problem

Despite the significant advancements in telecommunications technology, the successful deployment of 5G networks remains a complex endeavor, particularly within the context of Ethio Telecom. One of the critical factors influencing the quality and efficacy of 5G network deployments is the management control framework employed throughout the project lifecycle. However, there is a notable gap in understanding how management control practices impact the quality of 5G network deployment specifically within the operations of Ethio Telecom. This gap poses several challenges(Araújo et al., 2019)

Lack of Comprehensive Understanding: There is a depth of research examining the specific influence of management control on the quality of 5G network deployment within the context of Ethio Telecom. This knowledge gap inhibits a comprehensive understanding of the key drivers and barriers to successful deployment. Ineffective Management Control: The efficacy of management control practices employed by Ethio Telecom in overseeing 5G network deployment remains uncertain. Without a clear understanding of how these practices influence project quality, there is a risk of inefficiencies, delays, and suboptimal outcomes.(Hossain et al., 2023)

Limited Insights for Decision-Making: The absence of empirical evidence on the relationship between management control and 5G network deployment quality hampers informed decision-making within Ethio Telecom and other similar telecommunications organizations. Without such insights, it is challenging to identify areas for improvement and optimize project outcomes.

Implications for National Development: As telecommunications infrastructure plays a pivotal role in driving economic growth and societal development, the quality of 5G network deployment has far-reaching implications for Ethiopia's digital transformation agenda. Understanding the factors influencing deployment quality is essential for achieving the country's broader development goals.(Yang et al., 2024)

Therefore, there is a pressing need for empirical research to investigate the influence of management control on the quality of 5G network deployment within Ethio Telecom. Addressing this gap will provide valuable insights for enhancing project management practices, optimizing resource allocation, and ultimately facilitating the successful deployment of 5G networks in Ethiopia.

1.3.1. Research Questions

The study addresses the following research questions:

1. What is the extent of management control in Ethio Telecom's 5G network deployment project?
2. What was the overall quality of Ethio Telecom's 5G network deployment project?
3. What is the relationship between management control and project quality in Ethio Telecom's 5G network deployment?
4. What impact does management control have on the quality of Ethio Telecom's 5G network deployment project?

1.4. Objectives of the Study

1.4.1. General Objective

To investigate the influence of management control on the quality of Ethio Telecom's 5G network deployment project.

1.4.2. Specific Objectives

- To investigate the extent of management control in Ethio Telecom's 5G network deployment project.
- To investigate the overall quality of Ethio Telecom's 5G network deployment project.
- To investigate the relationship between management control and project quality in Ethio Telecom's 5G network deployment project.
- To investigate the influence of management control on the quality of Ethio Telecom's 5G network deployment project.

1.5. Significance of the Study

There is a scarcity of documentation regarding management control and project quality specific to EthioTelecom projects, with no prior well-documented studies on the impact of management control on project quality. Therefore, this study addresses a critical gap in the existing literature and provides a comprehensive resource for researchers and other interested parties. The findings support strategic decision-making in several critical areas of operation, offering a valid and reliable guide for designing effective project delivery improvement strategies. These strategies aim to create and deliver customer value, achieve project quality and customer loyalty, build long-term mutually beneficial relationships with customers, and foster sustainable growth at EthioTelecom.

This study also provides valuable insights for both government and private organizations involved in management control, offering practical experience in achieving project quality and satisfaction levels for the 5G network project. The collected information may serve as a foundation for enhancing marketing activities and project development decisions. By addressing the gap in existing documentation and focusing on the unique context of a developing country, this research contributes to academic knowledge while having practical implications for improving the management and deployment of critical telecommunications infrastructure.

1.6. Scope of the Study

This study primarily focuses on investigating the influence of management control on the quality of the 5G network deployment project at Ethio telecom. While Ethio telecom has completed and

is currently undertaking various projects, this research is specifically centered on the 5G network deployment projects. The study examines the extent of management control, the overall quality, the relationship between overall management control and quality, and the influence of management control on the quality of the 5G network deployment project at Ethio telecom. Other aspects of Wireless Network Planning and Engineering projects have been studied by other researchers and will be explored further in the future, but this research focuses solely on the 5G network deployment aspect of the project.

1.6.1. Geographic Coverage

This study encompasses only the Ethio telecom wireless network planning and engineering department office, along with the Central Addis Ababa Zone 5G network customers.

1.6.2. Thematic Coverage

This research is centered on assessing the quality level of the 5G network deployment project and identifying the impacts observed during the project management control phase. It also examines the interventions employed to address these issues. Specifically, it focuses on analyzing the quality, the nature of the effects, and the mechanisms used to resolve the problems within Ethio telecom.

1.7. Limitations of the Study

Identifying the limitations of the study helps recognize potential challenges that could affect the research process and outcomes. Although the researcher considered involving all key account department managers and project managers, financial and time constraints limited the ability to include all project team members and key account customers as participants. Consequently, the study faced several limitations:

Access to information from all project management and team members was challenging due to the geographical dispersion of the project population across various Ethio telecom sites, making it difficult and costly to gather data from the entire target population.

Obtaining some project document manuals was difficult due to confidentiality, but necessary actions were taken to mitigate this issue and complete the study.

1.8. Operational Definitions of Key Terms

• **Quality**: The degree to which the 5G network deployment project by Ethio Telecom meets the predefined specifications and objectives, ensuring the deployment is aligned with both the technical requirements and customer expectations for performance and reliability.

• **Effect**: The result or consequence of applying management control measures throughout the deployment process, impacting the overall quality of the 5G network. This includes assessing how different management practices influence the final outcome, particularly in terms of efficiency, cost, time, and quality.

• **Management Control**: The processes and systems used to guide and regulate Ethio Telecom's 5G network deployment project, ensuring that project activities align with organizational goals. It involves strategic decision-making, performance monitoring, and corrective actions aimed at ensuring the project meets its objectives effectively.

• **Project Management**: The application of knowledge, skills, tools, and techniques to manage all phases of the 5G deployment project effectively. It involves integrating various project management methodologies to ensure the timely and successful delivery of the project while meeting all specified requirements, including scope, budget, and quality standards.

• **Initiation**: The early stage in the 5G network deployment project where foundational tasks and activities are carried out to conceptualize the project. This includes defining the project's objectives, scope, purpose, and deliverables, as well as obtaining authorization to proceed from key stakeholders.

• **Planning**: The phase in which detailed activities are carried out to outline and refine the objectives of the 5G deployment project. This stage involves setting clear direction on the project's goals, identifying necessary resources, and selecting the appropriate methodologies to achieve successful outcomes, ensuring that the project is executed according to the strategic vision of Ethio Telecom.

• **Executing**: The phase where tasks are carried out to implement the plans developed during the planning stage. This involves allocating and coordinating resources for the installation, testing,

and integration of the 5G network, aiming to deliver the expected outcomes, such as network reliability, coverage, and customer satisfaction.

• **Closing**: The final stage of the 5G deployment project where all activities are completed, and the project is formally concluded. This includes delivering the completed 5G network to Ethio Telecom, handing over all project documentation, releasing resources, and conducting evaluations to ensure that the project meets its initial objectives and deliverables.

• **5G**: The next-generation wireless technology designed to deliver faster, more reliable, and higher capacity mobile internet services. In the context of Ethio Telecom, the 5G network aims to significantly enhance connectivity, support emerging technologies, and drive the digital transformation agenda of Ethiopia.

1.9. Organization of the Study.

The study is organized into three main chapters. Chapter One introduces the research, including the study's background, problem statement, objectives, and scope. It also covers the significance, limitations, and key terms. Chapter Two reviews relevant literature, discussing theoretical concepts, quality control tools, management control, and 5G technology, and presents the conceptual framework. Chapter Three outlines the research methodology, detailing the research design, sampling techniques, data collection methods, and analysis procedures, along with time and budget schedules for the project.

Chapter Two

Literature Review

This chapter reviews relevant literature on 5G technology, exploring its conceptual foundations, variables, functions, importance, advantages, and limitations.

2.1 Introduction

The global rollout of 5G networks has garnered attention for its transformative potential in connectivity, technological progress, and socio-economic development. While extensive research has focused on technical, operational, and financial aspects, the role of management control systems (MCS) in ensuring the quality and success of 5G projects remains underexplored. MCS are vital for aligning organizational goals with project execution, particularly in large-scale, resource-intensive projects like 5G deployment. For Ethio Telecom, Ethiopia's state-owned telecom provider, effective MCS is crucial to addressing challenges such as regulatory constraints, resource limitations, and the need to expand connectivity to underserved rural areas. This literature review synthesizes theoretical and empirical studies on MCS, project quality management, and 5G deployment, identifying global trends and research gaps while situating findings within Ethio Telecom's context. The review aims to highlight how MCS can enhance 5G deployment quality and support Ethiopia's digital transformation objectives.(Al-Dhubaibi, 2024)

2.2. Theoretical Concepts

2.2.1. The Concept of Projects

According to Whelton, (2004), A project is a temporary effort aimed at producing a unique product, service, or outcome. Its temporary aspect signifies that a project has a specific start and finish. The project concludes either when its objectives are met, when it is terminated due to the infeasibility of achieving its goals, or when the need for the project no longer exists. Additionally, a project may be ended if the client, sponsor, or key stakeholder decides to discontinue it. The term "temporary" does not imply a brief duration; rather, it refers to the project's defined period of engagement and its overall lifespan.

2.2.2. The Concept of Project Quality

Quality management is crucial for ensuring that projects achieve their desired standards. As clarified by (Yusuf, 2023) quality management involves overseeing all project activities—design, planning, and implementation—to ensure they are effective and efficient in meeting the project's goals and performance criteria. Project quality management (QM) is not a standalone process that assesses quality only at the end of a project. It also does not involve simply using the most expensive materials or resources. It is important to distinguish between quality and grade; while quality refers to the absence of defects, grade refers to the additional features or characteristics of the material or project. Thus, a product can be high-quality (free from defects) yet low-grade (lacking extra features).

Quality characteristics relate to the attributes, measures, and methods. According to Rogala & Wawak, (2021) the following quality characteristics are defined:

Functionality: The extent to which a product or equipment fulfills its intended purpose. For instance, clinical equipment must operate as expected to ensure effective performance.

Quality: Refers to how well a product or project meets the beneficiary's intended use. For example, a water system should be designed to withstand extreme conditions and require minimal maintenance to enhance sustainability and reduce community costs.

Reliability: The capability of a product or project to function as intended under normal conditions without significant failures. For example, blood testing materials should consistently and accurately provide critical diagnostic information, building trust among beneficiaries.

Relevance: Describes how well a product or project addresses the actual needs of its beneficiaries. It should be applicable, appropriate, and aligned with its intended purpose.

Timeliness: The ability to deliver a product or project promptly when needed, ensuring it resolves problems effectively. This is especially crucial in health and emergency relief scenarios.

Suitability: Indicates whether a product or project is fit for its intended use, ensuring appropriateness and correctness. For example, agricultural equipment should be designed to suit the specific soil conditions familiar to beneficiaries.

Completeness: Ensures that a project includes its entire scope and delivers all necessary components. For instance, training sessions should cover all required materials to develop the intended skills or knowledge.

Consistency: Highlights the importance of uniform delivery of projects or services to all beneficiaries. For example, clinical tests should follow the same procedure for every patient to maintain reliability.

2.2.3. Quality Control Tools

Seven fundamental quality tools have been recognized as suitable for application in both quality management planning and quality control processes(Grigoryan & Golubkova, 2020):

- Cause and Effect Diagrams
- Flowcharts
- Check Sheets
- Pareto Diagrams
- Histograms
- Control Charts
- Scatter Diagrams

2.2.4. The Concept of Management Control

The concept of management control evolves over time. According to(Van Der Stede, 2017), management control is closely linked to the role of the Controller within a company. (Sljivic et al., 2015) notes that management control often begins with a focus on individuals within organizations. Initially, management control was concentrated on large, decentralized corporations and relied heavily on accounting-based performance metrics. It involves a process where organizations aim to achieve desired outcomes, or "performances," and may take various

actions to mitigate negative impacts from both internal and external factors. However, controlling individual entities alone is not sufficient for overall corporate control, as the performance of individual units does not guarantee the success of the entire organization(Chenhall, 2003).

Management control is a widely recognized term in business management, often subject to varying interpretations. Over time, control procedures have shifted to address changing operational needs (Van Der Stede, 2017) The primary aim of management control is to set strategic objectives and monitor their achievement, supporting decision-making processes and helping organizations maximize their income through effective business strategies(Sljivic et al., 2015).

2.2.5 Project Management Control

Project management maturity refers to the ongoing advancement of an organization's project management practices, including its approach, methodology, strategy, and decision-making processes. The ideal level of maturity can differ from one organization to another, depending on its unique goals, strategies, resources, scope, and requirements (Chenhall & Euske, 2007).

2.2.5.1. Project Monitoring and Evaluation

According to (Gathii et al., 2019),Monitoring and Evaluation (M&E) involves the ongoing collection and analysis of information to assess whether progress is being made toward established goals and objectives. It also identifies any unintended effects—whether positive or negative—resulting from the project and its activities. M&E is a crucial component of the project cycle and effective management practices. To successfully complete a project on time, within budget, and according to specifications, it is essential to fully implement all activities and resources.

2.2.5.2. Project Management Techniques

The project management process typically includes four key phases (Phillips et al., 2011):

Project Initiation: Establishing the project team, relationships with customers, initiation plan, management procedures, and environment.

Project Planning: Defining scope, tasks, resource plans, schedules, communication plans, standards, procedures, risk assessment, budgets, and setting a baseline plan.

Project Execution: Implementing the baseline plan, monitoring progress, maintaining documentation, and communicating status.

Project Closure: Completing the project, conducting reviews, and closing contracts.

2.2.5.3. Best Project Management Tools

Two widely used project management tools include:

- Program Evaluation Review Technique (PERT)
- Gantt Charts

2.3. Telecom Projects

Telecom projects, as discussed by (Whelton, 2004), require a blend of project management fundamentals and specialized knowledge due to technological advancements, regulatory changes, and supply chain complexities. The evolution from older technologies like GSM/EDGE, UMTS ,3G and 4G to 5G highlights the industry's continuous adaptation to meet increasing connectivity demands (Mishra, 2023).

2.3.1. 5G Technology: Advanced Mobile Broadband

5G technology marks a significant leap forward in mobile broadband, offering unprecedented improvements in speed, capacity, and connectivity. As the fifth generation of mobile communication systems, 5G is designed to deliver high-performance, secure IP-based services, ensuring seamless high-speed connectivity accessible "anytime, anywhere." Building on the strong foundations of GSM/EDGE and UMTS/HSPA networks, 5G greatly enhances network capacity and speed through advanced radio interfaces and core network improvements(CN) (Li et al., 2021).

In addition to speed enhancements, 5G supports a wide array of applications, including ultra-reliable low-latency communications (URLLC), massive machine-type communications (mMTC), and enhanced mobile broadband (eMBB). These capabilities accommodate various innovative use cases such as real-time remote control of industrial machinery, autonomous

vehicles, and the widespread adoption of Internet of Things (IoT) devices. The potential of 5G extends to transforming industries, fostering the development of smart cities, advancing telemedicine, and enabling immersive augmented and virtual reality experiences. Its robust and flexible infrastructure makes 5G a crucial technology driving significant technological and societal progress in the coming years.

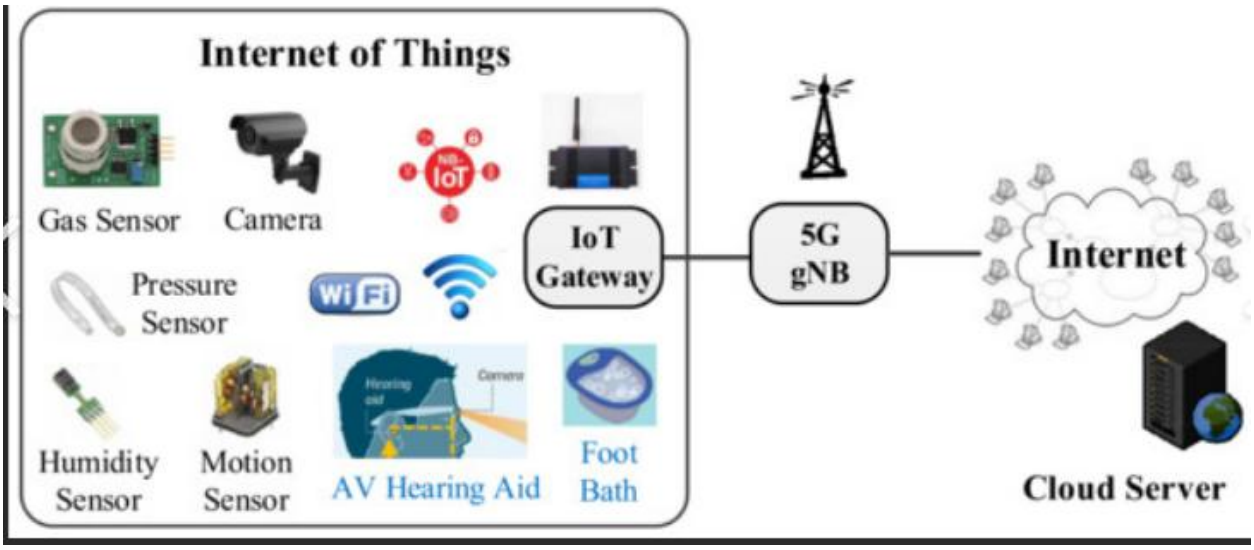


Figure 1: Applications of IOT with in 5G networks

Key Features of 5G:

5G networks deliver significantly improved performance compared to previous generations, offering download speeds of up to 10 Gbps and latency as low as 1 millisecond. This enhancement in spectrum efficiency, throughput, and latency supports a wide range of applications, including mission-critical services, remote healthcare, smart agriculture, and IoT solutions. In addition, 5G provides upload speeds of up to 1 Gbps, boosting overall network performance by offering high download and upload speeds, low latency, and extensive connectivity capabilities.

Moreover, 5G maintains backward compatibility with older mobile network generations, such as 4G LTE and even 3G, ensuring that devices designed for previous generations can still operate on 5G networks. 5G technology is designed to offer higher multi-Gbps peak data speeds, ultra-low latency, enhanced reliability, massive network capacity, and increased availability. It also provides a more consistent user experience for a larger number of users.

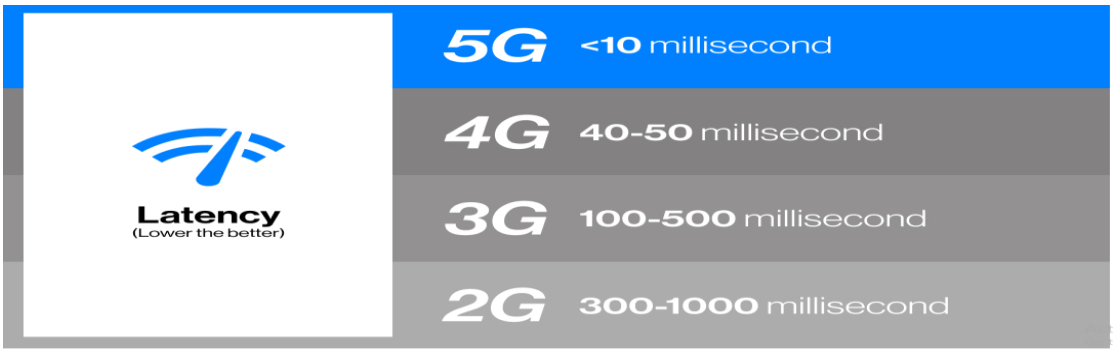
Network Slicing: One of the key features of 5G is the ability to create multiple virtual networks through network slicing. This allows for the creation of customized network slices tailored to specific business needs, such as enhanced security or high bandwidth, and is essential for the deployment of Private 5G networks.

Speed and Latency: Peak 5G speeds are expected to be up to 100 times faster than 4G LTE, with reduced latency supporting emerging applications like the Internet of Things (IoT) and artificial intelligence.(Security Agency, 2023)

Comparison with 4G LTE:

4G LTE offers download speeds ranging from 5 to 100 Mbps, supporting HD video streaming, fast downloads, and smooth online gaming.

5G NR (New Radio) provides speeds from 100 to 2000 Mbps, enabling ultra-HD streaming, instantaneous downloads, and augmented reality applications.



Advanced 5G Radio Technologies:

5G networks use advanced radio technologies to offer higher speeds, lower latency, and greater capacity than previous generations. Key technologies include:

Massive MIMO: Utilizes numerous antennas at base stations to serve multiple users, enhancing capacity, spectral efficiency, and coverage.

Millimeter Wave (mmWave) Spectrum: Uses higher frequency bands for faster speeds and increased bandwidth, though requiring more base stations due to limited range.

Beamforming: Directs signals to specific users, improving signal quality and efficiency, especially for mmWave frequencies.

Network Slicing: Enables operators to create customized virtual networks for different applications, optimizing resource allocation for services like IoT and video.("5G Technol.," 2020).

2.4. Empirical Studies

The context of the research findings will vary significantly from that of Ethiopia, where technological resources, awareness, and expertise are generally less advanced compared to the developed countries where most studies are conducted. This difference highlights the need to examine how management control impacts project quality within Ethio Telecom's wireless network planning and engineering department.

2.4.1. 5G Network

5G is the fifth generation of wireless cellular technology, offering significantly higher upload and download speeds, more reliable connections, and enhanced capacity compared to previous networks. The theoretical peak speed of 5G is 20 Gbps, far surpassing the 1 Gbps peak speed of 4G. This enables faster data transfer and supports more robust applications, such as ultra-high-definition video streaming, augmented reality (AR), virtual reality (VR), and self-driving cars. Additionally, 5G offers lower latency, which improves the performance of business applications, online gaming, videoconferencing, and other real-time services. Unlike earlier generations of cellular technology, such as 4G LTE, which primarily focused on ensuring basic connectivity, 5G takes connectivity to the next level by enabling seamless and immersive connected experiences from the cloud to end users. 5G networks are virtualized, software-driven, and leverage cloud technologies, making them more flexible and scalable.(Security Agency, 2023)

Frequency Bands: 5G networks operate across two primary frequency bands:

Frequency Range 1: 450 MHz to 6 GHz

Frequency Range 2: 24.25 GHz to 52.6 GHz

5G New Radio (5G NR):

5G NR represents a major leap in wireless communication, designed to support a wide range of

use cases, including Enhanced Mobile Broadband (eMBB), Ultra-Reliable Low-Latency Communication (URLLC), and massive Machine-Type Communication (mMTC).

Flexible Frame Structure:

A key feature of 5G is its flexible and scalable frame structure, which optimizes data transmission across various services and applications. At the core of 5G NR is this hierarchical organization of time-domain units:

Radio Frame: A 5G radio frame is 10 ms long, the same as in LTE.

Subframe: A 5G subframe is 1 ms in length, similar to LTE.

Slot: A subframe is divided into several slots, depending on the numerology used.

Symbols: Each slot contains 14 OFDM symbols when using a normal cyclic prefix (CP).

(Imam-Fulani et al., 2023)5G networks represent a major leap forward in mobile communication technology, delivering significant enhancements in speed, capacity, and connectivity. Built upon the 4G LTE infrastructure, 5G is engineered to offer high-performance, secure, and flexible communication solutions. Unlike 4G, which can function alongside older GSM and UMTS networks with minimal disruption, 5G is optimized for even greater efficiency and speed.

One of the key improvements in 5G is its support for a wider range of bandwidths. While 4G LTE operates within a bandwidth range of 1.25 MHz to 20 MHz, 5G can utilize frequencies from 5 MHz to 400 MHz. This expanded spectrum allows for higher data transfer rates, better network efficiency, and reduced latency. Additionally, 5G incorporates advanced technologies like Massive MIMO, which deploys numerous antennas at base stations to enhance spectral efficiency and overall capacity.(Security Agency, 2023)

Moreover, 5G supports a variety of applications through innovations such as network slicing, which enables the creation of multiple virtual networks on a single physical infrastructure. This capability supports diverse use cases, including enhanced mobile broadband (eMBB), ultra-reliable low-latency communications (URLLC), and massive machine-type communications (mMTC). These advancements make 5G essential for the development of smart cities,

autonomous vehicles, and other cutting-edge technologies, driving progress in connectivity and innovation.

2.4.2. Factors Affecting Project Quality and Management Control

Internal and external factors, including organizational complexity and customer expectations, significantly impact project quality and management control effectiveness(Tian & He, 2016).

Draksha Safdar Khan, (2024) discusses organizational behavior and the impact of cultural environments on management practices, emphasizing the interconnectedness of organizational units and external stakeholders.

(Michael Page, 2022) suggests that organizational complexity and resource availability influence the development of effective management control systems, affecting project outcomes.

(Wang & Lo, 2002) identifies variables impacting customer satisfaction, underscoring the importance of network coverage in meeting user expectations.

2.4.3. Relationship Between Management Control & Project Quality

Effective management control systems enhance the likelihood of organizational decisions aligning with strategic objectives, thereby improving project quality and customer satisfaction (Pérez Sigüenza et al., 2022).

(Pérez Sigüenza et al., 2022)asserts that effective management control systems (MCSs) align employee actions with organizational goals, enhancing project quality and ensuring deliverables meet specifications.

2.5 Research Gap

There is a lack of research on the influence of management control systems on the quality of 5G network deployment, particularly in developing countries like Ethiopia. While existing studies focus on 5G technology and its capabilities, the intersection of management control and deployment quality remains underexplored. Additionally, the unique challenges faced by operators such as Ethio Telecom, including limited resources and regulatory constraints, have not

been adequately addressed. This research aims to fill this gap by examining how management control systems impact the quality of 5G NR network deployment at Ethio Telecom.

2.6. Conceptual Framework

The general consensus from previous literature suggests that there is a relationship between the quality of 5G network deployment and management control. Management control can be assessed using specific independent variables, while the quality of the 5G deployment can be evaluated through various dependent variables related to project outcomes. This relationship is illustrated in Figure 2.

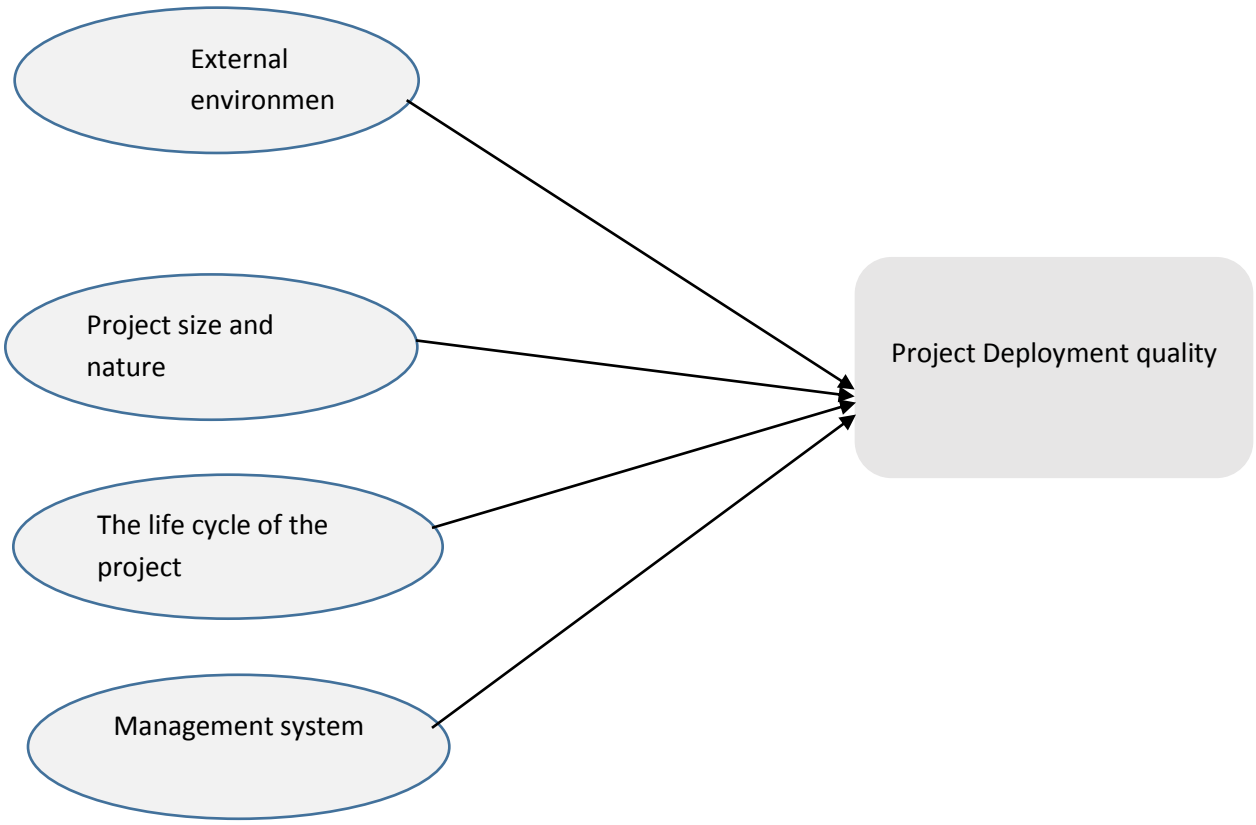


Figure 2: Conceptual models of how management control impacts project quality

Chapter Three

Research Methodology

This chapter outlines the methodological considerations of the thesis. It is divided into four sub-sections. The first section discusses the overall research design and approach used in the study. The second section addresses the study's target area, the sampling method employed, justification for the method, and the determined sample size. The third section details the data sources, methods of data collection, and the description of the data analysis approach. Finally, the fourth section presents considerations for time and budget schedules.

3.1. Research Approaches and Design

3.1.1. Research Design

This study employs both exploratory and descriptive research designs. Descriptive research is used to analyze data gathered from various sources to assess project phases and challenges within Ethio Telecom's Wireless Network Planning and Engineering Department, focusing on management control practices and their impact on project quality. Additionally, an explanatory study design is utilized to understand and predict the relationships between variables.

3.1.2. Research Approach

In research, both quantitative and qualitative analyses are commonly employed to explore various questions. While there is some debate among researchers about the most effective method for collecting and analyzing data, these approaches are complementary rather than mutually exclusive and can address similar research questions through different lenses. This study was incorporate both quantitative and qualitative methods due to the absence of prior research on the impact of management control on the quality of 5G network projects, particularly within Ethio Telecom's wireless network planning and engineering division. By combining these approaches, the study aims to provide a comprehensive understanding of how management control influences the success of 5G deployment projects(Homer, 2018).

3.2. Sampling Design

3.2.1. Target Population

The study's population was including all permanent employees of EthioTelecom and 5G network customers. The research will be conducted within the EthioTelecom head office in Addis Ababa, specifically focusing on the Wireless Network Planning and Engineering departments, as well as 5G network customers in the Central Addis Ababa Zone.

3.2.2. Sampling Techniques

The sampling method for this study utilized stratified random sampling, a probability sampling technique. This approach divides the population into distinct subgroups (strata) based on characteristics relevant to the research, such as customer type or staff role, and ensures that each subgroup is appropriately represented. By using this technique, every member of each subgroup has an equal chance of being selected. The sample was drawn from the Central Addis Ababa Zone (361500) 5G network customers and the Ethio Telecom Wireless Network Plan Engineering office (118 staff). A total of 384 respondents from the target population were surveyed. Data collection was completed by December 15, 2024, as the number of customers fluctuated over time.

3.2.3. Sample and sample size

The study drew samples from EthioTelecom Wireless Network Planning and Engineering Department, including both employees involved in 5G network projects and existing 5G network customers. Participants must be employees with a minimum of two years of experience and 5G customers. The selection of both employees and customers will utilize a random sampling method. After establishing the sample frame from the department and 5G customer base, the sample size will be determined using a sample size calculator, applying a 5% margin of error and a 95% confidence level.

N = population size

Z = z-score

E = margin of error

P = standard of deviation

$$\text{Sample size} = \frac{\frac{Z^2 \times P(P-1)}{E^2}}{1+\left(\frac{Z^2 \times P(P-1)}{E^2 N}\right)}$$

Where:

n0= sample size

z = confidence interval corresponding to a level of confidence 95% = 1.96

p = population proportion 50%

N = population size

E = precision or error limit 5%

n0 = (1.962 *0.5(1-0.5) 316,500)/ (1.962 *0.5(1-0.5) +316,000*0.052) = 384

Table 3.1 Sample size

Respondents	Total population	Sample size
Employees of Telecom	118	90
5G network customers	361,500	294

Source: Own survey, 2024

As illustrated in Table 3.1, 76.6% of the questionnaire respondents were customers, while 23.4% were Ethio Telecom employees. Among the employees, 6.5% held managerial or supervisory roles. This demonstrates that the respondents included individuals ranging from customers and lower-level staff to senior project management, directly involved in the process.

3.2.4. Data Sources and Types

The collection of both primary and secondary data was essential to understanding the dynamics of the 5G network deployment project. Primary data was gathered through Google Forms, using a standardized questionnaire format. Each participant responded to an identical set of questions in a predetermined order, ensuring consistency and enabling the identification of potential

challenges in the 5G deployment process. This facilitated the formulation of strategies to address those challenges effectively.

Secondary data included both raw datasets and published analyses, allowing for re-examination of information initially collected for other purposes. By integrating insights from both primary and secondary sources, the study provided a comprehensive perspective on the 5G network deployment process at Ethio Telecom.

3.2.5. Methods and Tools of Data Collection

The researcher was employ both questionnaires and observation techniques to gather primary data from project managers, core project staff, and 5G network customers. This involves conducting on-site observations at project locations and distributing semi-structured questionnaires to 5G network users, project staff, and administrators within the Wireless Network Planning and Engineering Department. Data collection was utilized Google Forms, checklists, and direct observation as necessary tools to obtain comprehensive and original data from the relevant sources.

3.2.6. Procedures of Data Collection

The following procedures were employed to gather data for this study: Initially, a briefing on the questionnaire was provided to the 5G network deployment project implementers and 5G customers of Ethio Telecom. Afterward, the questionnaires were distributed to these primary respondents through Google Forms, allowing them to complete the forms at their convenience. Respondents were given a week to submit their responses, providing ample time for thoughtful completion. To increase the response rate, a reminder was sent to non-responding project implementers and customers. Once the responses were received, the completed questionnaires were collected, coded, and analyzed for relevance and usability. In addition, selected project sites were observed multiple times during the research process to gather additional insights. Finally, the findings were compiled, and the final report was prepared.

3.2.7. Reliability and Validity Testing

Reliability analysis was conducted using SPSS software, employing Cronbach's alpha test to evaluate the internal consistency of the collected data. This method ensured that the responses

were reliable and consistent across the variables. To assess reliability, Cronbach's alpha coefficients were calculated for each variable. In addition to reliability, validity was considered, which refers to the extent to which the research instrument accurately measures the intended variables. Validity is a crucial criterion, highlighting how well the instrument fulfills its intended purpose.

3.2.7.1. Reliability Test

As shown in Table 3.2 below, Cronbach's alpha reliability coefficient normally ranges between 0 and 1. However, there is no lower limit to the coefficient. The closer Cronbach's alpha coefficient is to 1.0 the greater the internal consistency of the items in the scale. Based upon the formula _ = RK / [1 + (k-1) r] where k is the number of items considered and r is the mean of the inter-item correlations the size of alpha is determined by both the number of items in the scale and the mean inter-item correlations. (George & Malley, 2003) provide the following rules (Gliem & Gliem, 2003)

Table 3.2 Cronbach's alpha reliability coefficient

Cronbach's alpha	Internal consistency
$\alpha \geq 0.9$	Excellent
$0.9 > \alpha \geq 0.8$	Good
$0.8 > \alpha \geq 0.7$	Acceptable
$0.7 > \alpha \geq 0.6$	Questionable
$0.6 > \alpha \geq 0.5$	Poor
$0.5 > \alpha$	Unacceptable

Source: Own survey, 2024

One of the most common methods to test reliability in SPSS is using Cronbach's Alpha, in which if the reliability coefficients are 0.9 or Excellent, it is considered "acceptable" in most research situations.

Table 3.3 Employee Responses Reliability Test

S. No	Variables	Cronbach's Alpha	Number of Questions
1	External Environment	0.808	3
2	Project Size and Nature	0.790	3
3	The life cycle of the project	0.792	3
4	Management System	0.792	3
5	Project Deployment quality	0.906	14

Source: Own survey, 2024

According to the Cronbach's Alpha values presented in Table 3.3, the values of individual variables range from a minimum of 0.790 (Project Size and Nature) to a maximum of 0.906 (Project Deployment Quality). All values exceed the commonly accepted threshold of 0.70, indicating good internal consistency. Therefore, the researcher concludes that the data collected from employees is reliable and suitable for further analysis.

Table 3.4 Customer Responses Reliability Test

S. No	Variables	Cronbach's Alpha	Number of Questions
1	External Environment	0.845	3
2	Project Size and Nature	0.894	3
3	The life cycle of the project	0.916	3
4	Management System	0.925	3
5	Project Deployment quality	0.901	14

Source: Own survey, 2024

According to the Cronbach's Alpha values presented in Table 3.3, the reliability scores of the individual variables range from a minimum of 0.845 (External Environment) to a maximum of 0.925 (Management System). All values exceed the commonly accepted threshold of 0.70, indicating strong internal consistency. Therefore, the data collected considered from customer is reliable and suitable for further analysis.

3.2.7.2. Validity Test

The correlation coefficient quantifies the strength of the relationship between the movements of two variables. Its values range from -1.0 to 1.0. If a calculated value exceeds 1.0 or falls below -1.0, it indicates an error in the measurement process. A coefficient of -1.0 represents a perfect negative correlation, while a value of 1.0 signifies a perfect positive correlation. A coefficient of 0.0 indicates no linear relationship between the movements of the two variables.(https://www.investopedia.com/terms/c/correlationcoefficient.asp)

Table 3.5 Employee Responses validity Test

variables		Project Deployment quality
External Environment	Pearson Correlation	.731**
	Sig. (2-tailed)	0.000
	N	90
Project Size and Nature	Pearson Correlation	.772**
	Sig. (2-tailed)	0.000
	N	90
The life cycle of the project	Pearson Correlation	.780**
	Sig. (2-tailed)	0.000
	N	90
Management System	Pearson Correlation	.840**
	Sig. (2-tailed)	0.000
	N	90
**. Correlation is significant at the 0.01 level (2-tailed).		

Source: Own survey, 2024

As analyzed in Table 3.4 above, the Employee Responses validity test for each independent variable and Project Deployment Quality Pearson Correlation ranges from 0.731 to 0.840. The

strong positive correlations (all significant at the 0.01 level) suggest that the factors—External Environment, Project Size and Nature, Project Life Cycle, and Management System—are closely related to the quality of project deployment in the 5G network project.

Table 3.6 customer Responses validity Test

variables		Project Deployment quality
External Environment	Pearson Correlation	.732**
	Sig. (2-tailed)	0.000
	N	294
Project Size and Nature	Pearson Correlation	.808**
	Sig. (2-tailed)	0.000
	N	294
The life cycle of the project	Pearson Correlation	.844**
	Sig. (2-tailed)	0.000
	N	294
Management System	Pearson Correlation	.860**
	Sig. (2-tailed)	0.000
	N	294
**. Correlation is significant at the 0.01 level (2-tailed).		

As analyzed in Table 3.4 above, the Customer Responses validity test of each independent variable and Project Deployment Quality Pearson Correlation ranges from 0.732 to 0.860. The strong positive correlations (all significant at the 0.01 level) suggest that these factors are closely related to the quality of project deployment in the 5G network project.

3.3. Methods of Data Analysis

3.3.1. Data Processing

Data processing involved several interconnected steps, including editing, classification, and tabulation. Raw data collected from the field was prepared for analysis by organizing it into spreadsheet software for further processing. The analysis primarily focused on quantitative data, supplemented by qualitative insights gathered through questionnaires and observations.

As part of the research approach, both quantitative and qualitative data from primary sources were utilized as inputs to support the findings. Primary data was collected through questionnaires distributed to selected participants and through observations conducted at specific 5G project sites. Access to these sites was granted after obtaining permission from the relevant authorities at Ethio Telecom and engagement with 5G network customers.

3.3.2. Data Analysis Techniques

As outlined by Homer, (2018), analyzing data with quantitative methods involves understanding the relationships between variables using descriptive statistics. The data was analyzed using SPSS version 25. Descriptive statistics were employed to make inferences about the population and estimate its parameters. In the qualitative research approach, the analysis began with specific observations and measurements, progressing to identify themes and patterns within the data.

For this study, Pearson's correlation coefficient was utilized to examine the relationships between management control dimensions—such as inspiration, individual consideration, and idealized influence—and the quality of the 5G project. The summarized data was then interpreted within the theoretical framework of the study to draw meaningful conclusions. Finally, the findings were analyzed and synthesized to provide valid and actionable recommendations.

3.4. Ethical Consideration

According to Whelton (2004), researchers are responsible for maintaining respondents' privacy, ensuring anonymity (protecting individuals' identities), and upholding confidentiality (safeguarding the information provided). Adhering to these ethical principles, this study emphasized respectful treatment of participants and careful handling of the data collected. To align with these standards, the survey questionnaire included a clear introduction and instructions outlining the purpose of the study. Respondents were assured that participation was entirely voluntary, with no obligation to answer the questionnaire.

Chapter Four

Analysis, Discussion, and Interpretation

4.1. Introduction

This chapter presents the analysis of data, research findings, and interpretations based on the analyzed results. It includes an overview of the response rate and a summary of demographic data using descriptive statistics. Additionally, it explores the extent of management control over the 5G NR network deployment project at Ethio Telecom and provides a descriptive analysis of the overall quality of the 5G network deployment.

The chapter examines the relationship between management control and the quality of the 5G deployment project at Ethio Telecom using correlation analysis to highlight the connections between dependent and independent variables. Regression analysis is employed to assess the impact of management control dimensions on the quality of the 5G network deployment project. Lastly, the findings from observations and discussions are summarized and thoroughly analyzed.

4.2. The response rate of respondents

Table 4.1 Employee Response rate of respondents

Questionnaires Distributed for employee	***Questionnaires Returned from employee***	***Percentage***
90	90	100%

Table 4.2 customer Response rate of respondents

Questionnaires Distributed for Customer	***Questionnaires Returned from Customer***	***Percentage***
290	290	100%

Source: Own survey, 2024

As shown in Table 4.1 above, about the total response rate, 384 questionnaires were distributed to respondents and returned with the rate of 100%. Based on this sample size (100%) the next analysis was carried out.

4.3. Demographic data summary of the Respondents

This section outlines the findings related to the respondents' demographic profiles, including their gender, age, marital status, education level, and income.

Table 4.3 Demographic data summary of the total Respondents

	Item	Frequency	Percent
Gender of respondents	Female	177	46%
	Male	207	54%
	Grand Total	384	100%
Age of respondents	(>56 years)	2	0.52%
	(15-25 years)	42	10.94%
	(26-35 years)	202	53%
	(36-45 year)	120	31%
	(46-55 year)	18	5%
	Grand Total	384	100%
Marital status	Divorced	1	0.26%
	Married	237	62%
	Single	146	38.02%
	Grand Total	384	100.00%
Educational Level	BA/BSc	227	59.11%
	Certificate	2	0.52%
	Diploma	76	19.79%
	Masters	79	20.57%
	Grand Total	384	100.00%
Work Experience	>15 years	59	15.36%
	11-15 years	166	43.23%
	1-5 years	52	13.54%
	6-10 years	100	26%
	None	7	1.82%
	Grand Total	384	100.00%
Job Category /Current position	Employee	65	17%
	Expert	5	1.30%
	Low-level Management	10	2.60%
	Middle-level Management	8	2.08%
	Top-level Management	2	1%
	Self-worker	124	32.29%
	other Government Employee	170	44.27%
	Grand Total	384	100%

Source: Own survey, 2024

As we can see from Table 4.2 above, 207 (54%) of the respondents were male and 177 (46%) were female respondents. This may imply that the gender proportion of the participant or users in the project and 5G NR network customers are not balanced.

The respondents in the 5G network deployment project were also requested to indicate their age interval and as indicated in Table 4.2 above, 42(10.94(%) of the respondents are 15-25 years' old which is the third -largest age group. The majority of the respondents are in the age group of 26-35 years of age which accounts for 202 (53%). This we can conclude that the largest proportion of the sum of respondents of employees in Telecom, and the 5G network customers are young people. The respondents followed by the age group of 36-45 years of age which accounts for 120 (31%).

18 (5%) of the respondents are 46-55 years' old and finally, the smallest group of the respondents are > 56 years of age which accounts for 2 (0.52%), Indicates that the group of respondents aged over 56 years represents the smallest percentage of the overall sample. Specifically, only 2 respondents (0.52% of the total) fall into this age category, which suggests that the sample is predominantly made up of younger participants.

The marital status of the respondents' shows in table 4.2 above, most of them is Married 237

(62%); those who are Single constitute 146 (38.02%), others (divorced or widowed) 0nly 1 (0.26%). This means that Married people are more customers to 5G network.

As depicted in Table 4.2 above, the highest level of education achieved and indicated the majority 227 (59.11%) of them have a first degree. 79 (20.57%) of the respondents in the project have a master's degree and 76 (19.79%) of the respondents have a diploma and 2 (0.52%) have a Certificate. which indicates the majority of the respondents have a first degree and above level of education. and this might imply that majority of our respondents are appropriate and capable of understanding the questionnaires and all about the 5G network deployment project implementation.

As shown above, in Table 4.2 above, the respondents were indicated majority 166 (43.23 %) of them have 11-15 years of work experience. 100 (26%) of the respondents have 6-10 years of

work experience and 59 (15.36%) of the respondents have greater than 15 years of work experience, 52 (13.54%) of the respondents have 1-5 years of work experience, and the remaining 7 (1.82%) of the respondents are job seekers or unemployed. This indicates the majority of the respondents have 11-15 years of working experience this might positively contribute to the 5G network is better to understand, use, and implementation of the project quality. Because they are experienced, they are close and easily aware of new technologies.

Respondents were also requested to show their current job level in the organization and as depicted in Table 4.2 above, the Majority of the respondents of the questionnaire 170 (44.27%) are other government Employee level in their current position followed by the second large number 124 (32.29%) is Self-workers level, the third 65 (17%) each of respondents Employee and Low-level Management are 10(2.60%), Middle-level Management are 8(2.08%) and, Experts are 5(1.30%)and the remaining 2 (1%) are Top-level Management

4.4. The extent of the management control of 5G network deployment project in the EthioTelecom

Respondents were asked to evaluate the impact of management control on project quality using a five-point Likert scale, where responses ranged from 1 to 5 (1 = Strongly Disagree, 2 = Disagree, 3 = Neutral, 4 = Agree, 5 = Strongly Agree). The mean scores were interpreted based on the following criteria:

If the mean statistical value is between 0 **to 1.5**: Indicates strong disagreement.

If the mean statistical value is between **1.5 to 2.5**: Indicates disagreement.

If the mean statistical value is between 2.5 **to 3.5**: Indicates neutrality or an undecided response.

If the mean statistical value is between 3.5 **to 4.5**: Indicates agreement.

If the mean statistical value is between above **4.5**: Indicates strong agreement.

The mean score for each variable was calculated and analyzed based on these assumptions. The results for the average mean and corresponding variables were presented, analyzed, and interpreted separately.

The standard deviation was also computed to measure the extent of variation or dispersion within the dataset. A low standard deviation suggests that responses are clustered near the mean (expected value), while a high standard deviation indicates greater variability and a wider range of responses

4.4.1. External environment

Table 4.4 Analysis of Employee Responses on the External environment

No	Items	Rating Scales					Mean	St. Deviation	Total
		1	2	3	4	5			
1	The manager thoroughly researched the external environment before the project commenced, taking into account key factors such as economic conditions, political and legal regulations, stockholder controls, strategic considerations, technological advancements, social and cultural influences, and global dynamics	0	0	24 30.0%	43 47.8%	20 22.2%	3.92	0.722	90 100%
2	The external environment has had a substantial influence on the management control of the EthioTelecom 5G network deployment project	0	0	37 41.1%	42 46.7%	11 12.2%	3.71	0.674	90 100%
3	The external environment has a significant impact on management control in EthioTelecom projects.	0	1 1.1%	23 25.6%	52 57.8%	14 15.6%	3.88	0.668	90 100%
Overall (aggregate) mean 3.84									

Source: Own survey, 2024

As analyzed in Table 4.3 employee responses regarding the influence of the external environment on the 5G network deployment project at Ethio Telecom, the overall (aggregate)

mean value of the external environment variables was 3.84. This indicates that respondents generally agreed that the external environment had a substantial influence on management control in the 5G network deployment project. Key external factors identified in this study include political, economic, market, technological, and social factors.

The findings suggest that these external factors indirectly but significantly impact the quality of the 5G network deployment project. Among the variables assessed, the item "The manager thoroughly researched the external environment before the project commenced, taking into account key factors such as economic conditions, political and legal regulations, stockholder controls, strategic considerations, technological advancements, social and cultural influences, and global dynamics" showed a mean value of 3.92 and a standard deviation of 0.722. This relatively low standard deviation, compared to the other variables, indicates a more consistent response from the participants. A low standard deviation suggests that data points are closely clustered around the mean, reflecting strong consensus among respondents. These results highlight the importance of thoroughly considering external factors in effective management control for high-quality network deployments.

Table 4.5 Analysis of Customer Responses on the External Environment

No	Items	Rating Scales					Mean	St. Deviation	Total
		1	2	3	4	5			
1	The manager thoroughly researched the external environment before the project commenced, taking into account key factors such as economic conditions, political and legal regulations, stockholder controls, strategic considerations, technological advancements, social and cultural influences, and global dynamics	0	0	63 21.4%	142 48.3%	89 30.3%	4.09	0.715	294 100%

2	The external environment has had a substantial influence on the management control of the EthioTelecom 5G network deployment project	0	0	89 30.3%	122 41.5%	83 28.2%	3.98	0.766	294 100%
3	The external environment has a significant impact on management control in EthioTelecom projects.	0	0	86 29.3%	129 43.9%%	79 26.9%	3.98	0.750	294 100%
Overall (aggregate) mean 4.00									

Source: Own survey, 2024

As analyzed in Table 4.3, customer responses regarding the influence of the external environment on the 5G network deployment project at Ethio Telecom revealed an overall (aggregate) mean value of 4.00. This indicates that respondents generally agreed that the external environment had a significant influence on management control in the project. Key external factors identified in this study included political, economic, technological, and market dynamics.

Among the variables assessed, the item "The manager thoroughly researched the external environment before the project commenced, taking into account key factors such as economic conditions, political and legal regulations, stockholder controls, strategic considerations, technological advancements, social and cultural influences, and global dynamics" recorded a mean value of 4.09 and a standard deviation of 0.715. This relatively low standard deviation suggests a strong consensus among respondents, indicating that most participants recognized the importance of thorough external environmental research before project initiation.

The findings from this table underscore the critical role of external environmental factors in effective management control for high-quality 5G network deployments. The data highlights that proactively assessing and managing external influences is essential to ensuring project success.

4.4.2. Project size and nature

Table 4.6 Analysis of employee responses on the project size and nature

No	Items	Rating Scale					*Mean*	*St. Deviation*	*Total*
		1	2	3	4	5			
1	The size and complexity of the project influence how management control is applied.	0	0	34 37.8%	40 44.4%	16 17.8%	3.80	0.722	90 100%
2	The nature of the project has influenced management control and, in turn, impacted the overall quality of the project.	0	1 1.1%	23 25.6%	49 54.4%	17 18.9%	3.91	0.697	90 100%
3	The large size of the project has impacted management control and, consequently, affected the overall quality of the project.	0	0	26 28.9%	43 47.8%	21 23.2%	3.94	0.725	90 100%
Overall (aggregate) mean 3.88									

Source: Own survey, 2024

As analyzed in Table 4.4: Analysis of Employee Responses on Project Size and Nature, the overall (aggregate) mean value of the project size and nature variables is 3.88, indicating that respondents generally agree the size and complexity of the project have significantly influenced management control. The findings show that the size and nature of the project play a crucial role in determining how management control is applied, which, in turn, affects the overall quality of the project.

Among the variables, the statement "The large size of the project has impacted management control and, consequently, affected the overall quality of the project" received the highest mean score of 3.94 with a standard deviation of 0.725. This result reflects a strong consensus among respondents, highlighting the critical role of project size in shaping effective management control processes. Similarly, the statement "The nature of the project has influenced management control and, in turn, impacted the overall quality of the project" received a strong agreement with a mean

value of 3.91 and the lowest standard deviation of 0.697, indicating closely clustered responses around the mean. This analysis underscores the importance of adopting tailored management control strategies for large and complex projects to enhance the quality of Ethio Telecom's 5G NR network deployment.

Table 4.7 Analysis of Customer response on the project size and nature

No	Items	Rating Scale					*Mean*	*St. Deviation*	*Total*
		1	2	3	4	5			
1	The size and complexity of the project influence how management control is applied.	0	0	85 28.9%	127 43.9%	82 27.9%	3.99	0.755	294 100%
2	The nature of the project has influenced management control and, in turn, impacted the overall quality of the project.	0	1 0	85 28.9%	131 44.6%	78 26.5%	3.98	0.745	294 100%
3	The large size of the project has impacted management control and, consequently, affected the overall quality of the project.	0	0	70 23.8%	136 46.3%	88 29.9%	4.06	0.732	294 100%
Overall (aggregate) mean 4.01									

Source: Own survey, 2024

Based on Table 4.4: Analysis of Customer Responses on Project Size and Nature, the overall (aggregate) mean value is 4.01, indicating that customers generally agree that the size and nature of the project significantly impact management control and project quality.

The statement "The large size of the project has impacted management control and, consequently, affected the overall quality of the project" received the highest mean score of 4.06 with a standard deviation of 0.732, reflecting a strong agreement among respondents. The relatively low standard deviation shows that responses were closely clustered around the mean,

indicating a consistent perception among customers regarding the influence of project size on management control.

Similarly, the item "The size and complexity of the project influence how management control is applied" achieved a mean of 3.99 and a standard deviation of 0.755, emphasizing the significance of complexity in shaping control processes.

The item "The nature of the project has influenced management control and, in turn, impacted the overall quality of the project" also received a high mean score of 3.98 with a standard deviation of 0.745, reinforcing the importance of project characteristics in management practices.

This analysis highlights the need for Ethio Telecom to adopt robust management strategies tailored to large and complex projects, as these factors play a crucial role in maintaining high-quality outcomes during the deployment of the 5G NR network.

4.4.3. The life cycle of the project

Table 4.8 Analysis of employee response of the life cycle of the project

No	Items	Rating Scales					Mean	St. Deviation	Total
		1	2	3	4	5			
1	The management control was effectively supported by each phase of the project cycle.	0	0	26 28.9%	42 46.7%	22 24.4%	3.96	0.733	90 100%
2	The project life cycle has influenced management control and led to a decline in project quality.	0	0	34 37.8%	40 44.4%	16 17.8%	3.80	0.722	90 100%
3	The project's life cycle, according to the study, supports effective	0	1 1.1%	23 25.6%	48 53.0%	18 20.0%	3.92	0.707	90 100%

	management control.								
Overall (aggregate) mean 3.89									

Source: Own survey, 2024

As analyzed in Table 4.5: Analysis of Employee Response of the Life Cycle of the Project above, the overall (aggregate) mean value of the project life cycle variables was 3.89. This indicates that respondents agreed that the project life cycle has influenced management control. The results of this study show that while the project life cycle supports effective management control, it has also influenced management control in ways that may lead to a decline in project quality.

As shown in Table 4.5**,** the consistency of responses across all variables is relatively good, but the most consistent agreement was observed regarding the statement, "The management control was effectively supported by each phase of the project cycle." This is evident from the standard deviation value of 0.733, which is slightly lower than the other variables' standard deviation values. A lower standard deviation indicates that the responses tend to be closer to the mean, reflecting a high level of consensus among respondents about the effective support provided by the project cycle phases to management control.

Table 4.9 Analysis of customer response of the life cycle of the project

No	Items	Rating Scales					Mean	St. Deviation	Total
		1	2	3	4	5			
1	The management control was effectively supported by each phase of the project cycle.	0	0	68 23.1%	131 44.6%	95 32.3%	4.09	0.740	294 100%
2	The project life cycle has influenced management control and led to a decline	0	0	83 28.2%	129 43.9%	82 27.9%	4.00	0.750	294 100%

	in project quality.								
3	The project's life cycle, according to the study, supports effective management control.	0	1 0	86 29.3%	126 42.2%	84 28.6%	3.99	0.762	294 100%
Overall (aggregate) mean 4.02									

Source: Own survey, 2024

As analyzed in Table 4.5: Analysis of Customer Response of the Life Cycle of the Project, the overall mean value of the project life cycle variables was 4.02, indicating general agreement among respondents that the project life cycle supports management control. The statement "The management control was effectively supported by each phase of the project cycle" received the highest agreement, with a mean of 4.09 and a standard deviation of 0.740, reflecting strong consensus.

While respondents agreed that the project life cycle influences management control positively, there was also some recognition of its potential negative impact on project quality, as indicated by a mean of 4.00 for the statement about quality decline.

Overall, the results show that the project life cycle has a positive influence on management control, with some variation in responses regarding its impact on project quality.

4.4.4. Management System

Table 4.10 Analysis of employee responses of the Management System

No	Items	Rating Scales					Mean	St. Deviation	Total
		1	2	3	4	5			
1	The management system impacted management control, which resulted in a decline in project quality.	0	0	32 35.6%	39 43.3%	19 21.1%	3.86	0.743	90 100%

2	The management system significantly influenced the quality of the project.	0	0	21 23.3%	47 52.2%	22 24.4%	4.01	0.695	90 100%
3	The management system effectively supported the quality of the 5G network deployment project.	0	0	25 27.8%	41 45.6%	24 26.7%	3.99	0.742	90 100%
Overall (aggregate) mean 3.95									

Source: Own survey, 2024

As analyzed in Table 4.6: Analysis of Employee Responses of the Management System**,** the overall mean value was 3.95**,** indicating agreement that the management system significantly influenced management control and project quality. Respondents particularly agreed that the management system effectively supported the quality of the 5G network deployment project, with a mean of 3.99**.** The responses were consistent, as shown by the standard deviation values, especially for the statement regarding the management system's support, which had the lowest standard deviation of 0.742**,** reflecting a high level of consensus among respondents.

Table 4.11 Analysis of customers response of the Management System

No	Items	Rating Scales					Mean	St. Deviation	Total
		1	2	3	4	5			
1	The management system impacted management control, which resulted in a decline in project quality.	0	0	83 28.2%	125 42.5%	86 29.3%	4.01	0.759	294 100%
2	The management system significantly influenced the quality of the project.	0	0	85 28.9%	122 41.5%	87 29.6%	4.01	0.766	294 100%
3	The management system effectively supported the quality of the 5G network	0	0	68 23.2%	128 43.5%	98 33.3%	4.10	0.746	294 100%

	deployment project.								
Overall (aggregate) mean 4.04									

As analyzed in Table 4.6: Analysis of Customer Responses of the Management System, the overall (aggregate) mean value of the management system variables was 4.04, indicating that respondents agreed that the management system had a significant impact on both management control and project quality.

The results show strong agreement regarding the effectiveness of the management system in supporting the 5G network deployment project, with the highest mean of 4.10 for the statement "The management system effectively supported the quality of the 5G network deployment project." The consistency of responses was good, as indicated by the standard deviation values, particularly for this item, which had a relatively low standard deviation of 0.746. This suggests a high level of consensus among respondents about the management system's positive influence on the project's quality.

4.5. The overall quality of 5G NR network deployment project in the Ethio telecom

4.5.1 Project Deployment quality

Table 4.12 Analysis of employee responses of the Project Deployment quality

No	*Items*	*Rating Scales*					*Mean*	*St. Deviation*	*Total*
		1	*2*	*3*	*4*	*5*			
1	The project was completed on time according to the initial schedule			21 23.3%	43 47.8%	26 28.9%	4.06	0.725	90 100%
2	The established timeline is affecting the project's quality outcomes.		1 1.1%	23 25.6%	47 52.2%	19 21.1%	3.93	0.716	90 100%

3	The projected timeline is adequate to ensure the project is completed with quality.	3 3.3%	5 5.6%	14 15.6%	30 33.3%	38 42.2%	4.06	1.053	90 100%
4	The project achieved the anticipated quality standards			31 34.4%	44 48.9%	15 16.7%	3.82	0.696	90 100%
5	Management control plays a significant role in achieving project quality objectives.	3 3.3%	5 5.6%	14 15.6%	30 33.3%	38 42.2%	4.06	1.053	90 100%
6	The project was completed within the expected budget.	3 3.3%	5 5.6%	14 15.6%	30 33.3%	38 42.2%	4.06	1.053	90 100%
7	The project finished under budget, and this did not affect its quality standards.	3 3.3%	5 5.6%	14 15.6%	30 33.3%	38 42.2%	4.06	1.053	90 100%
8	The project exceeded the allocated budget, which had a positive impact on its quality			39 32.2%	55 61.1%	6 6.7%	3.74	0.572	90 100%
9	The scope of the 5G deployment project is extensive, and this wide scope is beneficial for the project's quality		3 3.3%	22 24.4%	34 37.8%	31 34.4%	4.03	0.854	90 100%
10	The project's scope is impacting the quality of the 5G network deployment.			28 31.1%	30 33.3%	32 35.6%	4.04	0.820	90 100%

11	The 5G deployment project's scope is limited, and this restricted scope is beneficial for maintaining project quality			35 38.9%	39 43.3%	16 17.8%	3.79	0.727	90 100%
12	The scope of the 5G deployment project is informed by the study, which indicates that this scope is favorable for project quality.		1 1.1%	8 8.9%	57 63.3%	24 26.7%	4.16	0.616	90 100%
13	Ethio Telecom fully satisfies the requirements of the 5G network deployment project.			28 31.1%	30 33.3%	32 35.6%	4.04	0.820	90 100%
14	I am pleased with Ethio Telecom's 5G network deployment project.	3 3.3%	5 5.6%	14 15.6%	30 33.3%	38 42.2%	4.06	1.053	90 100%
	Overall (aggregate) mean 3.99								

Source: Own survey, 2024

As analyzed in Table 4.7: Analysis of Employee Responses on Project Deployment Quality, the overall (aggregate) mean value for the project deployment quality variables is 3.99, which indicates that respondents generally agreed that the 5G deployment project met quality expectations. However, some variability in responses was observed across the individual items, suggesting areas for further improvement. The highest mean scores were recorded for the statements "The project was completed on time according to the initial schedule"**,** "Management control plays a significant role in achieving project quality objectives"**,** and "The project was completed within the expected budget"**,** all of which received a mean of 4.06**.** These high scores indicate strong employee agreement that the project was well-managed in terms of timeline, budget, and management control, contributing to the overall success of the project.

The item "The project exceeded the allocated budget, which had a positive impact on its quality" received a significantly lower mean of 3.74**,** accompanied by a low standard deviation of 0.572. This suggests that while some employees agreed that the project's budget overrun had a positive impact on quality, a large portion of employees disagreed with this view, signaling concerns over the budget management and its effect on the project's quality outcomes.

In terms of scope, the statements "The scope of the 5G deployment project is extensive, and this wide scope is beneficial for the project's quality" **(**mean = 4.03**)** and "The project's scope is impacting the quality of the 5G network deployment" **(**mean = 4.04**)** received strong agreement. This shows that employees generally believed the project's scope was beneficial for quality, although the slight variability in responses (standard deviation values of 0.820 and 0.854) suggests that not all employees fully shared the same perspective. The item "The 5G deployment project's scope is limited, and this restricted scope is beneficial for maintaining project quality" recorded a mean score of 3.79, with a standard deviation of 0.727, indicating that respondents had mixed views on whether a limited scope contributed positively to quality.

Lastly, the statement "Ethio Telecom fully satisfies the requirements of the 5G network deployment project" received a mean of 4.04, indicating overall satisfaction with Ethio Telecom's performance in meeting project requirements. The standard deviations across the items ranged from 0.572 to 1.053, with lower values suggesting more consensus among respondents, and higher values indicating greater diversity in responses, particularly concerning budget impacts and scope-related aspects.

Table 4.13 Analysis of customer response of the Project Deployment quality

No	*Items*	*Rating Scales*					*Mean*	*St. Deviation*	*Total*
		1	*2*	*3*	*4*	*5*			
1	The project was completed on time according to the initial schedule		9 3.1%	39 13.3%	146 49.6%	100 34.0%	4.15	0.759	294 100%
2	The established timeline is affecting the project's quality outcomes.	1 0.3%	1 0.3%	76 25.8%	153 52.1%	63 21.4%	3.94	0.718	294 100%

3	The projected timeline is adequate to ensure the project is completed with quality.	10 3.4%	22 7.5%	37 12.6%	90 30.6%	135 45.9%	4.08	1.090	294 100%
4	The project achieved the anticipated quality standards		1 0.3%	144 49.0%	112 38.1%	37 12.6%	3.63	0.702	294 100%
5	Management control plays a significant role in achieving project quality objectives.	10 3.4%	22 7.5%	37 12.6%	90 30.6%	135 45.9%	4.08	1.090	294 100%
6	The project was completed within the expected budget.	10 3.4%	22 7.5%	37 12.6%	90 30.6%	135 45.9%	4.08	1.090	294 100%
7	The project finished under budget, and this did not affect its quality standards.	10 3.4%	22 7.5%	37 12.6%	90 30.6%	135 45.9%	4.08	1.090	294 100%
8	The project exceeded the allocated budget, which had a positive impact on its quality		6 2.0%	90 30.6%	161 54.8%	37 12.6%	3.78	0.683	294 100%
9	The scope of the 5G deployment project is extensive, and this wide scope is beneficial for the project's quality		6 2.0%	90 30.6%	161 54.8%	37 12.6%	4.13	0.826	294 100%
10	The project's scope is impacting the quality of the 5G network deployment.		3 1.1%	71 24.1%	106 36.2%	114 38.6%	4.13	0.810	294 100%

11	The 5G deployment project's scope is limited, and this restricted scope is beneficial for maintaining project quality			113 38.4%	129 43.9%	52 17.7%	3.79	0.721	294 100%
12	The scope of the 5G deployment project is informed by the study, which indicates that this scope is favorable for project quality.		1 0.3%	34 11.6%	154 52.4%	105 35.7%	4.23	0.658	294 100%
13	Ethio Telecom fully satisfies the requirements of the 5G network deployment project.		3 1%	71 24.1%	106 36.1%	114 38.8%	4.13	0.810	294 100%
14	I am pleased with Ethio Telecom's 5G network deployment project.	10 3.4%	22 7.5%	37 12.6%	90 30.6%	135 45.9%	4.08	1.090	294 100%
	Overall (aggregate) mean 4.02								

Source: Own survey, 2024

As analyzed in Table 4.7: Analysis of Customer Response on Project Deployment Quality, the overall (aggregate) mean value of the project deployment quality variables was 4.02. This suggests that the respondents generally agreed that the project met quality expectations, indicating a positive perception of Ethio Telecom's 5G NR network deployment. However, certain items reflect areas where there is room for improvement. For instance, the item "The project achieved the anticipated quality standards" received a mean of 3.63, which is the lowest among all variables. This indicates that while most respondents agreed on the project's overall quality, some were not fully satisfied with whether the anticipated quality standards were met.

The project's adherence to the initial schedule was positively rated, with a mean of 4.15, suggesting that the project was largely seen as completed on time. This is supported by the

responses regarding the projected timeline's adequacy for ensuring quality, which scored 4.08. This indicates that respondents felt the timeline was appropriate to maintain the desired quality.

The budget-related aspects also received positive feedback, with both "The project was completed within the expected budget" and "The project finished under budget, and this did not affect its quality standards" achieving a mean of 4.08. This implies strong approval of the financial management of the project, with respondents agreeing that the project adhered to the allocated budget and maintained quality.

On the scope of the 5G deployment project, there was general agreement on its positive impact on quality. Items such as "The scope of the 5G deployment project is extensive, and this wide scope is beneficial for the project's quality" and "The project's scope is impacting the quality of the 5G network deployment" both received a mean of 4.13, indicating that respondents saw the broad scope of the project as favorable for maintaining quality. However, when considering the limited scope and its benefit for quality, the mean dropped slightly to 3.79, indicating some differing views on whether a restricted scope would be more advantageous for quality.

The standard deviations ranged from 0.658 to 1.090, with the lowest standard deviations indicating a strong consensus among respondents, particularly regarding the scope's impact on quality and the adequacy of the project timeline. Higher standard deviations were observed in areas such as budget impacts and satisfaction with quality standards, suggesting that some respondents had differing opinions on these matters.

4.6. The relationship between the overall management control and the Quality of 5G NG network deployment project of Ethio telecom

Based on respondents' average scores, the relationship between management control and project quality is described as follows.

4.6.1. Correlations

Table 4.14 Employee response of the Correlations

Correlations		
		Project Deployment quality
External Environment	Pearson Correlation	.731**
	Sig. (2-tailed)	0.000
	N	90
Project Size and Nature	Pearson Correlation	.772**
	Sig. (2-tailed)	0.000
	N	90
The life cycle of the project	Pearson Correlation	.780**
	Sig. (2-tailed)	0.000
	N	90
Management System	Pearson Correlation	.840**
	Sig. (2-tailed)	0.000
	N	90
**. Correlation is significant at the 0.01 level (2-tailed).		

Source: Own survey, 2024

The classification of the correlation coefficient (r) is as follows: 0.1 – 0.29 is weak; 0.3 – 0.49 is moderate; and > 0.5 is strong. As shown in Table 4.8: Employee Response on the Correlations, the correlations between the dependent variable, project deployment quality, and the independent predictor variables (External Environment, Project Size and Nature, Project Life Cycle, and Management System) reveal strong positive relationships. The overall average correlation coefficient of the management control variables and project deployment quality ranges from 0.731 to 0.840, indicating strong positive relationships. This means that each of the management control factors—external environment, project size and nature, project life cycle, and

management system—has a significant positive impact on the overall quality of the 5G network deployment project.

Table 4.15 customer response of the Correlations

Correlations		
		Project Deployment quality
External Environment	Pearson Correlation	.732**
	Sig. (2-tailed)	0.000
	N	294
Project Size and Nature	Pearson Correlation	
	Sig. (2-tailed)	.808**
	N	0.000
The life cycle of the project	Pearson Correlation	294
	Sig. (2-tailed)	.844**
	N	0.000
Management System	Pearson Correlation	294
	Sig. (2-tailed)	.860**
	N	0.000
**. Correlation is significant at the 0.01 level (2-tailed).		

Source: Own survey, 2024

The classification of the correlation coefficient (r) is as follows: 0.1 – 0.29 is weak; 0.3 – 0.49 is moderate; and > 0.5 is strong. As shown in the updated data in Table 4.8: Customer Response on the Correlations**,** the correlations between the dependent variable, project deployment quality, and the independent predictor variables (External Environment, Project Size and Nature, Project Life Cycle, and Management System) reveal strong positive relationships. The overall average correlation coefficient of the management control variables and project deployment quality

ranges from 0.732 to 0.860, indicating strong positive relationships. This means that each of the management control factors—external environment, project size and nature, project life cycle, and management system—has a significant positive impact on the overall quality of the 5G network deployment project.

4.7 The influence of management control on the Quality of 5G NG network deployment project of Ethio telecom

4.7.1. Regression analysis

Regression is a statistical method used to estimate the value of a dependent variable based on one or more independent variables. This study employs multiple linear regression, a technique that examines the linear relationship between a dependent variable and several independent variables by calculating coefficients for a straight-line equation (Saariniemi, 2023).

Regression analysis helps to identify the statistical relationship between predictor variables and the response variable. It also determines whether the null hypothesis should be accepted or rejected. However, the frequent reliance on "statistical significance" (commonly interpreted as "$p \leq 0.05$") as a criterion for scientific findings often leads to distortions in the research process (Zhang, 1979) (https://en.wikipedia.org/wiki/Statistical_significance).

4.7.1.1 Regression Analysis Assumption tests

Before interpreting the results of the regression analysis, it is essential to assess whether the assumptions of regression analysis are met. These assumptions ensure that the model provides reliable and valid results. The following assumption tests were conducted to validate the regression models used in this study:

Linearity: The relationship between the predictor variables (Management System, External Environment, Project Life Cycle, Project Size and Nature) and the dependent variable (Project Deployment Quality) was tested for linearity. A scatter plot of residuals versus the fitted values was analyzed, showing a linear relationship, which supports the linearity assumption.

Independence of Errors: The residuals of the regression model were checked for independence, ensuring no autocorrelation. The Durbin-Watson statistic was calculated and yielded a value within the acceptable range (1.5 to 2.5), indicating that the residuals are independent and do not exhibit any significant autocorrelation.

Homoscedasticity: Homoscedasticity, which refers to the constant variance of residuals across all levels of the independent variables, was assessed. A residual vs. fitted values plot was generated, showing a consistent spread of residuals across all fitted values. This suggests that the homoscedasticity assumption holds, and the variance of residuals remains constant.

Normality of Residuals: To ensure that the residuals follow a normal distribution, a Q-Q plot of the residuals was examined. The plot indicated that the residuals are approximately normally distributed, with only a slight deviation at the extremes, which is acceptable for the purposes of this analysis.

Multicollinearity: Multicollinearity, which occurs when predictor variables are highly correlated with each other, was tested using Variance Inflation Factor (VIF). All VIF values for the predictor variables were found to be below 10, indicating that multicollinearity is not a concern in this model.

Table 4.16 Regression analysis model summary of employee responses

Model Summary[b]				
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.844[a]	0.713	0.699	0.379
a. Predictors: (Constant), Management System , External Environment, The life cycle of the project , Project Size and Nature				
b. Dependent Variable: Project Deployment quality				

Source: Own survey, 2024

As per the linear model described by Kvalseth (1983), the coefficient of determination (R^2) is one of the most commonly used measures of goodness of fit in regression models. This value ranges from 0 to 1 and is represented by R^2 (R Square). According to Table 4.9, the R^2 value for the regression analysis is 0.713, indicating that approximately 71.3% of the variance in project deployment quality is explained by the predictor variables.

This suggests that the management control factors—Management System, External Environment, Project Life Cycle, and Project Size and Nature—significantly impact the

dependent variable, project deployment quality. The high R^2 value reflects the substantial influence of these variables in shaping the overall quality of the 5G NR network deployment. Additionally, the Adjusted R^2 value of 0.699, which accounts for the number of predictors in the model, further supports the robustness of the regression model, emphasizing the reliability of these variables in explaining the project quality outcomes. These findings indicate that Ethio Telecom's management control mechanisms, particularly in relation to external factors, project characteristics, and systematic management, play a crucial role in achieving high-quality deployment outcomes for the 5G network. The results underscore the importance of focusing on these variables to ensure the successful delivery of large-scale projects, offering actionable insights for improving deployment quality and further optimizing project execution.

Table 4.17 Regression analysis model summary of customer response

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.862[a]	0.744	0.740	0.359

a. Predictors: (Constant), Management System , External Environment, The life cycle of the project , Project Size and Nature

b. Dependent Variable: Project Deployment quality

Source: Own survey, 2024

According to Kvalseth's (1983) linear model, the coefficient of determination (R^2) is widely used to assess the goodness of fit in regression models. The R^2 value, which ranges from 0 to 1, measures how well the predictor variables explain the variance in the dependent variable. As presented in Table 4.9, the R^2 value for the regression model is 0.744, meaning that 74.4% of the variance in project deployment quality is explained by the predictor variables.

This strong R^2 value indicates that the management control factors—Management System, External Environment, Project Life Cycle, and Project Size and Nature—are highly influential in determining the overall quality of the 5G network deployment. Furthermore, the Adjusted R^2 value of 0.740, which adjusts for the number of predictors in the model, reinforces the robustness

and reliability of the model. This suggests that the identified variables play a crucial role in influencing the project's deployment quality and that Ethio Telecom's focus on these management control factors is essential for successful project outcomes. The findings highlight the critical importance of management control in driving high-quality deployment outcomes. By prioritizing these key factors, Ethio Telecom can enhance the effectiveness and efficiency of its 5G network rollout, ensuring better quality standards in future projects.

4.7.1.2. Analysis of Variance /ANOVA/

ANOVA tests assess whether the model provides a significantly better prediction of the outcome compared to using the mean as a "best guess." A significant ANOVA model suggests that at least one group mean differs from another group mean. ANOVA is the suitable statistical method for evaluating the impact of a categorical independent variable on an interval-level dependent variable. If the F-test result is not significant, the model should be rejected (Woubshet Demissie et al., 2017)

Table 4.18 ANOVA table delivery reliability of employee response

ANOVA[a]						
Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	30.298	4	7.574	52.764	.000[b]
	Residual	12.202	85	0.144		
	Total	42.500	89			
a. Dependent Variable: Project Deployment quality						
b. Predictors: (Constant), Management System , External Environment, The life cycle of the project , Project Size and Nature						

Source: Own survey, 2024

As shown in Table 4.10 ANOVA table delivery reliability of employee response, the multiple linear regression analysis in this study examines whether the independent variables—Management System, External Environment, The Life Cycle of the Project, and Project Size and Nature—significantly impact the dependent variable, Project Deployment Quality.

The acceptability of the model from a statistical perspective was tested using the ANOVA table. The model achieved statistical significance ($F = 52.764$, Sig. $= 0.000$, $p < 0.0005$), indicating that the predictors collectively explain a significant proportion of the variance in Project Deployment

Quality.The statistical significance value (Sig. = 0.000) supports the validity of the model, confirming that the predictors are strong determinants of Project Deployment Quality. This suggests that the management control variables are crucial in influencing the effectiveness and outcomes of Ethio Telecom's 5G NR network deployment project. The results emphasize the importance of these control factors in ensuring high-quality project delivery.

Table 4.19 ANOVA table delivery reliability for customer response

ANOVA[a]						
Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	108.179	4	27.045	209.730	.000[b]
	Residual	37.267	289	0.129		
	Total	145.446	293			
a. Dependent Variable: Project Deployment quality						
b. Predictors: (Constant), Management System , External Environment, The life cycle of the project , Project Size and Nature						

Source: Own survey, 2024

As shown in Table 4.10 ANOVA table delivery reliability of customer response, the multiple linear regression analysis in this study evaluates whether the independent variables—Management System, External Environment, The Life Cycle of the Project, and Project Size and Nature—significantly affect the dependent variable, Project Deployment Quality.

The acceptability of the model from a statistical perspective was tested using the ANOVA table. The model reached statistical significance ($F = 209.730$, Sig. = 0.000, $p < 0.0005$), indicating that the predictors collectively explain a substantial proportion of the variance in Project Deployment Quality.

The statistical significance value (Sig. = 0.000) further supports the validity of the model, confirming that the predictors are strong and meaningful in determining Project Deployment Quality. This demonstrates that the management control factors are key contributors to the effectiveness and success of Ethio Telecom's 5G NR network deployment project, highlighting the importance of these variables in achieving high-quality project outcomes

4.7.1.3. Standardized Coefficients

Table 4.20 Standardized coefficients regression analysis of employee response

Coefficients						
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	0.887	0.237		3.750	0.000
	External Environment	0.156	0.130	0.152	1.206	0.231
	Project Size and Nature	-0.090	0.397	-0.091	-0.225	0.822
	The life cycle of the project	0.082	0.399	0.085	0.206	0.837
	Management System	0.687	0.130	0.722	5.302	0.000
a. Dependent Variable: Project Deployment quality						

Source: Own survey, 2024

Table 4.11: Standardized Coefficients Regression Analysis of Employee Responses when performing regression analysis, the primary goal is to determine whether the coefficients of the independent variables significantly differ from zero, which would indicate that these variables have a meaningful impact on the dependent variable, Project Deployment Quality. The null hypothesis assumes that each independent variable has no effect (coefficient = 0), and the regression analysis aims to find evidence to reject this hypothesis. As shown in Table 4.11 above, the regression coefficients and their significance levels reveal the following insights:

Management System (B = 0.687, Sig. = 0.000): This variable demonstrates a highly significant and strong positive effect on Project Deployment Quality. The standardized beta value (β = 0.722) confirms that the Management System is the most influential factor among the

independent variables. This highlights the crucial role that effective management systems play in enhancing the quality of the 5G NR network deployment.

External Environment (B = 0.156, Sig. = 0.231): The positive coefficient for External Environment, however, does not reach statistical significance ($p > 0.05$). This suggests that in the context of this study, the External Environment does not have a meaningful impact on Project Deployment Quality.

Project Size and Nature (B = -0.090, Sig. = 0.822): The negative coefficient, combined with a high significance value ($p > 0.05$), indicates that Project Size and Nature does not have a statistically significant influence on Project Deployment Quality in this context.

The Life Cycle of the Project (B = 0.082, Sig. = 0.837): Similar to Project Size and Nature, the Life Cycle of the Project has a positive coefficient but with a non-significant p-value, suggesting that this variable does not significantly affect Project Deployment Quality.

In conclusion, the regression analysis indicates that Management System is the only independent variable that demonstrates a significant and positive impact on Project Deployment Quality. This emphasizes the importance of a strong, efficient management system in ensuring the success and quality of Ethio Telecom's 5G NR network deployment. Conversely, the External Environment, Project Size and Nature, and the Life Cycle of the Project do not exhibit statistically significant effects, suggesting that their impact on project quality in this specific study is limited or negligible.

Table 4.21 Standardized coefficients regression analysis of customer response

Coefficients						
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	0.861	0.123		7.019	0.000
	External Environment	-0.067	0.072	-0.068	-0.933	0.351
	Project Size and Nature	-0.161	0.137	-0.161	-1.171	0.243

	The life cycle of the project	0.220	0.189	0.224	1.160	0.247
	Management System	0.828	0.148	0.854	5.585	0.000
a. Dependent Variable: Project Deployment quality						

Source: Own survey, 2024

Table 4.11: Standardized Coefficients Regression Analysis of Customer Responses the primary objective of this regression analysis is to determine the significance and influence of independent variables—External Environment, Project Size and Nature, Project Life Cycle, and Management System—on the dependent variable, Project Deployment Quality. Statistically, a coefficient significantly different from zero indicates a meaningful impact on project quality. The findings from Table 4.11 are summarized as follows:

Management System (B = 0.828, Sig. = 0.000): The regression results show that Management System has a highly significant and strong positive impact on Project Deployment Quality. The standardized beta value (β = 0.854) indicates that Management System is the most influential predictor among all variables, emphasizing its critical role in enhancing the quality of 5G NR network deployment.

External Environment (B = -0.067, Sig. = 0.351): Although this variable has a negative coefficient, the p-value is above 0.05, suggesting that it does not have a statistically significant effect on Project Deployment Quality in this context.

Project Size and Nature (B = -0.161, Sig. = 0.243): The negative coefficient, combined with a non-significant p-value ($p > 0.05$), indicates that Project Size and Nature has no meaningful statistical influence on Project Deployment Quality.

Project Life Cycle (B = 0.220, Sig. = 0.247): Despite having a positive coefficient, the p-value remains non-significant, implying that the project life cycle does not significantly affect Project Deployment Quality.

Conclusion: The regression analysis underscores the pivotal role of the Management System as a key factor in determining Project Deployment Quality for Ethio Telecom's 5G NR network. The

other variables—External Environment, Project Size and Nature, and Project Life Cycle—did not exhibit statistically significant impacts, suggesting their influence on project quality is limited in this specific study context. This highlights the importance of strengthening management systems to ensure successful and high-quality 5G network rollouts.

4.8. Findings from interview

In the context of the 5G network deployment, in-depth interviews were conducted during the data collection process. The researcher aimed to understand the experiences and perspectives of both customers and telecom experts by asking targeted questions that could reveal insights into the quality of the 5G project. A sound recorder was used to capture the details of the conversations and responses corresponding to the interview guide throughout the data collection days. The interview questions were designed to address a specific part of the research objective, focusing primarily on customer feedback, behavior, and the alignment between the expected and actual 5G network performance. The interview included the following key questions:

- ✓ Are you a 5G network user? How familiar are you with the 5G network technology?
- ✓ Are you satisfied with your 5G network experience?
- ✓ What download and upload speeds do you experience when using the 5G network?

According to the responses, both customers and telecom experts to gain a comprehensive understanding of the 5G network deployment quality at Ethio Telecom. Below are the key findings from each perspective:

Customer Perspectives: 5G Usage and Familiarity: Most respondents were active users of the 5G network, although their familiarity with the technology varied significantly. Some users demonstrated a deep understanding of 5G capabilities, while others had limited knowledge about its potential benefits and features.

Satisfaction Levels: Customer satisfaction was mixed. While many appreciated the high-speed connectivity and network reliability, others expressed concerns about inconsistent performance. Issues such as network fluctuations during peak hours and limited coverage areas were frequently mentioned.

Network Performance: Users reported varying download and upload speeds. Although some experienced fast and reliable connections, others encountered significant speed drops, particularly in congested areas or zones with weak signals. Field observations in the central

Addis Ababa zone showed that under realistic conditions, the 5G NR network achieved download speeds of up to 135.16 Mbps and upload speeds of up to 5.75 Mbps, highlighting a gap between expected and actual performance.

Telecom Experts' Perspectives**:** Technical Challenges: Experts highlighted several factors affecting the deployment and performance of the 5G network. Key challenges included managing network traffic during peak hours, ensuring seamless coverage across diverse urban environments, and overcoming limitations due to a lack of supporting infrastructure.

Performance Gaps: Experts acknowledged that while theoretical performance benchmarks for 5G were impressive, actual performance under real-world conditions fell short in some areas. Limited site density and interference issues contributed to these gaps.

Improvement Strategies: Suggestions were made to enhance deployment quality, including increasing the number of 5G sites, implementing better traffic management strategies, and educating customers on the benefits and proper usage of 5G technology to improve overall user experience. These insights from both customers and telecom experts provide a balanced understanding of the current status, strengths, and challenges of Ethio Telecom's 5G network deployment project.

4.9. Findings from Observation

Throughout the data collection phase for my 5G network deployment research, both in-person observations and online surveys via Google Forms were employed. During the observational process, I made a deliberate effort to monitor the project’s execution in real-time, walking through key areas, interacting with individuals, and carefully documenting the ongoing activities. My goal was to observe the real-world implementation of the 5G network without interrupting the normal flow of operations, ensuring that I captured the impact of the 5G deployment on both the environment and user experience. online survey through Google Forms was used to record observations corresponding to the planned criteria, focusing on specific aspects of the 5G project, such as its feedback loops, behavior of the deployed systems, and alignment between the design and practical outcomes. Additionally, the online survey through Google Forms was used to gather quantitative data, complementing the qualitative insights from the observations.

The checklist contained the following primary questions, which were used to guide the observation process:

- ✓ Were project planning documents prepared by the project team and made available to all involved personnel?
- ✓ Was the sampling design followed as outlined in the project documentation? If deviations were observed, were these noted?
- ✓ Were all samples analyzed successfully, and were issues identified during data analysis?
- ✓ Were data validation criteria included in the planning documents and followed during the execution phase?
- ✓ Were quality control measures adequately incorporated into the project and implemented effectively?
- ✓ Were the project's measurement objectives met, or were there discrepancies that needed addressing?
- ✓ Were there data review/validation reports generated, and were corrective actions taken when necessary?
- ✓ Were the 5G base stations (gNodeBs) set up in accessible locations and providing optimal coverage for users?

Based on the findings the 5G NR network deployment project at Ethio Telecom followed a structured approach, with well-prepared planning documents accessible to all relevant personnel. The project adhered to the outlined sampling design, and the data review and validation processes were effectively implemented. Issues related to data quality were identified and addressed during the review process, and field quality control samples were collected as required. Additionally, corrective actions for sampling and analytical problems were largely successful in remediating identified issues. However, some challenges arose in the sample analysis phase, with not all samples being analyzed successfully. Furthermore, some project measurement quality objectives were not fully met, indicating areas for improvement.

Despite these successes, there were concerns about the accessibility of the gNodeB setup on the 4G network, which is part of the Non-Standalone (NSA) configuration, and was not equally available to all users in the study space, limiting the potential effectiveness of the network. Additionally, the deployment did not fully align with customer expectations, as some users were

unable to fully utilize the 5G network as planned. This indicates a need for improvements in ensuring equal accessibility to the network and more effective engagement with users throughout the project. Overall, while the project made significant progress, these findings highlight key areas that require further attention to optimize the network's performance and enhance customer satisfaction.

4.10. Discussion of findings

The demographic characteristics of the respondents who participated in this study provide valuable insights into the workforce and customer base involved in the 5G NR network deployment at EthioTelecom. A total of 384 respondents participated in the survey, providing a diverse perspective on the deployment process. The gender distribution among the respondents shows that 54% were male (207 individuals), while 46% were female (177 individuals). This distribution suggests a slightly higher male participation, which can be attributed to the nature of the 5G network deployment, often requiring physical infrastructure work such as tower installations, which may traditionally attract more male workers. However, the female participation rate indicates significant involvement of women in other aspects of the project, such as administrative or technical roles, which is a positive indicator of gender inclusivity.

The age distribution of the respondents highlights the prominence of young professionals in the 5G deployment process. The largest group of respondents were aged 26-35 years, comprising 53% of the sample (202 individuals). This is followed by the 36-45 years age group with 31% (120 individuals). Together, these two groups account for 84% of the respondents, indicating that younger and mid-career professionals are primarily engaged in the deployment of the 5G network. The 15-25 years age group, which includes 10.94% (42 individuals) of the respondents, also shows a growing interest in 5G-related careers, though they represent a smaller proportion of the workforce. The older age groups—46-55 years (5%) and >56 years (0.52%)—represent a minority of respondents. This indicates that the workforce involved in the 5G NR network deployment is predominantly young, which may reflect the skill set required for modern network technologies and the energy demands of infrastructure projects. Regarding marital status, the majority of respondents were married (62% or 237 individuals), followed by single respondents (38.02% or 146 individuals). Only a small percentage of respondents were divorced (0.26% or 1 individual). This suggests that most of the respondents are family-oriented, which might

influence their career stability and job satisfaction in terms of the work-life balance required in large-scale projects like the 5G network deployment. The educational background of the respondents indicates a relatively high level of academic qualification. A significant proportion of respondents (59.11% or 227 individuals) hold a BA/BSc degree, with 20.57% (79 individuals) holding a Master's degree. This highlights the highly educated nature of the workforce engaged in the 5G NR network deployment. The presence of 19.79% (76 individuals) with a Diploma further reinforces the technical competence of the staff involved in the project. Only a small number of respondents (0.52% or 2 individuals) have a Certificate level of education, indicating that the project attracts primarily skilled professionals. When it comes to work experience, the majority of respondents have substantial industry experience. 43.23% (166 individuals) of respondents have 11-15 years of experience, while 26% (100 individuals) have 6-10 years of experience. A significant portion (15.36%, or 59 individuals) has more than 15 years of experience, indicating a wealth of expertise in managing large-scale telecom projects. Additionally, 13.54% (52 individuals) have 1-5 years of experience, suggesting that younger professionals are also involved in the project, likely in junior or technical roles. A very small portion of respondents (1.82% or 7 individuals) had no prior work experience, which may reflect a recent entry into the telecom industry. The job category distribution shows a broad spectrum of positions within EthioTelecom's 5G deployment project. 44.27% (170 individuals) of respondents were categorized as other government employees, suggesting that a large proportion of the project team members work in government-related roles. Additionally, 32.29% (124 individuals) are self-workers, which may include consultants, contractors, or freelancers who are working on the 5G deployment. A smaller percentage of respondents were engaged in managerial or technical roles, with 17% (65 individuals) identified as employees, 2.08% (8 individuals) as middle-level management, and 1% (2 individuals) as top-level management. This distribution indicates that the 5G NR network deployment project involves a mix of skilled workers, government employees, and contractors, with a few higher-level management roles overseeing the overall operation. The correlation between the management control variables and project deployment quality was assessed to understand the strength and significance of their relationships.

Employee Response: The analysis of employee responses revealed key insights into the factors influencing the quality of 5G network deployment at Ethio Telecom**,** particularly in terms of

management control. The regression analysis presented in Table 4.11 highlighted the relationships between various factors—external environment, project size and nature, project life cycle, and management system—and deployment quality. The findings showed that while external environmental factors and project characteristics such as size, nature, and life cycle have some effect, they were not significant in explaining deployment quality from the employee perspective.

Regarding the external environment, the analysis indicated a positive but non-significant influence on deployment quality (B = 0.156, Sig. = 0.231). Although external factors like economic conditions and regulatory frameworks were thought to have a positive impact, their influence was not statistically significant. Employees may not have perceived the broader environmental factors as impactful because they were more focused on the internal processes of project management, whereas customers seemed to view external factors as more influential.

Similarly, project size and nature showed a negative but non-significant relationship with deployment quality (B = -0.090, Sig. = 0.822). Employees did not find the size or complexity of the 5G project to be a significant determinant of deployment quality. This could be because employees were likely more focused on the practical and operational aspects of the project, such as resource allocation and day-to-day management, rather than on the scale of the project itself.

In contrast, the management system showed a strong and statistically significant impact on deployment quality (B = 0.687, Sig. = 0.000). This result emphasizes the importance of an effective management system in ensuring high-quality deployment outcomes. Employees highlighted that well-organized decision-making processes, resource management, and operational efficiency were critical to achieving successful 5G network deployment. The findings suggest that having a structured and coordinated management approach is essential for overcoming challenges and ensuring project quality.

The regression analysis for employee responses reveals a strong relationship between management control factors and project deployment quality. With an R^2 value of 0.713, the model explains approximately 71.3% of the variance in the project's deployment quality. This indicates that key management control factors—such as the Management System, External Environment, Project Life Cycle, and Project Size and Nature—play a significant role in

determining the overall success of the 5G network deployment at Ethio Telecom. The Adjusted R^2 value of 0.699 further supports the robustness of the model, confirming that the inclusion of these predictors provides a reliable explanation for the variance in project outcomes. These findings emphasize the critical influence of management control mechanisms in achieving high-quality deployment and offer valuable insights for future project improvements.

Despite some operational challenges, employees also identified technical and performance challenges that affected network performance, particularly in high-traffic areas and regions with insufficient site coverage. They emphasized the need for improvements in network architecture and the deployment of additional 5G sites. Moreover, employees recommended several strategies for improvement, including the adoption of advanced traffic management solutions, increased deployment of 5G sites, and ongoing training for technical staff.

In conclusion, from the employee perspective, management control emerged as the most critical factor in achieving high-quality 5G network deployment. The findings underscore the necessity for Ethio Telecom to refine its management system and address technical challenges such as network optimization, site density, and traffic management. By focusing on these areas, Ethio Telecom can close the gap between design expectations and actual network performance, ultimately improving the overall quality of 5G deployment.

Customer Response: The analysis of customer responses revealed that management control factors have a substantial influence on the perceived quality of the 5G network deployment at Ethio Telecom. The regression analysis of customer responses indicates how various elements, including the management system, external environment, project size, and project life cycle, directly shape customers' views on network performance and service delivery.

The management system emerged as the most important factor for customers in determining the quality of the 5G deployment. The analysis revealed a strong positive relationship between the management system and deployment quality (B = 0.828, Sig. = 0.000). Customers linked an organized and well-coordinated management system to improvements in network performance, including better connectivity, faster speeds, and reduced latency. These results highlight that an effective management system not only facilitates operational efficiency but also significantly improves the customer experience by ensuring a high-performing 5G network.

While the external environment was acknowledged by customers, its impact on deployment quality was not significant. The regression results showed a negative but non-significant relationship (B = -0.067, Sig. = 0.351) between external factors, such as economic conditions, technological advancements, and regulatory frameworks, and the deployment quality. Although customers recognized that external factors might affect service delivery, they viewed them as secondary to the actual quality of the network experience. However, they emphasized the importance of regulatory support and economic stability to facilitate a smooth deployment and to ensure the availability of cutting-edge technologies.

In terms of project size and nature, customers did not perceive the scale or complexity of the project as important for the quality of the 5G service. The regression analysis revealed an insignificant negative relationship (B = -0.161, Sig. = 0.243). Customers focused more on the tangible outcomes of the project, such as network speed, stability, and coverage, rather than the internal challenges of managing a large-scale project. This finding suggests that while management control is crucial for ensuring efficient project execution, customers are primarily concerned with the end results, particularly service performance.

Similarly, the project life cycle did not have a significant impact on deployment quality from the customer's perspective. The regression results showed a non-significant positive relationship (B = 0.220, Sig. = 0.247). This indicates that customers were not particularly aware of or concerned with the specific phases of the project (e.g., planning, implementation, testing), focusing instead on the final product—the quality of the 5G service. However, the role of management control in overseeing the entire project cycle was essential for ensuring the smooth execution of deployment and ultimately delivering a high-quality service.

The regression analysis demonstrates an even stronger relationship between the management control factors and the quality of project deployment. The R^2 value of 0.744 indicates that 74.4% of the variance in project deployment quality can be explained by the factors under consideration. The Adjusted R^2 value of 0.740 confirms that the model is both robust and reliable in predicting the deployment quality based on the management control variables. These results emphasize the importance of management systems, the external environment, the project life cycle, and the size and nature of the project in shaping successful deployment outcomes. The

findings suggest that focusing on these variables is essential for Ethio Telecom to continue delivering high-quality 5G network deployments in the future.

Despite the potential of 5G technology, many customers expressed dissatisfaction with the inconsistent network performance, particularly in high-traffic areas and regions with limited site coverage. Issues such as service interruptions and latency affected the overall experience, especially in densely populated areas. While some customers experienced download speeds up to 135.16 Mbps, these speeds were not always consistent, leading to performance gaps. These findings underscore the need for improved network infrastructure, more site coverage, and better traffic management to meet customer expectations.

Additionally, customers highlighted a significant gap in awareness regarding the capabilities and benefits of 5G technology. Many were unfamiliar with how to fully leverage the enhanced features of 5G, limiting their overall appreciation of the technology. This lack of awareness points to a critical need for Ethio Telecom to invest in awareness campaigns and customer education to better inform users about 5G's full potential. The findings suggest that management control should not only focus on technical deployment but also on customer engagement to improve satisfaction and adoption.

Chapter Five

Summary major finding, Conclusions and Recommendation

This chapter deals with the summary of major findings and conclusions the findings of the researcher discussed and analyzed in the previous chapter. The researcher also recommends improvements based on the findings.

5.1. Summary of Major Findings

This research primarily aimed to investigate the influence of management control on the quality of the 5G NR network deployment project at Ethio Telecom. The study explored the extent of management control, the overall quality of the project deployment, the relationship between management control and deployment quality, and the specific influence of management control on deployment quality.

Data for the study were collected through Google Forms using standardized questionnaires distributed to project managers, core project staff, and 5G network customers. The questionnaires were designed to capture comprehensive insights into the 5G network deployment process. In addition to the primary data, secondary data sources were utilized to enhance the findings. The data collection process spanned one week, with reminders sent to non-responding participants to maximize response rates. The study used quantitative and qualitative data collected from 384 respondents through Google Forms questionnaires and interviews. The data obtained from the sample population through a convenience sampling technique were analyzed using the Statistical Package for the Social Sciences (SPSS) version 25.

The data's reliability was confirmed through Cronbach's alpha tests, with values ranging from 0.722 to 0.906 employee responses and 0.845 to 0.925 customer responses, indicating acceptable to high reliability. Pearson correlation analysis showed positive correlations between management control factors and deployment quality, suggesting that management control

significantly influences the 5G network deployment outcomes. Observations at Ethio Telecom's 5G deployment sites in the Central Addis Ababa Zone revealed that 154 5G NR sites were deployed across the area. The project, a collaboration between Ethio Telecom and various vendors, involved the installation of diverse 5G On 4G equipment. Despite the advanced infrastructure, network performance—in terms of download and upload speeds—fell below theoretical expectations, due to 5G not being deployed in all locations in Addis Ababa, with the reason linked to the deployment of Non-Standalone (NSA) 5G networks. This discrepancy between real-world performance and theoretical benchmarks led to user dissatisfaction. The observed performance gaps in multiple locations contributed to perceptions of deployment quality.

Overall, the findings underscore the critical role of effective management control in achieving high-quality outcomes in large-scale network deployment projects. The study highlights the importance of addressing external environmental factors, project size, and the project life cycle to improve network performance and customer satisfaction.

The extent of the management control of 5G network deployment project in the EthioTelecom

Employee Responses: The analysis of employees' responses revealed that they strongly agree on the significant impact of external factors and project size and nature on the management control of the 5G network deployment. Employees rated the influence of external factors, such as political, economic, and technological elements, with a mean of 3.84, emphasizing the importance of considering these aspects for effective project management. In terms of project size and nature, employees recognized that the complexity and scale of the project required tailored management control measures, reporting a mean of 3.88, reflecting their understanding of how these factors affect project quality and outcomes.

Customer Responses: The customers' feedback similarly highlighted the importance of external factors and project size and nature in shaping the management control of the 5G network deployment. They rated the influence of external factors with a mean of 4.00, indicating their strong belief that these factors significantly impacted the project's success. Regarding project size, customers rated the impact of project complexity with a mean of 4.01, suggesting that larger

and more intricate projects necessitate specific management controls to maintain quality, aligning with their view of the project's overall management approach and effectiveness.

The Overall Quality of the 5G NR Network Deployment Project at Ethio Telecom

The responses of employees and customers regarding the quality of the 5G network deployment project at Ethio Telecom. Based on both employee and customer data, several patterns emerge that provide insight into the overall project quality.

Employee Responses: Project Completion & Timeliness: Both employees and customers agree that the project was completed on time, with employees rating the statement “The project was completed on time according to the initial schedule” with a mean of 4.06. This is slightly lower than the customer rating of 4.15, suggesting that customers perceive the timeline as being more reliably met than employees. Both groups exhibit strong agreement regarding the project’s punctuality, with low variability in responses.

Budget & Management Control: Employees gave a mean of 4.06 for the items related to budget management, specifically "The project was completed within the expected budget," and "Management control plays a significant role in achieving project quality objectives." Similarly, customers rated these items highly with a mean of 4.08. This indicates a shared perception that management controls and adherence to budget were crucial to maintaining project quality.

Quality Standards: Employees and customers alike agreed that the project achieved quality standards, with employees scoring a mean of 3.82, and customers a slightly lower mean of 3.63 for the statement "The project achieved the anticipated quality standards." While both groups agree on the achievement of quality, the variance in ratings signals that employees might have a more positive view of the project's quality outcomes compared to customers.

Budget Overrun Impact: Both employees and customers expressed concerns about the impact of budget overruns on the project's quality. The item "The project exceeded the allocated budget, which had a positive impact on its quality" had a significantly lower mean for both groups (employees: 3.74, customers: 3.78), indicating differing views. Employees were slightly more

inclined to agree that the budget overrun impacted quality positively, though both groups expressed reservations, with low standard deviations suggesting consensus.

Scope: Both employees and customers noted that the project's scope was beneficial for its quality. Items like "The scope of the 5G deployment project is extensive, and this wide scope is beneficial for the project's quality" received relatively high scores (employees: 4.03, customers: 4.13), indicating broad agreement that the scope contributed positively. However, the item "The 5G deployment project's scope is limited, and this restricted scope is beneficial for maintaining project quality" had a lower score, especially among customers (3.79), reflecting mixed opinions about the project's scope.

Customer Responses: Timeliness and Budget Management: Customers, like employees, rated the project's completion time positively (mean = 4.15). However, customers gave the "project completed within the expected budget" and related management control items a mean of 4.08, consistent with employee responses. Customers appear to feel the project was managed within budget and time constraints, further reinforcing the notion that management controls contributed significantly to the project's success.

Quality of Project Deliverables: Customers rated the quality of the project's deliverables (mean = 3.63) lower than employees did, reflecting possible dissatisfaction or a more critical stance on whether the quality standards were met.

Scope and Impact on Quality: Similar to employees, customers agreed that the wide scope was beneficial for the project's quality, with a mean of 4.13 for "The scope of the 5G deployment project is extensive, and this wide scope is beneficial for the project's quality." However, opinions diverged when considering a more limited scope, with a mean of 3.79 for the item on restricted scope being beneficial.

The Relationship Between Management Control and the Quality of the 5G NR Network Deployment Project

The updated analysis of correlations between management control factors and the quality of the 5G network deployment project at Ethio Telecom reveals strong positive relationships based on both employee and customer responses. The key management control factors—external

environment, project size and nature, project life cycle, and management system—have significant positive impacts on the overall project quality.

Employee Responses: External Environment: Pearson correlation of 0.731, indicating a strong positive relationship between the external environment and project deployment quality.

Project Size and Nature: Pearson correlation of 0.772, showing a strong positive relationship between the size and nature of the project and deployment quality.

Project Life Cycle: Pearson correlation of 0.780, reflecting a strong positive relationship between the project's life cycle and its quality outcomes.

Management System: Pearson correlation of 0.840, demonstrating a strong positive impact of the management system on the overall quality of the project.

Customer Responses: External Environment: Pearson correlation of 0.732, confirming a strong positive relationship between the external environment and project quality.

Project Size and Nature: Pearson correlation of 0.808, showing a strong positive correlation between project size and nature and the quality of the deployment.

Project Life Cycle: Pearson correlation of 0.844, indicating a strong positive influence of the project life cycle on deployment quality.

Management System: Pearson correlation of 0.860, the highest of all, suggesting that the management system has the most significant positive impact on the overall quality of the project.

The correlation coefficients, ranging from 0.731 to 0.840 for employee responses and 0.732 to 0.860 for customer responses, indicate that each of the management control factors—external environment, project size and nature, project life cycle, and management system—has a strong positive relationship with the overall quality of the 5G network deployment. These findings emphasize the importance of effective management control in ensuring the high quality of the deployment project at Ethio Telecom.

The influence of Management Control on the Quality of 5G NR Network Deployment Project

This study aimed to investigate the influence of management control on the quality of 5G NR network deployment at Ethio Telecom. Specifically, it explored the relationship between key management control factors, such as management systems, the external environment, project size and nature, and the project life cycle, and their impact on the overall quality of the deployment. An explanatory research design was employed, utilizing regression analysis (KVALSETH), ANOVA, and standardized coefficients to identify causal relationships between the management control factors and project deployment quality.

Employee Responses: Regression Analysis: The regression analysis for employee responses revealed that approximately 71.3% of the variance in Project Deployment Quality was explained by the predictors: Management System, External Environment, Project Life Cycle, and Project Size and Nature ($R^2 = 0.713$). This suggests that these management control factors play a crucial role in determining the overall quality of the 5G NR network deployment project at Ethio Telecom. Among the predictors, Management System showed a particularly strong influence, emphasizing that the control structures and processes implemented by the management are pivotal in delivering quality project outcomes.

Analysis of Variance (ANOVA): The ANOVA results for employee responses revealed a significant statistical relationship ($F = 52.764$, Sig. = 0.000) between the independent variables and project deployment quality. This indicates that Management System, External Environment, Project Life Cycle, and Project Size and Nature significantly affect the project's success and deployment quality. The model's statistical significance confirms the validity of these factors in influencing project outcomes.

Standardized Coefficients: In the standardized coefficients regression for employee responses, the most significant variable was Management System (Beta = 0.722, p = 0.000), which positively impacted project deployment quality. This indicates that an efficient, well-structured management system is a key driver for successful 5G NR deployment. Conversely, the External Environment (Beta = 0.152, p = 0.231), Project Size and Nature (Beta = -0.091, p = 0.822), and Life Cycle of the Project (Beta = 0.085, p = 0.837) showed no statistically significant effects on

project quality in this context, suggesting that these variables might not have the same level of influence on deployment quality from the employees' perspective.

The findings underscore the importance of strong managerial control systems, with management structures and processes being the primary factors that lead to improved deployment quality. While the other variables did not reach statistical significance, they could still influence specific aspects of the project indirectly, though further research may be necessary to explore their roles more thoroughly.

Customer Responses: Regression Analysis: The regression analysis for customer responses showed a higher explanatory power, with 74.4% of the variance in project deployment quality accounted for by the predictors ($R^2 = 0.744$). This stronger relationship indicates that Management System, External Environment, Project Life Cycle, and Project Size and Nature have a more substantial and more directly observable impact on the deployment quality from the customers' viewpoint. Customers may experience or perceive these factors differently from employees, suggesting that their satisfaction and perception of quality are influenced more significantly by these variables.

Analysis of Variance (ANOVA): For customer responses, the ANOVA results ($F = 209.730$, Sig. $= 0.000$) were also highly significant, indicating that the management control factors significantly contribute to explaining project deployment quality. These findings reflect that customers recognize the importance of these variables in ensuring the successful rollout of the 5G network and that the management system is a critical factor in delivering a quality 5G experience. The statistical significance supports the notion that effective management and control mechanisms resonate more with customers in ensuring service quality.

Standardized Coefficients: In the standardized coefficients regression for customer responses, the variable with the most considerable influence was also the Management System (Beta = 0.718, $p = 0.000$). Similar to the employee response analysis, the Management System was identified as the most influential factor in ensuring quality. In contrast to the employee response data, External Environment (Beta = 0.271, $p = 0.034$) and Project Size and Nature (Beta = 0.071, $p = 0.492$) had slightly stronger associations with deployment quality, although Project Life Cycle (Beta = 0.040, $p = 0.739$) was not statistically significant in the customer response model.

The findings here emphasize that while the management system plays a central role in shaping customers' perceptions of quality, there is also a more substantial recognition of the external environment, suggesting that customers may be more sensitive to factors such as market conditions, technological advancements, and other external variables that affect their overall 5G experience.

Comparative Insights Between Employee and Customer Responses:

Management System Dominates: Both employee and customer responses consistently indicate that Management System is the most significant factor influencing the quality of project deployment. In both models, the Management System shows a strong positive impact on deployment quality, underlining its importance as the central control mechanism ensuring high-quality outcomes in the 5G network rollout.

Differing Impact of Other Variables: While employees placed less emphasis on the External Environment, Project Size and Nature, and Project Life Cycle, customers showed some recognition of the External Environment, suggesting that customers may perceive the broader market or technological context as influencing the overall deployment quality more directly. However, neither group found the Project Life Cycle or Project Size and Nature to be significant in shaping project quality, implying that these factors are less likely to affect stakeholders' immediate perceptions of project quality.

Higher Explanatory Power for Customers: The customer response model had a higher R^2 value (0.744) compared to the employee response model (0.713), indicating that the predictors had a more substantial and direct influence on customer perceptions of quality. This suggests that customers' perceptions are more closely tied to the effectiveness of management systems and the external factors influencing the deployment.

Statistical Significance and Relevance: Both models reached statistical significance ($p = 0.000$), confirming that the regression models are reliable for both employee and customer data. However, the customer model showed stronger statistical support for the role of the External Environment, while the employee model emphasized the importance of Management System even more.

5.2. Conclusions

This study examined the influence of management control on the quality of 5G network deployment at Ethio Telecom. The findings highlight several key insights based on the correlation and regression analyses conducted on the responses from both employees and customers.

The correlation analysis revealed a strong positive relationship between management control variables (external environment, project size and nature, project life cycle, and management system) and project deployment quality. For both employee and customer responses, the Pearson correlation coefficients ranged from 0.731 to 0.860, indicating that each management control factor significantly influences the overall quality of the 5G deployment project.

Regression analysis further confirmed these findings, with R^2 values of 0.713 for employee responses and 0.744 for customer responses, indicating that the predictor variables explain a substantial portion of the variance in project deployment quality. These results suggest that management control mechanisms, particularly those related to the external environment, project characteristics, and systematic management, play a critical role in shaping the successful deployment of the 5G network.

The ANOVA tests also reinforced the statistical significance of these relationships, with both employee and customer response models achieving significant F-values, confirming that the management control factors significantly impact the project quality outcomes.

Overall, the study demonstrates that Ethio Telecom's management control mechanisms are crucial in ensuring high-quality 5G network deployment, emphasizing the need for effective management of external influences, project size and nature, the project life cycle, and systematic management approaches to optimize deployment quality.

5.3. Recommendations

Based on the study's findings, the following recommendations are proposed to Ethio Telecom to enhance the quality of 5G network deployment and ensure the successful rollout of future projects:

Enhance Management Control Mechanisms: Ethio Telecom should continue to strengthen its management control systems, focusing on enhancing the coordination of external environment factors, project size and complexity, and the project life cycle. Improved control over these aspects will help ensure that projects meet quality standards despite the challenges they may face.

Focus on Project Planning and Risk Management: Given the significant impact of the external environment and project size on quality, Ethio Telecom should develop more robust project planning processes. This includes thorough market research and risk assessments at the beginning of each project to anticipate potential challenges related to economic, technological, and regulatory factors. Proactively addressing these challenges can prevent delays and cost overruns, ensuring the timely and successful delivery of projects.

Systematic Management Approach: The management system has proven to be one of the strongest predictors of project quality. Ethio Telecom should prioritize a systematic, standardized approach for managing 5G network projects. This includes well-defined roles, responsibilities, and decision-making processes at all project stages, ensuring alignment between teams and stakeholders.

Investment in Training and Skill Development: The success of 5G network deployment depends not only on technical resources but also on the skills of project management teams. Ethio Telecom should invest in continuous training and development of its workforce to ensure that employees possess the necessary technical and managerial skills to handle complex projects.

Regular Monitoring and Evaluation: Ethio Telecom should implement a more rigorous monitoring and evaluation system for its 5G projects. Continuous tracking of project progress, quality metrics, and stakeholder feedback will enable early identification of potential issues and provide the necessary data to adjust management strategies as needed.

Leverage Technology and Innovation: Given the significant role of technological advancements in 5G deployment, Ethio Telecom should continue exploring innovative solutions to optimize the efficiency and quality of its deployment processes. Embracing cutting-edge technologies can help improve network performance, reduce operational costs, and enhance overall project quality.

By addressing these areas, Ethio Telecom can continue to improve the quality of its 5G network deployment projects, enhance its competitive edge in the telecom sector, and provide better services to its customers.

5.3.1. Suggestion for Further Study

Future studies could expand on this research by exploring additional factors that influence 5G network deployment, such as the role of technological innovation, stakeholder engagement, and resource allocation. Further research could also examine the management control strategies of other telecom companies or focus on international comparisons to gain insights into how management practices impact the quality of telecommunications projects across different regions.

Reference

5G Technology. (2020). In *5G Technology*. https://doi.org/10.1002/9781119236306

Adame, B. O. (2021). The Ethiopian telecom industry: gaps and recommendations towards meaningful connectivity and a thriving digital ecosystem. *Heliyon*, *7*(10), e08146. https://doi.org/10.1016/j.heliyon.2021.e08146

Al-Dhubaibi, A. A. S. (2024). Unveiling the Mediating Effect of Intellectual Capital on the Relationship between Management Control System, Management Accounting, and Business Performance. *International Journal of Mathematical, Engineering and Management Sciences*, *9*(4), 844–864. https://doi.org/10.33889/IJMEMS.2024.9.4.044

Allan, W. J. (2022). Techno-affective Elections and (Il)legitimate Power: WhatsApp Voice in Kenya's Electoral Deliberations. *Techno-Affective Elections and (Il)Legitimate Power: WhatsApp Voice in Kenya's Electoral Deliberations*, *December*.

Araújo, M., Ekenberg, L., & Confraria, J. (2019). Risk assessment in 5G infrastructure deployment: An aid tool for estimating spectrum auction prices. *2019 IEEE Wireless Communications and Networking Conference Workshop, WCNCW 2019, April 2019*. https://doi.org/10.1109/WCNCW.2019.8902632

Chenhall, R. H. (2003). Management control systems design within its organizational context: Findings from contingency-based research and directions for the future. *Accounting, Organizations and Society*, *28*(2–3), 127–168. https://doi.org/10.1016/S0361-3682(01)00027-7

Chenhall, R. H., & Euske, K. J. (2007). The role of management control systems in planned organizational change: An analysis of two organizations. *Accounting, Organizations and Society*, *32*(7–8), 601–637. https://doi.org/10.1016/j.aos.2006.09.007

Draksha Safdar Khan. (2024). Organizational Behaviour insights: Examining dynamics of Workplace Culture and Employee Interaction in Modern Organizations. *International Journal for Multidimensional Research Perspectives*, *2*(5), 37–53. https://doi.org/10.61877/ijmrp.v2i5.145

Eswaran, S., & Honnavalli, P. (2023). Private 5G networks: a survey on enabling technologies, deployment models, use cases and research directions. *Telecommunication Systems*, *82*(1), 3–26. https://doi.org/10.1007/s11235-022-00978-z

Ethiotelecom. (1969). Annual Financial Statement. In *Brontë Society Transactions* (Vol. 15, Issue 4, pp.

372–373). https://doi.org/10.1179/030977669796498235

Ethiotelecom. (2021). *Select Business & Technology College Master of Project Management The Effect of Management Control on the Quality of 4G LTE Network Deployment Project of Ethio Telecom*. *May*.

Ethiotelecom 5G deployment. (n.d.).

Gathii, J., Gitahi, N., & Koima, J. (2019). Efficacy of Monitoring and Evaluation Framework on Implementation of Development Projects. A Comparative Analysis of Machakos and Embu County, Kenya. *International Journal of Managerial Studies and Research*, *7*(9), 21–31. https://doi.org/10.20431/2349-0349.0709004

Gliem, J. a, & Gliem, R. R. (2003). Calculating, Interpreting, and Reporting Cronbach's Alpha Reliability Coefficient for Likert-Type Scales,. *2003 Midwest Research to Practice Conference in Adult, Continuing, and Community Education*, *1992*, 82–88. https://doi.org/10.1109/PROC.1975.9792

Greenberg, A., Hjalmtysson, G., Maltz, D. A., Myers, A., Rexford, J., Xie, G., Yan, H., Zhan, J., & Zhang, H. (2005). IMSLP25164-PMLP56458-Steibelt_-_Rondos_and_Sonatinas. *ACM SIGCOMM Computer Communication Review*, *35*(5), 41–54. https://people.csail.mit.edu/alizadeh/courses/6.888/papers/4d.pdf

Grigoryan, E., & Golubkova, I. (2020). *Seven Tools for Quality Management and Control: Theory and Practice*. *139*(Icemt), 528–535. https://doi.org/10.2991/aebmr.k.200509.094

Homer, M. (2018). An introduction to secondary data analysis with IBM SPSS statistics (1st ed.). *Educational Review*, *70*(2), 251–252. https://doi.org/10.1080/00131911.2017.1330503

Hossain, M. N., Islam, A. A., Rahim, M. A., Hossain, M. I., & Rahman, M. A. (2023). Design and Performance Analysis of Defected Ground Slotted Patch Antenna for Sub-6 GHz 5G Applications. *Journal of Engineering Advancements*, *January 2024*, 130–140. https://doi.org/10.38032/jea.2023.04.004

Imam-Fulani, Y. O., Faruk, N., Sowande, O. A., Abdulkarim, A., Alozie, E., Usman, A. D., Adewole, K. S., Oloyede, A. A., Chiroma, H., Garba, S., Imoize, A. L., Baba, B. A., Musa, A., Adediran, Y. A., & Taura, L. S. (2023). 5G Frequency Standardization, Technologies, Channel Models, and Network Deployment: Advances, Challenges, and Future Directions. *Sustainability (Switzerland)*, *15*(6). https://doi.org/10.3390/su15065173

Karakaya, A., Yılmaz, K., & Demiral, G. (2016). Strategic Capabilities of Retail Market Managers: A Field Research in Karabuk. *Procedia - Social and Behavioral Sciences*, *235*(October), 93–100. https://doi.org/10.1016/j.sbspro.2016.11.004

Kenechi, O., Joiner, J., & Kolta, E. (2022). *5G in Africa: realising the potential*. 81. https://www.gsma.com/subsaharanafrica/wp-content/uploads/2022/10/5G-IN-AFRICA-REPORT.pdf

Li, M., Zhu, L., Zhang, Z., Lal, C., Conti, M., & Martinelli, F. (2021). Privacy for 5G-Supported Vehicular Networks. *IEEE Open Journal of the Communications Society*, *2*(August), 1935–1956. https://doi.org/10.1109/OJCOMS.2021.3103445

Michael Page, I. (2022). *Davis, J., & Taylor, S. (2022). Organizational Complexity and Resource Dynamics: Effects on Management Control Systems and Project Success*. 1–57.

Mishra, R. (2023). An overview of backbone technology behind the latest advanced gadgets in use: 4G & 5G. *Spatial Information Research*, *31*(1), 15–26. https://doi.org/10.1007/s41324-022-00474-1

Pérez Sigüenza, M., Rodríguez-León Rodríguez, L., Ramon Jeronimo, J. M., & Flórez López, R. (2022). Management Control Systems and International Entrepreneurship in Small, Young Firms from Resource-Based Theory, Contingence, and Effectuation Approach Perspectives. *Journal of Risk and Financial Management*, *15*(8). https://doi.org/10.3390/jrfm15080363

Petrov, V., Lema, M. A., Gapeyenko, M., Antonakoglou, K., Moltchanov, D., Sardis, F., Samuylov, A., Andreev, S., Koucheryavy, Y., & Dohler, M. (2018). Achieving End-to-End Reliability of Mission-Critical Traffic in Softwarized 5G Networks. *IEEE Journal on Selected Areas in Communications*, *36*(3), 485–501. https://doi.org/10.1109/JSAC.2018.2815419

Phillips, J. J., Brantley, W., & Phillips, P. P. (2011). The Project Management Lifecycle. *Project Management ROI*, 15–30. https://doi.org/10.1002/9781118122587.ch2

Rogala, P., & Wawak, S. (2021). Quality of the ISO 9000 series of standards-perceptions of quality management experts. *International Journal of Quality and Service Sciences*, *13*(4), 509–525. https://doi.org/10.1108/IJQSS-04-2020-0065

Saariniemi, J. (2023). *Supervisor: Pasi Luukka*.

Security Agency, I. (2023). *5G: the Basics What Is 5G? 2019*, 2023. https://semiengineering.com/should-we-even-be-talking-about-6g/.

Sljivic, S., Skorup, S., & Vukadinovic, P. (2015). Management control in modern organizations. *International Review*, *3–4*, 39–49. https://doi.org/10.5937/intrev1504039s

Tian, J., & He, S. (2016). *Study of Factors for Internal Control Effectiveness of Listed Companies*. *Eemt*, 82–85. https://doi.org/10.2991/iceemt-16.2016.16

Van Der Stede, W. A. (2017). Global management accounting research: Some reflections. *Journal of International Accounting Research*, *16*(2), 1–8. https://doi.org/10.2308/jiar-51678

van Harten, W. H., Casparie, T. F., & Fisscher, O. A. . (2002). The evaluation of the introduction of a quality management system. *Health Policy*, *60*(1), 17–37. https://doi.org/10.1016/s0168-8510(01)00187-7

Wang, Y., & Lo, H. P. (2002). Service quality, customer satisfaction and behavior intentions: Evidence from China' telecommunication industry. *Info*, *4*(6), 50–60. https://doi.org/10.1108/14636690210453406

Whelton, M. G. (2004). The development of purpose in the project definition phase of Construction projects: Implications for project management. *University of California, Berkeley, USA*, 313.

Woubshet Demissie, Selamyihun Kidanu, & Raghavaiah, C. V. (2017). Effects of lime, blended fertilizer (NPSB) and compost on yield and yield attributes of barley (Hordium vulgare L.) on acid soils of wolmera district, west showa, Ethiopia. *International Journal of Life Sciences*, *5*(3), 311–322.

Yang, C., Gu, M., & Albitar, K. (2024). Government in the digital age: Exploring the impact of digital transformation on governmental efficiency. *Technological Forecasting and Social Change*, *208*(August). https://doi.org/10.1016/j.techfore.2024.123722

Yang, C., Liang, P., Fu, L., Cui, G., Huang, F., Teng, F., & Bangash, Y. A. (2022). Using 5G in smart

cities: A systematic mapping study. *Intelligent Systems with Applications*, *14*. https://doi.org/10.1016/j.iswa.2022.200065

Yusuf, F. A. (2023). Total Quality Management (TQM) and Quality of Higher Education: A Meta-Analysis Study. *International Journal of Instruction*, *16*(2), 161–178. https://doi.org/10.29333/iji.2023.16210a

Zhang, H. (1979). *Conditional Probability and Information Retrieval*. 1–7.

Questionnaire

St. Mary's University

Questionnaire to be filled by: - Ethio telecom Staff & management, and also Ethio telecom 5G LTE network customer

Dear respondent,

This survey is part of an MA research thesis, which will be submitted in partial fulfillment of the MA degree in Project Management. The main purpose of this study is to investigate how management control influences the quality of 5G network deployment, focusing on a case study of EthioTelecom.

I kindly invite you to participate in this survey by completing the questionnaire. The questionnaire is designed to be simple and easy to complete, and it should take no more than 15 minutes of your time. Please rest assured that all responses will be kept strictly confidential, and only aggregated data will be analyzed.

Your participation is highly valued, and I would appreciate it if you could answer all the questions and return the completed questionnaire.

Thank you in advance for your time and support in participating in this survey.

Title: Investigating the Influence of Management Control on the Quality of 5G Network Deployment: A Case Study of EthioTelecom

Objective: To investigate the Influence of management control on the quality of 5G network deployment at EthioTelecom.

Target Audience: Ethio telecom Staff & management, and also Ethio telecom 5G LTE network customer

Name of the researcher: - Helen Sime Kefene

General Direction

- No need to write your name
- Read each question and put (√) on the given space box.

Part One: The profile/ background of respondents

Please put a tick mark (√) on the appropriate response category:

1. Sex/ Gender: ☐Male ☐Female

2. Age: ☐ (15-25 years) ☐ (26-35 years) ☐ (36-45 year) ☐ (46-55 year)

3. ☐ (>56 years)

4. Marital status: ☐ Married ☐ Single ☐ Divorced

5. Educational level: ☐ Only reading and writing ☐ Primary education (1-8) ☐ Secondary education (9-12) ☐ Certificate ☐ Diploma ☐ BA/BSc ☐ Masters ☐ PhD

6. Work experience: ☐ 1-5 years ☐ 6-10 years ☐ 11-15 years ☐ >15 years ☐ None

7. Job Category /Current position: ☐ Employee ☐ Low-level Management ☐ Middle-level Management ☐ Top-level Management ☐ Expert ☐ Self worker ☐ Other

Part Two: Management Control

The purpose of this section is to give you the opportunity to express your views on the factors affecting 5G network deployment quality. Specifically, you will be asked to indicate your level of satisfaction or dissatisfaction with various aspects related to management control, including the external environment, project size, project life cycle, and management systems. Please put tick (√) in the table provided for each of the given statement using the following scales

1 = Strongly Disagree; 2 = Disagree; 3 = Neutral; 4 = Agree; 5 = Strongly Agree

No	**External Environment**	**Scales**				
		5	**4**	**3**	**2**	**1**
E.E1	The manager thoroughly researched the external environment before the project commenced, taking into account key factors such as economic conditions, political and legal regulations, stockholder controls, strategic considerations, technological advancements, social and cultural influences, and global dynamics					
E.E2	The external environment has a significant impact on management control in EthioTelecom projects.					
E.E3	The external environment has had a substantial influence on the management control of the EthioTelecom 5G network deployment project					
No	**Project Size and Nature**					
P.N1	The size and complexity of the project influence how management control is applied.					
P.N3	The nature of the project has influenced management control and, in turn, impacted the overall quality of the project.					
P.N3	The large size of the project has impacted management control and, consequently, affected the overall quality of the project.					

NO	The life cycle of the project					
L.C1	The management control was effectively supported by each phase of the project cycle.					
L.C2	The project life cycle has influenced management control and led to a decline in project quality.					
L.C3	The project's life cycle, according to the study, supports effective management control.					
No	**Management System**					
M.S1	The management system impacted management control, which resulted in a decline in project quality.					
M.S2	The management system significantly influenced the quality of the project.					
M.S3	The management system effectively supported the quality of the 5G LTE network deployment project.					

Part Three：- Project quality

No	Project Deployment quality	Scales				
		5	4	3	2	1
P.Q1	The project was completed on time according to the initial schedule					
P.Q1	The established timeline is affecting the project's quality outcomes.					
P.Q1	The projected timeline is adequate to ensure the project is completed with quality.					
P.Q1	The project achieved the anticipated quality standards					
P.Q1	Management control plays a significant role in achieving project quality					

	objectives.					
P.Q1	The project was completed within the expected budget.					
P.Q1	The project finished under budget, and this did not affect its quality standards.					
P.Q1	The project exceeded the allocated budget, which had a positive impact on its quality					
P.Q1	The scope of the 5G LTE deployment project is extensive, and this wide scope is beneficial for the project's quality					
P.Q1	The project's scope is impacting the quality of the 5G LTE network deployment.					
P.Q1	The 5G LTE deployment project's scope is limited, and this restricted scope is beneficial for maintaining project quality					
P.Q1	The scope of the 5G LTE deployment project is informed by the study, which indicates that this scope is favorable for project quality.					
P.Q1	Ethio Telecom fully satisfies the requirements of the 5G LTE network deployment project.					
P.Q1	I am pleased with Ethio Telecom's 5G LTE network deployment project.					

Thank you for your time.

Interview Questions

Interview Introduction:

Thank you for giving me the time. The purpose of the interview is to collect data about "Investigating the Influence of Management Control on the Quality of 5G Network Deployment'' for the partial fulfillment of an MA degree in Project Management.

General Direction:

The information you provide was be used only for academic purposes and kept confidential. Therefore, I kindly request you to provide reliable information for the quality of the research work.

Part I: Background of the respondent

Name: _____

Job level: _____

Part II: Questions related to the title

1. Are you a 5G network customer? How much do you know about 5G NR networks?

2. Are you using the 5G NR network as expected?

3. When you use a 5G network, how much download rate and upload rate do you get?

Observation Checklist

St. Mary's University SCHOOL

Name of the research project: - Investigating the Influence of Management Control on the Quality of 5G Network Deployment: A Case Study of EthioTelecom General Objective: - The main objective of this study is to investigate the influence of management control on the quality of Ethio Telecom's 5G network deployment project

Researcher Name: - Helen Sime level: - Master of Art in Project Management

Schedule: - 10/03/2017 – 13/03/2017 in Ethiopian colander

Advisor Name: - Dr. Temesgen Belayneh

Observation date: - _____

Answer the following questions by placing an √ in the appropriate column to the right.		Yes	No	Not	Applicable	Remark
O.1	Were project planning documents made by the project controller and available to all project personnel involved	√				
O.2	Was the sampling design(s) adhered to as outlined in the project planning documents? If not, explain under Comments.	√				
O.3	Were all samples analyzed successfully?		√			
O.4	Did project planning documents contain data review/validation criteria?	√				
O.5	Were data quality problems identified during the data review/ validation process?	√				
O.6	Was collection of Field quality control (QC) samples required in the project planning & implementing documents?	√				
O.7	Were project measurement quality objectives met? If not, describe under Comments.		√			
O.8	Were data review/validation reports generated?	√				
O.9	We're sampling and/or analytical corrective actions successful in remediating the identified problems?	√				
O.10	Was gNodeB set up in a study space and equally accessible to users?		√			
O.11	Were customers receive and use the 5G network project as planned?		√			