PROJECT CONSTRAINTS AND PERFORMANCE OF RESIDENTIAL CONSTRUCTION PROJECTS IN NAIROBI COUNTY, KENYA

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A RESEARCH PROJECT SUBMITTED TO SCHOOL OF BUSINESS ECONOMICS AND TOURISM IN PARTIAL FULFILLMENT OF THE REQUIREMENT FOR THE AWARD OF DEGREE OF MASTER OF BUSINESS ADMINISTRATION (PROJECT MANAGEMENT) OF KENYATTA UNIVERSITY

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DECLARATION

This research project is my sole intellectual contribution and has not been previously evaluated for assessment at this institution or any other academic institution. Unauthorised replication of any portion of this project is forbidden without explicit agreement from the author.

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This academic research project is submitted for examination with my authorisation as the appointed university supervisor.

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DEDICATION

This academic research is principally dedicated to the supreme God for bestowing upon me the inspiration and aptitude to pursue this research. I profoundly cherish the prayers, support, and morale boost from my family and friends throughout my research pursuits.

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ABBREVIATIONS AND ACRONYMS

TOC	Theory of Constraints
CPM	Critical path method
NCA	National Construction Authority
AAK	Architectural Association of Kenya
ICPMK	Institution of Construction Project Managers of Kenya
CAGR	Compound Annual Growth Rate
KNBS	Kenya National Bureau of Statistics
CAHF	Centre for Affordable Housing Finance

OPERATIONAL DEFINITION OF TERMS

Constraints	These are the economic, technical, social, legal and environmental limitations that hinder the smooth execution of residential construction projects. They are measured through indicators such as delays/ stalling in project completion, project cost overruns and time overruns.
Project	A set of activities that are planned and carried out in a certain way to reach a certain objective within a certain amount of time, money, and resources. It has a clear start and conclusion, specific deliverables, and follows a plan to get the desired result.
Project Performance	The extent to which a project achieves its intended goals within the agreed scope, time, and budget. It is measured by assessing whether project deliverables were completed as planned, within schedule, within cost limits, and to the required quality standards.
Residential Construction project	The scope of work encompasses the construction, modification, or restoration of residential dwellings, including single-family residences and apartment complexes, with a maximum height of four stories.
Project manager	The person responsible for planning and overseeing project activities to ensure completion within scope, time, and budget. Their effectiveness is assessed through tasks like coordinating teams, managing resources, and ensuring project objectives are met.
Performance indicator	How effectively a project, process, or individual achieves set objectives. It is assessed through specific metrics such as time, cost, quality, productivity, or stakeholder satisfaction.
Plan	A structured outline that details the steps, resources, and timelines required to achieve a specific objective. It is assessed by how clearly it guides actions, allocates resources, and supports the successful completion of tasks or projects.
Project plan	A formal document that outlines a project's objectives, tasks, timelines, resources, and responsibilities. It is assessed by how effectively it guides project execution and supports completion within scope, time, and budget.
Performance	The level at which a task, process, or project achieves its intended objectives in terms of efficiency, effectiveness, and quality. It is

	assessed through measurable outcomes such as time, cost, quality, productivity, and stakeholder satisfaction.
Economic Constraints	These are financial limitations that affect the planning, execution, or completion of a project. They are assessed through indicators such as budget shortfalls, funding delays, cost overruns, and limited access to financial resources.
Legal Constraints	These are regulatory and compliance requirements that limit or influence how a project is carried out. They are evaluated through indicators such as permit delays, adherence to building codes, contract requirements, and compliance with environmental or safety regulations.
Environmental Constraints	These are natural or site-related factors that limit or influence project activities. They are evaluated through indicators such as weather conditions, environmental regulations, site terrain, and ecological impact considerations.
Technical Constraints	These are limitations related to design, technology, and engineering requirements that affect project execution. They are measured through indicators such as design errors, technology gaps, specification changes, and inadequate technical expertise.
Social Constraints	These challenges arising from the interactions, expectations, and influence of stakeholders on a project. They are measured through indicators such as community opposition, labor disputes, cultural considerations, and stakeholder engagement issues.

ABSTRACT

Construction projects are characterized by their intricate nature, encompassing numerous interconnected operations executed in a seamless manner to prevent exceeding allocated budget and timeline retaining quality. Residential construction projects in Nairobi face constraints that affect planning, design, and execution, leading to delays, budget overruns and compromised quality. Rapid urban population growth and inadequate infrastructure aggravate housing shortages, making it critical to understand and manage these constraints to ensure successful project performance. The research conducted primarily sought to validate the influence of project constraints on the performance of residential construction projects within Nairobi County. The specific objectives of the study were to ascertain the influence of legal, technical, environmental, economic and social project constraints on performance of residential construction projects in Nairobi County, Kenya. The study was anchored on three theories namely, theory of constraints, black swan theory and decision theory and the descriptive research design was employed in this research. The participant population targeted for this study consisted of 334 construction project managers who are registered members of the Architectural Association of Kenya (AAK) and the Institute of Construction Project Managers (ICPMK). The study sample involved 77 respondents selected based on a calculated target population of 334, with a 90% confidence level and a 0.1 margin of error, using the Yamane formula and convenience sampling was employed to identify respondents. Through the process of pilot testing the research instruments, the validity and reliability of the research instruments as well as the results of the study were obtained. The data collection process entailed the direct acquisition of information from the respondents through the utilization of both physical and online questionnaires, contingent upon the respondents' individual preferences. The acquired data was analysed using the SPSS statistical software, which utilises descriptive statistics. From the findings of the study, it is clear that the performance of residential projects in Nairobi is greatly impacted by the presence of project constraints, which negatively impact the timeline, budget, and quality of the projects. The majority of projects are currently in progress, with a substantial number on hold or abandoned, and only a few were completed. The study results showed that most construction projects were initiated after the year 2020. Economic constraints such as difficulties in obtaining loans from banks and financial institution, inflation and interest rate increase, limited resources/ budget limits had the greatest impact and were noted to be extremely impactful to the performance of residential construction projects. Legal constraints such as safety regulations, acquiring construction permits, prevalent corruption in the permit approval process, and delays in project approval followed in close succession were noted to be impactful to performance. Technical constraints were also noted to be impactful this includes restrictive site area/congested surroundings and inadequate storage and handling areas. Environmental constraints such as unforeseen climate changes, traffic and transportation challenges were impactful to project performance. Social constraints such as political dynamics within a region and ownership issues regarding land and construction site had the least impact on the performance of residential construction projects. The study recommends that construction companies should adopt comprehensive project cost estimation techniques, engage with legal experts early in projects, implement comprehensive environmental management plans and improve technical capabilities by providing advanced training for skilled labor and introducing modern construction techniques in order to enhance performance of residential construction projects.

CHAPTER ONE

INTRODUCTION

1.1 Background of the Study

One of the most fundamental and largest industries in existence today is the construction field. The industry is liable for essential infrastructure for countries, cities, and towns; from hospitals, schools, roads, residential buildings, malls, bridges and rail roads all of these benefit from the civil works industry. It plays a crucial part in economic development, urbanization, and improving living standards worldwide (Assaad et al., 2020). The global construction sector is expected to continue growing mainly because of increased urbanization, population growth, infrastructure needs, and renovation projects. It is projected to reach $17 trillion by 2029 from $8.2 trillion in 2022 (Toolsense, 2022).

The construction industry today employs a significant proportion of the global population. Approximately ten percent of the global economy is committed to construction projects; public and private housing and non-residential public buildings. The construction field has been under pressure to advance into a sector that is continually changing. Technological advancement and sustainable practices are likely to shape the outlook for the construction industry and this will influence the parties involved in the sector (Sanni-Anibire et al., 2022).

Globally, the construction enterprise faces unique challenges in coordinating all aspects of the project activities to have a seamless flow. The industry: however, is marked by various challenges and hindrances due to the complexities involved such as planning, designing, financing, building, and maintenance of structures and infrastructure. Project

constraints, including financial limitations, resource shortages, and delays, play a significant role in affecting residential construction project performance worldwide.

Worldwide real construction spending is projected to experience a compound annual growth rate (CAGR) of 2.2% from 2019 to 2024. The forecast indicates that there would be a compound annual growth rate (CAGR) of 1.3% in residential spending. When examining the trajectory of long-term growth trends, it is projected that expenditure on residential construction will see a Compound Annual Growth Rate (CAGR) of 2.6% from 2024 to 2029, notwithstanding the deceleration in global population growth.

Despite the various project elements seen in the construction the industry, overruns in both costs and schedules are always viewed as being of the utmost importance in the project controls sector (Assaad et al., 2020). The industry however is little understood, there are many uncertainties involved in the process. The key to managing construction projects effectively is comprehensive and strategic planning, which will maximise efficiency and ensure on time completion and within budget.

Sanni-Anibire et al. (2020) assert that delays and other output losses, including inefficiency, persistently plague the construction industry. Delays can result in project abandonment, legal disputes, and increased time and financial expenditures. The causes of delay were financial constraints, lack of material availability for the projects, postponements in project approval, inadequate site administration and collaboration among parties, and insufficient resource planning and interval estimation/scheduling.

Construction is an intricate task involving many factors. If a construction project is not adequately strategized, it will result in huge losses as well wasted time to the project participants. Effectively managing a construction project is difficult because of the

numerous limitations inherent in the undertaking. The gap between the known and unknown is bridged by the knowledge of these constraints, resulting in the effective completion of construction projects within the designated timeframe, budget, and desired quality standards, all to the client's satisfaction (Bhavsar & Solanki, 2020).

In the African context, it is noteworthy that the COVID-19 pandemic has resulted in a deficit, which has subsequently affected the purchasing power and household expenditure. However, it is anticipated that there will be a resurgence in residential spending growth. This projection is mostly attributed to the increasing population and the prevailing housing scarcity in several countries within the area (IHS Markit, 2020).

Ghozzi (2019) predicts a rapid growth in the civil works sector in East Africa. The construction productivity in the three main markets in the region, namely Ethiopia, Kenya, and Tanzania, is expected to expand from US$25.9bn in 2017 to US$98.8bn by 2022. Although this growth is expected, there are still innumerable dynamics that hinder the construction industry in East Africa. High transactional overheads, getting the required permits and licenses, dealing with external parties typical in capital projects and inadequate local capacity for project preparation are among the hindrances to construction projects in East Africa. In this regional context, project constraints such as regulatory hurdles, limited local capacity, and coordination challenges significantly influence the performance of residential construction projects, affecting timelines, budgets, and quality outcomes.

Integral to the socioeconomic progress of any nation is the construction business. The productivity of this component is essential for national development and serves as an indicator of the country's economic capacity to maintain growth and progress. Continued improved effectiveness of this sector will contribute to wealth and

employment creation as well as many other benefits to the country (National Construction Authority (NCA) Kenya, 2018). According to Kwatsima (2017), the achievement of vision 2030 for Kenya will be largely impacted by the advancement of the structural works sector and there is a direct link between industry growth and employment creation as well as better economic livelihood for Kenyans.

An article by Kenya Investment Authority - Ken Invest (2017), stated that the rapid expansion of the population, in conjunction with a heightened need for cost-effective housing, has resulted in an upsurge of prospects for the construction of residential, commercial, and industrial structures. The presence of substantial government funding in infrastructure, a legislative framework that promotes favorable conditions, a growing need for both commercial and residential structures, and the status of being the primary market for construction materials in East Africa; are some of the favorable conditions accelerating growth of construction industry in Kenya.

There are considerable opportunities in the development of private housing, commercial, and industrial buildings due to increasing demand for affordable housing and rapid population growth. The demand for housing in Kenya is rising at an annual rate of 200,000 units, while the country faces a deficit of 2 million housing units. Statistical data from the National Housing Corporation reveals that the annual housing supply in the country is limited to a maximum of 50,000 units. The construction sector in Kenya will benefit from increased prospects due to significant demand for residential spaces. Additionally, the rapid urbanisation process, the increasing number of industrial facilities, and the enactment of Kenya's Vision 2030 Strategy are all expected to offer a variety of advantageous opportunities for the broader construction sector and building enterprises in the country (Transparency Market Research & The Big 5 Construct Kenya, 2020).

Concurring with Babalola, et al., (2015), the civil works sector is inherently intricate due to its extensive involvement of many project participants, including consumers, consultants, contractors, stakeholders, and regulators. This complex nature makes it susceptible to poor construction project performance and an economic situation which cannot be managed. The construction sector, meanwhile, assumes a meaningful part in the advancement and attainment of objectives within society. Residential construction projects also face numerous constraints which if not addressed will affect the performance of projects. In Kenya, the role of project constraints such as financial limitations, delays in approvals, insufficient site administration, and inadequate collaboration is particularly critical, as these factors directly impact project timelines, cost, and quality.

1.1.1 Project Constraints

Project performance in construction projects is significantly influenced by constraints, which are factors that limit or dictate the actions of a project team (Anjay, 2020; Sagar et al., 2022). These constraints can lead to delays, cost overruns, and suboptimal outcomes if not properly identified and managed. While the traditional triple constraints of scope, time, and cost remain fundamental to assessing project performance, other factors such as quality, risk, resource management, stakeholder engagement, and integration also play critical roles (Usman, 2019; Pollack et al., 2018). Effective identification of these constraints at the outset ensures informed decision-making, better allocation of resources, and enhanced project outcomes.

Construction projects, in particular, face a diverse set of constraints beyond the triple constraint framework. Studies have highlighted economic, legal, environmental, technical, and social constraints as critical determinants of project performance (Rai et

al., 2021; Shinde et al., 2019; Talib & Kashkol, 2019). Legal and technical constraints often have the most significant impact, whereas social constraints may exert a comparatively smaller influence. Recognizing and addressing these constraints allows project managers to plan, schedule, and control project activities effectively, thereby mitigating potential disruptions to project goals (Meredith et al., 2017; Bhavsar & Solanki, 2020).

The study prioritized key measures of project performance that reflect both the traditional and extended dimensions of project constraints. The selected measures included scope management, schedule adherence, cost control, quality assurance, risk management, and resource allocation. Additionally, procurement processes, stakeholder management, and integration mechanisms were considered critical for ensuring project success. These measures were chosen because they directly influence the achievement of project objectives and provide a comprehensive framework for evaluating performance in the context of multiple constraints (Romzi & Shu Ing, 2022; Masoetsa et al., 2022).

By systematically identifying and classifying constraints, the study aimed to provide actionable insights for improving construction project performance. Following classifications established in prior research, constraints were categorized into economic, legal, environmental, technical, and social dimensions, which served as independent variables for assessing their impact on project outcomes. This approach enables project managers to anticipate potential challenges, allocate resources efficiently, and implement strategies that minimize delays, cost overruns, and quality issues, ultimately enhancing overall project performance (Ricardo & Vicente, 2015; Sultana, 2019).

1.1.3 Performance of Construction Project

Project constraints are factors that limit or define the actions of a project team and directly affect the performance of construction projects (Ong'ondo et al., 2019; Bhavsar & Solanki, 2020). Effective management of these constraints is critical for achieving timely completion, adherence to budget, and quality standards. While the traditional measures of project performance—time, cost, and quality—remain central, additional constraints beyond the triple constraint must be considered to accurately assess project outcomes (Egboga & Ogohi Daniel, 2022; Abdelnaser et al., 2012). These constraints are inherent to the project environment and, if not properly identified and managed, can result in delays, cost overruns, and unsatisfactory quality.

Legal constraints refer to the statutory and regulatory requirements that govern construction activities, including building codes, labor laws, zoning regulations, and safety standards. Non-compliance with legal frameworks can result in project stoppages, fines, or litigation, which directly impact time and cost performance (Rai et al., 2021; Bhavsar & Solanki, 2020). Proper identification and adherence to legal requirements are crucial to ensuring smooth project execution and avoiding delays or financial penalties.

Technical constraints involve limitations arising from the design, engineering, or construction methods used in a project. These include availability of technology, complexity of design, construction methods, and technical expertise of the workforce (Sultana, 2019; Ullah et al., 2017). Failure to address technical constraints can compromise project quality, increase rework, and extend project timelines, affecting overall performance. Project managers must plan resources and schedule activities to mitigate technical risks and ensure construction standards are met.

Social constraints encompass the human and community factors that can influence project execution, such as stakeholder expectations, labor relations, cultural considerations, and community opposition (Rai et al., 2021; Mirzaei & Mabin, 2014). These constraints can affect resource availability, workflow, and acceptance of project outcomes. Engaging stakeholders and ensuring community alignment is therefore essential to maintain progress and achieve customer satisfaction, which is a key measure of project success (Barret, 2000).

Economic constraints relate to financial limitations, including budgetary allocations, cash flow, market fluctuations, and funding availability (Assaad et al., 2020; Ronoh, 2020). Economic constraints influence both time and quality performance, as insufficient funds can delay procurement, labor payments, or material supply, potentially escalating project costs. Effective financial planning and monitoring are vital to maintain the project within budget and ensure predictable performance.

Environmental constraints involve ecological and sustainability considerations that affect construction projects, such as land conditions, climate, environmental regulations, and sustainability standards (Romzi & Shu Ing, 2022; Ingle & Mahesh, 2022). Failure to account for environmental factors can lead to project delays, regulatory penalties, or increased mitigation costs. Incorporating environmental planning into project management ensures compliance, minimizes negative impacts, and supports long-term project sustainability.

By recognizing legal, technical, social, economic, and environmental constraints as critical sub-variables, project managers can proactively plan, monitor, and control factors that influence performance. Addressing these constraints alongside traditional measures of time, cost, and quality ensures a comprehensive assessment of project

success and enhances the likelihood of completing construction projects efficiently, within budget, and to stakeholder satisfaction (Ong'ondo et al., 2019; Abdelnaser et al., 2012).

1.1.4 Residential Construction Projects in Nairobi

Residential construction project encompasses the process of expanding, renovating, or constructing new dwellings or living spaces specifically designed for residential occupancy (Kabirifar & Mojtahedi, 2019). Residential construction encompasses the activities involved in constructing, altering, fixing, improving, or upkeeping residential structures, including single-family homes, duplexes, apartments, condominiums, and other residential buildings that are no taller than four stories, including basements, and are exclusively meant for residential human habitation. The scope of this project does not encompass the installation of utilities such as water and sewer lines, nor does it involve any street construction or the development of other structures, such as those intended for recreational or business purposes.

According to Eglin, (2023) the urban area of Nairobi has promising prospects for alternate paths of development within the building industry, owing to its rapid growth as one of the fastest-expanding cities in the region. Despite the implementation of certain initiatives by the national and county government in Nairobi and Kenya as a whole, the limited success of these projects indicates that the issue of affordability remains a significant obstacle for individuals in the low- and middle-income demographic to acquire suitable and reasonably priced housing in the capital city. This population segment continues to encounter exorbitant housing expenses and substandard living conditions. Despite diligent endeavours to enhance project performance, residential construction projects continue to exhibit poor performance.

Nairobi County has the lowest proportion of houses that have been constructed, as indicated by the Kenya National Bureau of Statistics (2019) study on the distribution of households that own the primary dwelling unit based on the mode of acquisition, area of residence, county, and sub-county. The average number of constructed houses in the country is 93.9% while the percentage of constructed houses in urban areas is 80.6% while that of Nairobi County is 53.7%. Hence, it is imperative to thoroughly examine residential development projects within Nairobi County, with the aim of bridging the existing gap and facilitating the emergence of further residential construction projects in the region.

An article by Building Efficiency Accelerator (2018) stated that from 2016, the real estate and construction sector made a contribution of 13.8% to Kenya's Gross Domestic Product (GDP), and this proportion has been seeing a positive trend of growth. The predicted investment in new buildings for Nairobi between 2018 and 2025 is forecast to range from USD 8 to 9 billion. A significant portion of this investment, roughly USD 5.5 billion, is expected to be allocated to residential development. The growth of multi-unit residential projects is anticipated to drive this investment, with a projected annual growth rate of 6.5%. Hence, it is of the utmost importance to investigate the constraints that restrict the effective execution of residential construction projects, since these limitations play a crucial part in the process of supporting economic growth.

In research published by Cytonn Real Estate in 2017, it was identified that the primary obstacles encountered in residential buildings inside the Nairobi metropolis are the limited availability and high cost of land, limited access to funding, escalating construction expenses, and the burden of infrastructure costs. These issues make it more difficult to alleviate the housing shortage that exists in the region. The problems are the

result of unanticipated constraints that occur during the development process. These constraints either lead to an increase in expenses or the appearance of new obstacles within the system. Assessing the restrictions affecting the performance of residential construction projects is crucial for minimising costs and unforeseen issues, so aiding in alleviating the housing shortage in Nairobi.

Residential construction projects in Nairobi, and more broadly, are significantly affected by a range of constraints that influence their performance. These constraints include legal factors such as regulatory approvals and compliance with building codes, technical limitations related to design, construction methods, and site conditions, social considerations involving stakeholders and community expectations, economic factors such as high construction costs and limited funding, and environmental challenges including sustainability requirements and site-specific conditions (Cytonn Real Estate, 2017). The presence of these constraints can lead to delays, cost overruns, and suboptimal quality if not properly identified and managed, highlighting the need for careful planning and monitoring to improve the success of residential construction projects.

1.2 Problem Statement

The performance of residential construction projects in Nairobi County is critical, given the region's pressing housing demand and rapid urban growth. These projects are susceptible to numerous constraints that can affect planning, design, and implementation, often arising from a combination of legal, technical, social, economic, and environmental factors. Such constraints directly impact project outcomes, including timely delivery, adherence to budget, and overall quality of construction (Romzi & Shu Ing, 2022). Ensuring effective performance through careful planning

and early identification of potential limitations is essential for the smooth execution of residential projects, as it determines whether projects can meet the housing needs of Nairobi's growing population or face delays and cost overruns that exacerbate the housing shortage.

Nairobi is experiencing rapid population growth, with projections suggesting that its population may double within the next 15 years. The city's urban population growth rate of 4.1% in Africa has outpaced the development of housing infrastructure, creating a significant housing shortage. This gap has forced many residents to live in substandard dwellings and informal settlements, highlighting the urgent need for effective residential construction projects (County Government of Nairobi, 2018). Despite substantial investments in residential development, many projects in Nairobi have exhibited dismal performance, frequently failing to meet critical success criteria. Specifically, numerous projects experience delays beyond their scheduled completion dates, exceed allocated budgets, and fall short of required quality standards. The consistent underperformance of these projects underscores the need to investigate the factors constraining their timely, cost-effective, and quality-driven delivery, which are key measures for assessing the success of residential construction initiatives.

Kenya's global ranking for ease of dealing with construction permits is 124 out of 190 economies, with the permit process requiring an average of 159 days, 16 procedural steps, and costs equivalent to 2.8% of total construction expenses (CAHF, 2023). This illustrates how procedural, legal, and administrative constraints within the construction sector can significantly influence the performance of residential construction projects. Understanding these constraints is therefore crucial, as they directly affect the timely completion, adherence to budgets, and quality of residential developments in Nairobi County. A comprehensive examination of project constraints can provide valuable

insights into improving efficiency and effectiveness in the local residential construction sector.

A review of data from the National Construction Authority (NCA) indicates numerous residential construction projects in Nairobi County have been suspended, highlighting the impact of unaddressed constraints on project performance. Kieti (2020) notes that residential projects in Nairobi encounter multiple constraints that hinder their successful implementation and overall effectiveness. These constraints span legal, economic, technical, social, and environmental aspects, all of which can influence schedule, cost, and quality. Proper identification and management of these constraints are therefore critical to enhancing project success and ensuring that residential construction projects deliver timely, within-budget, and high-quality outcomes. Previous studies, however, have often focused on affordable housing or specific segments, limiting the understanding of constraints across diverse residential projects in Nairobi.

Managing project constraints is closely linked to improved performance. Tanko et al. (2017) argue that identifying and mitigating bottlenecks reduces uncertainties, improves transparency, and enhances project administration. Similarly, Momanyi & Sang (2019) highlight that assessing residential construction project constraints enables better planning, resource allocation, budget control, and risk management, all of which contribute to overall project success. Their study, however, focused primarily on the National Housing Corporation, which may experience advantages due to government backing, and therefore does not fully reflect the constraints faced by typical residential construction projects in Nairobi County.

Other studies, such as David et al. (2020), emphasize that early identification of project constraints provides managers with foresight to plan effectively, minimizing disruptions and improving project outcomes. Yet, much of the existing research has concentrated on general project constraints or affordable housing, without exploring the unique challenges affecting residential construction projects in Nairobi. This presents a research gap: there is limited empirical evidence on how legal, technical, social, economic, and environmental constraints collectively influence the performance of residential construction projects in Nairobi County. This study aims to fill that gap by examining the relationship between these constraints and project performance—measured by timely completion, adherence to budget, and quality standards—thereby providing insights that can improve planning, execution, and the overall delivery of residential housing in the region. The findings will also support broader housing goals and contribute to Target 11.1 of the Sustainable Development Goals, which seeks to ensure access to adequate, safe, and affordable housing for all by 2030 (UN-Habitat, 2016b).

1.3 Objectives of the Study

1.3.1 General Objective

The study aimed to substantiate the influence of project constraints, namely environmental, legal, economic, social and technical constraints on the performance of residential construction projects in Nairobi County.

1.3.2 Specific Objectives

The research was focussed on the subsequent precise objectives:

i. To determine how legal constraints influence performance of Nairobi County's residential construction projects.

ii. To evaluate the performance of residential construction projects in Nairobi County when influenced by economic constraints.

iii. To verify the influence of environmental constraints on the performance of residential construction projects in Nairobi County.

iv. To analyse how technical constraints influence the performance of residential construction projects in Nairobi County.

v. To evaluate the influence of social constraints on the performance of residential construction projects in Nairobi County

1.4 Research Questions

The research project aimed to address the inquiries below:

I. What influence do legal constraints have on the performance of residential construction projects in Nairobi County?

II. What influence do economic constraints have on the performance of residential construction projects in Nairobi County?

III. What influence do environmental constraints have on the performance of residential construction projects in Nairobi County?

IV. What influence do technical constraints have on the performance of residential construction projects in Nairobi County?

V. What influence do social constraints have on the performance of residential construction projects in Nairobi County?

1.5 Significance of the Study

Construction project managers will be motivated to identify constraints that may impact the project. This will enable them plan accordingly to ensure that the project is realistic and has considered all aspects to ensure optimal performance. Project managers will also be able to plan ways of minimizing the effects that the constraints have on the project. The project managers will enhance their chances of securing future employment by effectively meeting the project owners' demands with the aid of these facts.

Construction projects are quite involving and costly especially to the owners. Therefore, prior knowledge of what to expect and particularly constraints is important to the project owners. They will be made aware of what to anticipate in the project which they wish to undertake and what they need to take into consideration before embarking on the building construction project.

The government and other institutional bodies in construction such as ICPMK & AAK will also benefit from this study as it will advance the planning process for residential construction projects. Acquiring knowledge pertaining to prevalent constraints in building construction projects would prove advantageous, as it would enable them to identify obstacles within the construction industry that impede project progress. The government has the capacity to contribute through the implementation of policies aimed at mitigating limitations, so facilitating the expeditious completion of projects. Consequently, this will yield advantages for the broader community.

The study will benefit the researcher in gaining knowledge on project constraints and ways of minimizing the effects on management of residential construction projects. This study is expected to yield valuable insights that can serve as a point of reference for future researchers.

1.6 Scope of the Study

The study focused on residential construction projects in Nairobi County, Kenya, initiated from the year 2000, including ongoing, completed, and abandoned projects, to assess how project constraints influence performance over time. Conceptually, it examined legal, technical, social, economic, and environmental constraints and their effect on timely completion, adherence to budget, and quality standards. Theoretically, the study was guided by the theory of constraints and the iron triangle (time, cost, quality) as a framework for understanding project performance. The research was confined to Nairobi County, given its rapid urban growth, housing shortages, and concentration of residential construction activity. Contextually, the study targeted residential projects, including single-family homes, duplexes, and low-rise multi-unit buildings and focused on responses by construction project managers registered with ICPMK and AAK, examining constraints in the external working environment to determine their impact on project success.

1.7 Limitations of the Study

An expected challenge was the availability of construction project managers to provide information on project constraints, as many construction sites were typically staffed by employees and team leaders rather than the project managers themselves. Additionally, project managers were often reluctant to disclose project-related information due to privacy concerns or the need for explicit authorization from the project owners. To address this, the study assured respondents of strict confidentiality, emphasizing that

the information they provided would be used solely for academic purposes. This reassurance encouraged project managers to freely share information and respond to the questionnaires, thereby minimizing the impact of these limitations on data collection.

1.8 Organization of the Study

The present academic research is structured in the subsequent format: In the first chapter of this study, the necessary research background is presented. This provides a succinct summary of the subject to guarantee a thorough comprehension of the study's primary focus. In this study, Chapter two conducts an absolute assessment of the current body of literature. This evaluation will include a thorough examination of theory, an analysis of real-world data, the identification of areas where research is lacking, and the creation of a conceptual framework. The upcoming chapter, Chapter three, concentrates on the approach and design utilised in the research. It provides a comprehensive explanation of the specific group of individuals being studied, the method used to choose participants, and the approaches employed to assess the precision of research tools. This section offers a thorough exploration of several approaches used for gathering and analysing data, as well as the ethical factors involved in the study. Chapter four presents the research findings and gives a discussion and analysis on the same. Section five gives a synopsis of the conclusion, recommendations based on the research findings and suggestions for future research.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

This chapter concentrates on literature about project constraints and the efficacy of construction projects. The section affords a comprehensive examination of the theories related to project constraints and project performance. It also includes an empirical review of the variables that affect project constraints and the performance of construction projects. Additionally, the chapter identifies knowledge gaps and explains how the study will address these gaps. Finally, it exhibits the conceptual framework that guided the academic study. The primary sources utilised for this literature evaluation consisted of textbooks, scholarly publications, and online resources.

2.2 Theoretical Review

The theory of constraints, the theory of black swans, and decision theory served as our primary theoretical frameworks throughout this research project.

2.2.1 Theory of Constraints

The Theory of Constraints (TOC) was coined by Dr. Eliyahu Goldratt (1990). It presents a management perspective rooted in systems thinking and aims to elucidate and identify the factors that impede a system from achieving increased performance in comparison to its objectives (Goldratt, 1990). The focus of TOC is directed at the most challenging component of a system with the aim of enhancing overall system performance. The upper limit of output that a system can generate is determined by the quantity of its scarcest resource, whereas the maximum rate at which the system can operate is determined by the speed of the operation that requires the greatest amount of time to perform. Hence, enhancements to the system can be achieved by recognizing and alleviating constraints, thereby mitigating future limitations.

In a similar vein, residential construction projects are subject to several constraints that, when identified and addressed from the outset, can provide an additional advantage to the project's performance. TOC assumes that every real system must have at least one constraint (Noreen, Smith & Mackey, 1995). Construction projects are not an exception since they have several constraints in the process from planning to implementation. The output of the system will be determined by the constraints. Management of the constraints as well as proper planning around them will ensure a favorable outcome. According to Goldratt (1990), TOC involves the systematic identification and elimination of restrictions within organizational processes that hinder the achievement of organizational objectives. Eliminating limitations on crucial processes is a highly effective approach to improving overall performance.

TOC has five sequential steps, which involve concentration on the areas likely to cause the most impact on the system. In the process of system analysis, it is crucial to identify the constraints that exist within the system. Once these constraints have been identified, a decision must be made regarding whether to exploit these restrictions. This decision should take precedence over all other considerations. Ultimately, the constraints should be given priority and elevated in importance inside the system. Developing constraints in the system can be considered by reapplying the steps in TOC (Justyna & Ewa, 2017). Figure 2.1 explains the flow of the theory of constraints from identification to elevation.

Despite its usefulness, TOC has been criticized for focusing on a single primary constraint, which may oversimplify complex systems where multiple constraints interact simultaneously. In highly dynamic environments, such as residential construction projects with numerous interdependent activities, focusing on only one constraint may not adequately address all performance bottlenecks. Additionally, the practical implementation of TOC requires accurate identification of constraints and

effective coordination across processes, which may be challenging in projects with resource limitations or fragmented management structures (Noreen, Smith & Mackey, 1995).

The concept of constraints is directly applicable to both project management and this specific study, as per Zeynep et al. (2014). TOC describes an approach designed to identify and resolve the primary constraint that impedes the achievement of a desired objective. TOC helps to guide the study toward identifying the constraints in construction projects, understanding how they affect overall performance, and finding ways to improve project outcomes. According to New Bold (1998), TOC can be used to identify and remedy constraints in project management, particularly in residential construction projects, which are complex and involve several activities that may hinder progress. Tools like Critical Chain Project Management (CCPM) allow project managers to plan activities, account for task interdependencies, optimize schedules, and remove detrimental behaviors that obstruct project objectives (Azar, Diana & Artem, 2016).

The theory of constraints provides a methodical methodology for identifying restrictions in residential development projects in Nairobi County, Kenya. The idea of constraints, which includes identification, exploitation, subordination, and elevation, can also be applied in residential construction projects. Project managers can apply these theoretical principles to improve their understanding and strategic handling of constraints in the construction process. In order to enhance the efficiency of projects and increase the likelihood of meeting project objectives and deadlines, project managers must prioritize critical constraints, optimize resource utilization, and foster a mindset of continuous improvement, ultimately improving project performance.

2.2.2 Black Swan Theory

The Black Swan theory was initially presented to the public by Nassim Nicholas Taleb in 2007. Taleb (2010) describes a “black swan” as an event that catches people off guard, has massive repercussions, and is generally unmatched until it actually occurs. The theory integrates both philosophical and mathematical perspectives to illuminate the stochastic nature of uncertainty (Boztemur, 2018).

The concept is illustrated by the historical example in Western culture where it was widely accepted that all swans were white; however, the discovery of black swans in the 18th century revealed the rarity and unpredictability of such events. Taleb (2010) argues that the modern world is dominated by black swan events, and identifying these can help explain why certain developments recur throughout history and their resulting effects.

According to Boztemur (2018), the Black Swan idea encompasses three distinct features. First, the event is highly unexpected, making it rare and surprising. Second, the event has significant and profound consequences, often resulting in far-reaching impacts. Third, after the fact, the event may appear predictable in hindsight, demonstrating reflective predictability. Taleb (2007) also emphasizes that a black swan occurs when there is a large gap between what is known and what is believed to be known.

In the context of construction projects, project managers should carefully examine these three features during planning to avoid encountering black swan events or at least be prepared when they occur. Kendrick (2008) highlights that projects, especially large and complex ones, often fail due to unlikely and unforeseen occurrences. By identifying these potential risks early, they cease to be “black swans” and can be forecasted,

allowing project managers to apply effective planning and risk management strategies to reduce their impact.

The Black Swan Theory has been criticized for its unpredictability, which limits practical applicability in some project management contexts. While the theory highlights the importance of rare and high-impact events, it does not provide precise methods for predicting when and how such events will occur. This makes it difficult to implement in projects with tight schedules or fixed resources, such as residential construction projects, where managers must balance the focus on black swans with the practical need to manage routine constraints (Murphy & Conner, 2012; Flyvberg & Budzier, 2011). Additionally, critics argue that labeling too many events as black swans may reduce the focus on systematic risk management, potentially undermining planning effectiveness.

The Black Swan theory is relevant to this study because it emphasizes identifying rare, high-impact, and potentially unforeseen events that can disrupt construction projects. Constraints in construction projects can behave like black swans—they may occur unexpectedly, have major effects, and might have been predicted in hindsight. By applying the principles of the theory, project managers can proactively assess potential constraints, perform risk analysis, and develop contingency plans to mitigate their impact.

Kendrick (2008) suggests that project planning should include thorough analysis of assumptions, constraints, and the project environment to enhance certainty. Similarly, Murphy and Conner (2012) recommend detecting early indicators of potential disruptions, while Flyvberg and Budzier (2011) advise conducting stress tests to evaluate preparedness for improbable events. By addressing these potential black swan

events, project managers can minimize bottlenecks, reduce risks to project performance, and ensure smoother execution of residential construction projects.

The planning process for residential construction projects requires managers to thoroughly analyze possible constraints to proactively reduce their impact or prevent them altogether. The Black Swan Theory emphasizes the importance of readiness for rare and unforeseen events. Implementing robust risk management strategies, contingency planning, and fostering adaptability in project execution ensures that constraints are managed effectively, thereby improving project performance.

2.2.3 Decision Theory

Decision Theory was posited by Herbert A. Simon in 1947. It is an academic discipline that examines the cognitive processes and empirical characteristics associated with making decisions in situations characterized by ambiguity (Parmigiani, 2001). Simon's work laid the foundation for understanding how decision makers act under uncertainty and how choices can be optimized when information is incomplete or ambiguous.

Decision theory, also referred to as decision analysis, provides a framework to identify optimal solutions when decision makers are faced with multiple options and uncertain or potentially hazardous future events. In construction projects, decisions are made under considerable uncertainty due to numerous constraints affecting project activities. The identification of constraints in construction projects is often not pre-established, leading to ambiguity even at the initial stages of project design (Kochenderfer, 2015). Decision Theory is prescriptive and normative, focusing on how decisions should be made rather than merely describing human behavior.

According to Vohra (2006), decision-making involves several steps: identifying multiple potential outcomes beyond the decision maker's control, listing all available

courses of action within the decision maker's control, determining a pay-off function to describe the consequences of actions, and selecting the most suitable option among alternatives. In construction projects, this approach helps project managers systematically navigate constraints and make informed choices that affect project progression.

Decision theory combines both descriptive and prescriptive elements, aiming to categorize the level of knowledge and evaluate the expected outcomes of different actions (Myerson, Roger B., 1991). Construction project success, particularly under uncertainty and constraints, relies on the project manager choosing the best course of action. The theory allows for structured consideration of trade-offs, potential outcomes, and risks when selecting actions, which is crucial in managing construction projects that often face ambiguous scenarios and complex interdependencies.

Despite its utility, decision theory has limitations. It assumes that decision makers can identify all possible alternatives and outcomes, which may not be realistic in highly complex or dynamic construction projects. The theory also relies on the availability of reliable information to evaluate pay-offs and outcomes, which can be challenging when constraints are unclear or when unforeseen events occur. Critics argue that in real-world settings, decisions are often influenced by cognitive biases, incomplete knowledge, and time pressures, which may reduce the practical applicability of the theory (Kochenderfer, 2015; Parmigiani, 2001).

Decision theory supports this study by providing a framework for linking the independent variable, project constraints, with the dependent variable, project performance. By applying decision-making principles, project managers can identify potential constraints, evaluate possible actions, and select the most suitable alternatives

to mitigate risks. In residential construction projects, constraints such as financial limitations, technical challenges, environmental factors, and social restrictions can generate diverse outcomes that affect project performance. Decision theory enables project managers to systematically assess these constraints, analyze trade-offs, and make informed decisions that enhance project performance. By adopting a structured approach to decision-making, managers can improve project planning, optimize resource allocation, and ensure better achievement of project objectives under uncertainty.

2.3 Empirical Review

The empirical research that has been conducted on the five independent variables and their respective effects on the dependent variable is detailed in this section.

2.3.1 Legal Constraints and Performance of Construction Projects

Legal constraints have been widely examined in construction literature due to their substantial influence on project performance. Bhavsar and Solanki (2020), in their study titled *"Identification of Constraints in Construction Projects"*, sought to determine key factors affecting project delivery using a qualitative approach targeting construction professionals in India. Legal constraints were operationalised as the time and financial resources required to comply with statutory regulations, and the study found that compliance significantly affects project timelines and efficiency. They recommended comprehensive upfront assessment of required approvals to minimise delays.

Similarly, Romzi and Shu Ing (2022), in their Malaysian study *"Key Constraints in Construction Projects"*, used survey methods targeting project managers to examine how regulatory changes influence construction performance. Legal requirements were

operationalised through the need to revise project schedules after new regulatory guidelines, with findings revealing that legal constraints often cause delays and disrupt project planning. Their recommendation emphasised frequent schedule updates aligned with regulatory changes.

In the Kenyan context, Ochieng and Kiarie (2021) investigated *"Influence of Legal Constraints on Construction Project Performance in Kitengela-Kajiado County"* using a quantitative survey of project managers. Legal constraints were operationalised as compliance with government regulations such as licensing and permitting. Their findings showed a statistically significant relationship between regulatory compliance and project success, highlighting project management experience and adherence to legal guidelines as critical determinants of performance. They recommended strengthening compliance monitoring and improved regulatory awareness among managers. Beyond East Africa, Talib and Kashkol (2019), in their Iraqi study *"Theory of Constraints in Building Projects"*, applied a mixed-methods approach targeting construction managers and operationalised legal constraints through compliance costs, restrictions on activities, and limitations on innovation. The study concluded that legal regulations significantly impede productivity and recommended strategic planning, including early engagement with planning authorities, to manage compliance challenges.

Further, Masoetsa et al. (2022) examined the South African construction sector in their study *"Evaluation of Construction Constraint Variables and Their Impact on Project Performance"* using survey data from construction firms. Legal constraints were operationalised as non-compliance with safety rules, land acquisition complications, and contractual disputes. Their findings revealed that government policies represent major obstacles that adversely affect project outcomes, with recommendations centred

on enhanced compliance mechanisms and policy reforms. Sagar et al. (2022) extended this perspective in India through their study *"Recognition of Constraints in Small Construction Projects"*, employing quantitative surveys targeting small-scale project managers. Legal constraints were operationalised through challenges in land acquisition, licence procurement, and compliance with onsite safety regulations. Their findings ranked legal constraints among the most critical issues affecting project performance, recommending proactive engagement with regulatory bodies and early compliance planning.

Across these studies, several gaps emerge. There is a geographical gap as most research is concentrated in Asia and Southern Africa, with limited evidence specific to Kenya's regulatory context. A contextual gap is evident because existing studies either focus on general construction projects or small-scale developments, with insufficient attention to residential projects in urban Kenyan settings such as Nairobi County. Finally, a conceptual gap persists since many studies examine legal constraints broadly without linking them comprehensively to specific performance indicators (time, cost, quality). The current study addresses these gaps by analysing how legal constraints influence the performance of residential construction projects in Nairobi County, using a context-specific and performance-focused approach.

2.3.2 Economic Constraints and Performance of Construction Projects

Economic constraints are widely recognised as critical determinants of construction project outcomes. Romzi and Shu Ing (2022), in their study titled *"Key Constraints in the Construction Industry"*, set out to identify major impediments affecting construction performance in Malaysia. Using a review-based methodology focused on macroeconomic stability within the sector, the authors operationalised economic constraints through investment challenges, cash flow estimation, and uncertainties in

economic policy. Their findings showed that fluctuations in cash flow, inaccuracies in cost estimation, and policy uncertainty diminish project profitability and financial performance. They recommended continuous monitoring of economic activities throughout the project cycle to enhance financial resilience.

Similarly, Mohamud et al. (2020) examined *"Project Management Constraints Affecting Public Housing Projects in Isiolo County, Kenya"* using a quantitative survey targeting project officers involved in county-funded housing developments. Economic constraints were operationalised through cost management limitations and budgetary restrictions. The study found that cost management significantly influenced project execution, with time management emerging as the most impactful factor, followed by cost, scope, and quality management. The authors recommended strengthening project governance and ensuring more accurate financial planning for public housing initiatives.

In the Indian context, Bhavsar and Solanki (2020), in their study *"Identification of Constraints in Gujarat State's Construction Projects"*, used a qualitative approach targeting construction managers and operationalised economic constraints as inaccurate fund allocation and limited financial resources. Their findings revealed that misallocation of financial resources disrupts cash flow, delays site acquisition, and stalls project progress. They recommended comprehensive budgeting that accounts for land acquisition, relocation, compensation, and other project-related expenses.

Masoetsa et al. (2022) investigated *"Construction Constraint Variables and Their Impact on Project Performance in South Africa"* using survey data from construction firms. Economic constraints were operationalised through budget inadequacies and financial misallocation. Findings indicated that poor budget distribution adversely

affects project quality, safety, and functionality, while also disrupting cash flows within the supply chain. The authors recommended ensuring that clients possess sufficient financial capacity to support work at every stage of the project lifecycle.

Furthermore, Talib and Kashkol (2019), in their Iraqi study *"Theory of Constraints in Building Projects"*, employed mixed methods to examine how economic factors affect project delivery. Economic constraints were operationalised through delays arising from adding new suppliers, contractors, and subcontractors, and through budget-related resource limitations. Their findings showed that cost overruns and insufficient budget allocation often led to significant project delays. The authors recommended early assessment of resource and budget constraints before project initiation.

Sultana (2019) also explored *"Theory of Constraints in Building Project Management"* using a review methodology focusing on financial barriers. Economic constraints were operationalised through budgeting challenges and cash allocation deficiencies. She found that high costs and limited budgets reduce the likelihood of project completion, especially when resource prices rise mid-project. The study recommended proactive budgeting strategies that can accommodate unexpected cost escalations.

Lastly, Chin Foo (2021) conducted a study titled *"Management Elements Influencing Financial Performance in Malaysian Construction Projects"* using quantitative methods targeting Malaysian project managers. Economic constraints were operationalised through material price fluctuations and inaccuracies in cost and time forecasting. The findings revealed that economic restrictions significantly contribute to cost overruns and delays in overall project completion. It was recommended that project managers incorporate economic limitations into early planning to mitigate adverse effects on time, quality, and client satisfaction.

Based on the literature reviewed, several gaps become evident. A geographical gap persists because much of the evidence originates from Asia, with limited insight into economic constraints affecting construction projects in Kenyan urban contexts. A contextual gap is also present, as many studies examine general construction or public housing projects, leaving limited understanding of economic constraints in residential construction within Nairobi County. Finally, a conceptual gap remains, as most studies address economic constraints broadly without linking them comprehensively to key performance indicators such as cost efficiency, schedule adherence, and quality achievement. The current study addresses these gaps by assessing how economic constraints influence performance in residential construction projects in Nairobi County, using a context-specific and performance-oriented approach.

2.3.3 Environmental Constraints and Performance of Construction Projects

Environmental constraints have emerged as a critical consideration influencing construction project performance. Romzi and Shu Ing (2022), in their study titled *"Key Constraints in the Construction Industry"*, investigated regulatory and environmental barriers affecting construction performance in Malaysia. Using a review-based methodology, they operationalised environmental constraints through regulatory obligations related to air quality management, tree conservation, traffic control, and noise reduction. Their findings highlighted a close relationship between legal and environmental constraints, noting that public concerns and environmental preservation significantly shape project decisions. They recommended prioritising environmental policies during construction planning to ensure compliance and minimise negative ecological impacts.

In Kenya, Gichamba and Kithinji (2019) examined *"Impact of Environmental Regulations on Construction Project Efficiency in Nairobi County"* using a quantitative

survey targeting construction practitioners. Environmental constraints were operationalised through waste management rules, water resource regulations, noise, vibration, and physical planning oversight. Their results indicated that waste and water management had substantial effects on project efficiency, while noise, vibration, and physical planning enforcement had minimal influence. They recommended strengthening waste management practices to enhance local project performance.

In India, Jadhav and Patil (2020) conducted *"Factors Causing Cost Overruns in Residential Construction Projects"* using survey methods targeting residential builders. The researchers operationalised environmental constraints through soil instability, temperature fluctuations, and unpredictable weather conditions. Their findings revealed that these constraints were major drivers of cost overruns, adversely affecting project performance and budget accuracy. They recommended early geotechnical investigations and weather-responsive planning measures. Sagar et al. (2022) in their study *"Constraints in Small-Scale Construction Projects"* applied a quantitative approach targeting small-scale project managers in India. Environmental constraints were operationalised through air, water, noise, and dust pollution as well as topographical and soil-related challenges. Although their frequency and impact were moderate, these constraints still contributed to project delays and increased compliance costs. The authors recommended incorporating environmental considerations even when their perceived impact is low, due to potential unforeseen environmental events.

Further, Shinde et al. (2019) conducted *"Constraints Hindering Construction Project Performance"* using mixed methods targeting contractors and project managers. They operationalised environmental constraints as requirements to protect air quality, conserve trees, regulate traffic, and comply with excavation permit standards. Findings showed that environmental restrictions significantly affected project execution,

prompting the recommendation that construction activities be undertaken in harmony with ecological and human well-being considerations.

Similarly, Kolte and Ahire (2020), in their study *"Factors Contributing to Delays in Construction Projects and Proposed Solutions"*, used a qualitative approach targeting construction supervisors. Environmental constraints were operationalised through air preservation, tree conservation, noise control, traffic regulations, and excavation permit requirements. They found that securing environmental approvals is time-consuming and can delay project timelines if not obtained promptly. They recommended that project teams engage environmental regulatory agencies during the early planning stages to prevent approval delays that may render projects unfeasible.

In South Africa, Masoetsa et al. (2022) examined *"Construction Constraint Variables and Their Impact on Project Performance"* using survey data from building contractors. The study operationalised environmental constraints broadly, including pollution control, sustainable or hazardous material use, waste and water management, noise and vibration control, ecological preservation, traffic regulation, and climate resilience. Their findings indicated that although environmental constraints existed, their impact on project performance was relatively minimal compared to other constraints. They recommended enhancing environmental responsiveness, particularly in relation to climate change adaptation.

Drawing from these studies, several gaps are evident. A geographical gap persists because most evidence stems from Asia and Southern Africa, with limited research contextualised to Kenya's residential construction sector. A contextual gap exists since many studies focus on general construction or small-scale projects, leaving insufficient understanding of environmental constraints in urban residential construction in Nairobi

County. Additionally, a conceptual gap remains, as prior studies examine environmental constraints descriptively without comprehensively linking them to specific performance indicators such as cost efficiency, schedule adherence, environmental compliance outcomes, and project quality. The current research will address these gaps by investigating how environmental constraints affect the performance of residential construction projects in Nairobi County, using a comprehensive and context-specific approach.

2.3.4 Technical Constraints and Performance of Construction Projects

Technical constraints have been widely acknowledged as major determinants of construction project outcomes. Bhavsar and Solanki (2020), in their study titled *"Identification of Constraints in Construction Projects in Gujarat State"*, aimed to classify and rank the major constraints affecting construction performance in India. Using a survey-based methodology involving contractors and project engineers, the researchers operationalised technical constraints through factors such as delays in resolving design problems, limited site space, improper resource levelling, inadequate planning and scheduling, imperfect drawings, and insufficient storage capacity. Their findings revealed technical constraints as the second most prevalent challenge, emphasising that these limitations can be identified at early project stages—particularly during planning and design. They recommended early detection of technical issues to minimise disruptions during execution.

In Kenya, Ochieng and Kiarie (2021) conducted a case study titled *"Determinants of Performance of Construction Projects in Kitengela–Kajiado County"* targeting contractors, consultants, and project managers. Technical constraints were operationalised through design changes, consultant expertise, planning quality, and the robustness of project concepts. Their findings showed that technical constraints are a

major factor influencing project success. They highlighted that frequent client-driven design changes significantly compromise project performance and recommended developing project concepts with experienced consultants and engaging stakeholders early to reduce change orders and associated cost overruns.

Similarly, Romzi and Shu Ing (2022), in their review *"Key Construction Constraints in the Industry"*, examined technical constraints across Malaysian construction projects. Using secondary literature analysis, they operationalised technical constraints through feasibility challenges in construction methods, weaknesses in architectural design, site conditions, transportation limitations, and inadequate storage provisions. Their findings indicated that technical limitations substantially hinder project implementation, particularly when design deficiencies or unsuitable construction methods are present. They recommended strengthening standards and feasibility assessments to reduce technical setbacks.

According to Talib and Kashkol (2019) in their study *"Theory of Constraints in Building Projects in Iraq"*, long lead times resulting from poor coordination among project stakeholders represent a core technical constraint. Using interviews and surveys targeting design teams, contractors, and subcontractors, the study operationalised technical constraints through coordination gaps, workflow disruptions, and rework stemming from communication failures. The authors found that weak collaboration increases costly mistakes, delays, and schedule interruptions. They recommended establishing strong coordination mechanisms across all project phases to reduce technical delays.

In South Africa, Masoetsa et al. (2022) carried out the study *"Construction Constraint Variables and Their Impact on Project Performance"* using a quantitative design

targeting contractors and engineers. Technical constraints were operationalised through concurrent design–planning processes, drawing modifications, planning inadequacies, and delays in resolving technical issues. Their findings showed that while concurrency in planning and construction can provide efficiency benefits, technical limitations—particularly design modifications—still lead to costly revisions. They recommended value engineering and improved technical planning to reduce design-related interruptions.

Further, Chin Foo (2021) examined *"Management Elements Influencing Time and Cost Efficiency of Construction Projects in Malaysia"* using survey data from project managers. Technical constraints were operationalised through scarcity of skilled technical labour, subcontractor inefficiencies, and equipment limitations. The study found that technical constraints significantly contributed to project delays, which are critical indicators of project effectiveness. The author recommended anticipating technical issues during planning to prevent disruptions.

In India, Jadhav and Patil (2020), in their study *"Factors Leading to Cost Overruns in Residential Construction Projects"*, used surveys targeting residential builders and engineers. Technical constraints were operationalised through design conflicts, incomplete design at tendering, malfunctioning equipment, additional owner requirements, and poor site management and safety coordination. Their findings indicated that these technical limitations greatly affected both cost and schedule performance. They recommended improved design completeness at bidding and strengthening site management systems.

From the reviewed literature, notable gaps emerge. A geographical gap exists because most studies originate from India and Malaysia, with limited empirical evidence from

Kenya—particularly within Nairobi's residential construction sector. A contextual gap is observed as existing studies focus on general construction or infrastructure projects, leaving insufficient insights into technical constraints specific to residential construction projects. A conceptual gap also persists, as prior research identifies technical constraints but rarely links them systematically to performance metrics such as time adherence, cost efficiency, client satisfaction, and quality outcomes. The current study bridges these gaps by examining how technical constraints influence the performance of residential construction projects in Nairobi County, providing a focused, context-specific understanding.

2.3.5 Social Constraints and Performance of Construction Projects

Social constraints refer to human- and community-related factors that may influence the execution of construction projects. Bhavsar and Solanki (2020), in their study *"Identification of Constraints in Construction Projects"* conducted in Gujarat State, India, aimed to examine societal and economic constraints affecting project outcomes. Using a survey-based methodology targeting contractors and project managers, social constraints were operationalised through local beliefs, media influence, and political dynamics. The study found that while social constraints were present, their impact on project performance was negligible, as the level of orthodoxy and societal influence did not significantly disrupt project execution. The authors recommended maintaining awareness of potential conflicts in multi-stakeholder environments to minimise escalation.

Similarly, Sagar et al. (2022), in *"Constraints in Small-Scale Construction Projects in India"*, employed surveys targeting small project managers to identify social limitations, operationalised through community attitudes and conventional views on construction. Their findings indicated that social constraints were low in both

occurrence and impact, and they recommended cultivating positive relationships with local residents to address inquiries and reassure the community about project activities.

Romzi and Shu Ing (2022), in their review *"Key Constraints in the Construction Industry"*, classified social constraints as human-related issues, including resistance, emotional barriers, and problem ownership, operationalised through public concern and media influence. Their findings showed that even a small group of individuals could cause delays, increased costs, and overall project disruption, highlighting the potential indirect effects of societal factors.

Sultana (2019), in *"Application of Theory of Constraints in Building Project Management in Bangalore"*, used a mixed-method approach targeting project managers to examine the influence of public participation and scrutiny on construction projects. Social constraints were operationalised through community engagement, emotional responses, and internal oversight. Findings indicated that these factors could hinder innovation, affect design and procurement, and slow the initiation of new projects. In contrast, Rai et al. (2021), in their study on construction project limitations, reported that social constraints had the least substantial impact on project outcomes, though they emphasised the importance of monitoring community sentiment to prevent minor issues from escalating.

The reviewed literature highlights several gaps. A geographical gap exists as most studies are from India and Bangalore, with limited evidence from Kenya or Nairobi County. A contextual gap is observed because few studies examine social constraints in residential construction specifically, leaving uncertainty about their influence in urban housing projects. A conceptual gap also persists, as social constraints are often described qualitatively, with minimal empirical linkage to project performance metrics

such as cost, time, or quality. The current study addresses these gaps by examining how social constraints affect the performance of residential construction projects in Nairobi County, integrating both qualitative and quantitative perspectives to assess their actual impact on project outcomes.

Table 2.1: **Summary of Literature Review and Research Gaps**

Author	**Focus of Study**	**Research Variables**	**Research Finding**	**Type of Research Gaps**	**Focus of the current Study**
Bhavsar & Solanki (2020)	Identifying Constraints in Construction Projects	Legal, economic, social, technical constraints	The identification of legal constraints and the various elements encompassed within this category were determined to be significant contributors to project delays and failures.	Broad scope: The study examined a wide range of construction projects, encompassing many categories, rather than exclusively focusing on residential building projects.	Influence of legal, economic, technical, environmental, and social constraints on residential construction projects in Nairobi County
Mohamud et al., (2020)	The impact of project management constraints on the execution of public housing projects in Isiolo County, Kenya (Mohamud et al., 2020).	Project management constraints: time, cost, scope, quality	The research indicates that county governments must efficiently tackle and oversee limitations inside their programmes. This method has the likelihood to greatly expand the implementation of construction housing projects supported by the county in Isiolo County, Kenya.	The investigation was conducted to focus on three limitations of project controlling. Additional constraints on the effectiveness of construction projects was not examined.	Effects of economic and technical constraints on residential construction performance in Nairobi County
Gichamba & Kithinji (2019)	The implications of environmental rules on the efficiency of construction	Environmental constraints: water management, waste management,	The implementation of water laws and waste management regulations	The study focused on construction projects in a broad sense and did not	Effect of environmental constraints on residential construction project

Author	Focus of Study	Research Variables	Research Finding	Type of Research Gaps	Focus of the current Study
	projects in Nairobi County, Kenya (Gichamba & Kithinji 2019).	noise, vibration, physical planning	significantly affects the efficiency and outcomes of construction projects in Nairobi County.	specifically target residential development projects.	performance in Nairobi County
Romzi & Shu Ing (2022)	Key Constraint in Construction Industry	Legal, economic, technical, environmental, social constraints	During the early stages of a project, it is crucial to thoroughly identify and define constraints in order to efficiently handle the knowledge of these limitations and their possible outcomes.	The study only identified the constraints and classified them but did not show the level on influence on performance of construction projects.	Assessment of all constraint types and their influence on residential construction project performance in Nairobi County
Ochieng, & K. Kiarie, Dr. (2021)	Critical Factors on Performance of Building Construction Projects: A Case of Kitengela-Kajiado County, Kenya (Ochieng, & K. Kiarie, Dr. 2021).	Legal constraints, technical constraints, project management experience	The research demonstrated a substantial correlation between the success of projects and the experience of project managers, indicating that the expertise of managers was of paramount importance. The study also discovered a statistically significant correlation between the completion of building projects and government regulations.	Criteria for classifying critical factors is unclear. Additionally, it is imperative to conduct the study in Nairobi, as the current study was conducted in Kitengela-Kajiado County.	Examination of legal and technical constraints affecting residential construction projects in Nairobi County

Author	Focus of Study	Research Variables	Research Finding	Type of Research Gaps	Focus of the current Study
Masoetsa, et al., (2022)	An assessment of construction constraints on project performance in South Africa (Masoetsa, et al., (2022)	Legal, technical, economic, environmental constraints	The main limitations that impacted the efficiency of building projects in the South African construction industry were the insufficient project scheduling and coordination among stakeholders, along with issues connected to organization and government legislation.	Broad scope since the study was based on construction projects in South Africa and was not limited to residential construction projects.	Evaluation of multiple constraint types on residential construction performance in Nairobi County
Rai, et al., (2021)	Identification of Constraints in Construction Projects to Improve Performance (Rai, et al., 2021).	Legal, social, technical, environmental, economic constraints	There are five types of constraints, namely legal, social, technical, environmental, and economic. Each constraint can manifest independently or function as a sequence of issues. It was noted that at each step, there may be certain constraints that can impact both the overall duration and final cost of the project.	Broad scope: the focus was on construction projects in general.	Assessment of all five constraint types and their effect on residential project cost and schedule in Nairobi County
Sagar et al., (2022)	Identification of Constraints in small construction projects (Sagar et al., 2022)	Legal, economic, technical, environmental, social constraints	Limitations in construction projects impede the achievement of ideal performance, which can adversely affect the project's quality, timely	The study employed a relative importance index instead of the performance effect level to organize the findings.	Analysis of constraint types and their measurable impact on residential project performance in Nairobi County

Author	Focus of Study	Research Variables	Research Finding	Type of Research Gaps	Focus of the current Study
			completion, and cost.	Additionally, the study was conducted in India.	
Kolte & Ahire (2020)	Various Constraints for Delays in Construction Work and Suggesting Remedial Measures for the Same (Kolte & Ahire 2020).	Technical, legal, environmental constraints	It is considered that by gaining a better understanding of constraints from the beginning, one can ensure higher performance of the construction project.	The study had a rather broad scope. It was based on all kinds of construction work.	Technical, legal, environmental constraints
Shinde et al., (2019)	Identifying constraints in construction projects to enhance performance.	Legal, technical, environmental, social constraints	In order to obtain the best possible performance in a project, the study suggests that it is important to have a comprehensive understanding of how to effectively manage and oversee the working environment of the construction project, while adhering to any limitations or constraints.	Their research concentrated on the identification of constraints. Consequently, focus should be on c classifying the constraints.	Examination of social and environmental constraints in residential construction performance in Nairobi County
Sultana (2019)	Theory of Constraints in a Construction Project Management, An Empirical Study (Sultana (2019).	Social, technical, economic constraints	The primary objective should be to supervise and regulate the constraints within the construction project's working environment to achieve a productive and efficient construction project setting.	The research was expansive. The project encompassed several types of construction activities.	Investigation of social and technical constraints in residential construction project efficiency in Nairobi County

Author	Focus of Study	Research Variables	Research Finding	Type of Research Gaps	Focus of the current Study
Jadhav et al., (2020)	An examination of the elements that contribute to cost overruns in residential building construction projects(Jadhav et al., 2020).	Technical, economic constraints	The majority of projects experience delays as a result of expense overruns.	The only component of performance they focused on was the incidence of cost overruns. Moreover, the investigation mostly focused on India's geography.	Study of technical and economic constraints affecting cost and schedule performance in Nairobi County residential projects
Chin Foo, L. (2021)	Management factors affecting time and cost performance of construction projects (Chin Foo, L. 2021)	Technical, economic constraints	The main determinant of inadequate performance was identified as a blend of economic and technical limitations.	Their primary objective was to examine the variables that influence the efficiency and financial elements of construction projects. Consequently, other dimensions of performance were not explored.	Analysis of economic and technical constraints and their effect on residential project performance in Nairobi County
Talib & Kashkol (2019)	Theory of Constraints in Construction Projects (Talib & Kashkol 2019).	Legal, technical, economic, environmental, social constraints	The theory of constraints is most effectively employed to identify and address constraints by adopting specific modes of thinking.	The primary emphasis was on all types of construction projects situated in Iraq, so resulting in constraints that are specifically relevant to Iraq market.	Assessment of all constraint types on residential construction project performance in Nairobi County

2.4 Conceptual Framework

An in-depth understanding of the constraints and prospective effects to construction projects can be fostered through the conceptual framework.

The performance of the construction project (dependent variable) is influenced by the independent variable, which are the constraints (economic, legal, social, technical, and

environmental constraints), if they are not minimized. The conceptual framework guided the research as illustrated in Figure 2.1.

Conceptual Framework
Independent Variables

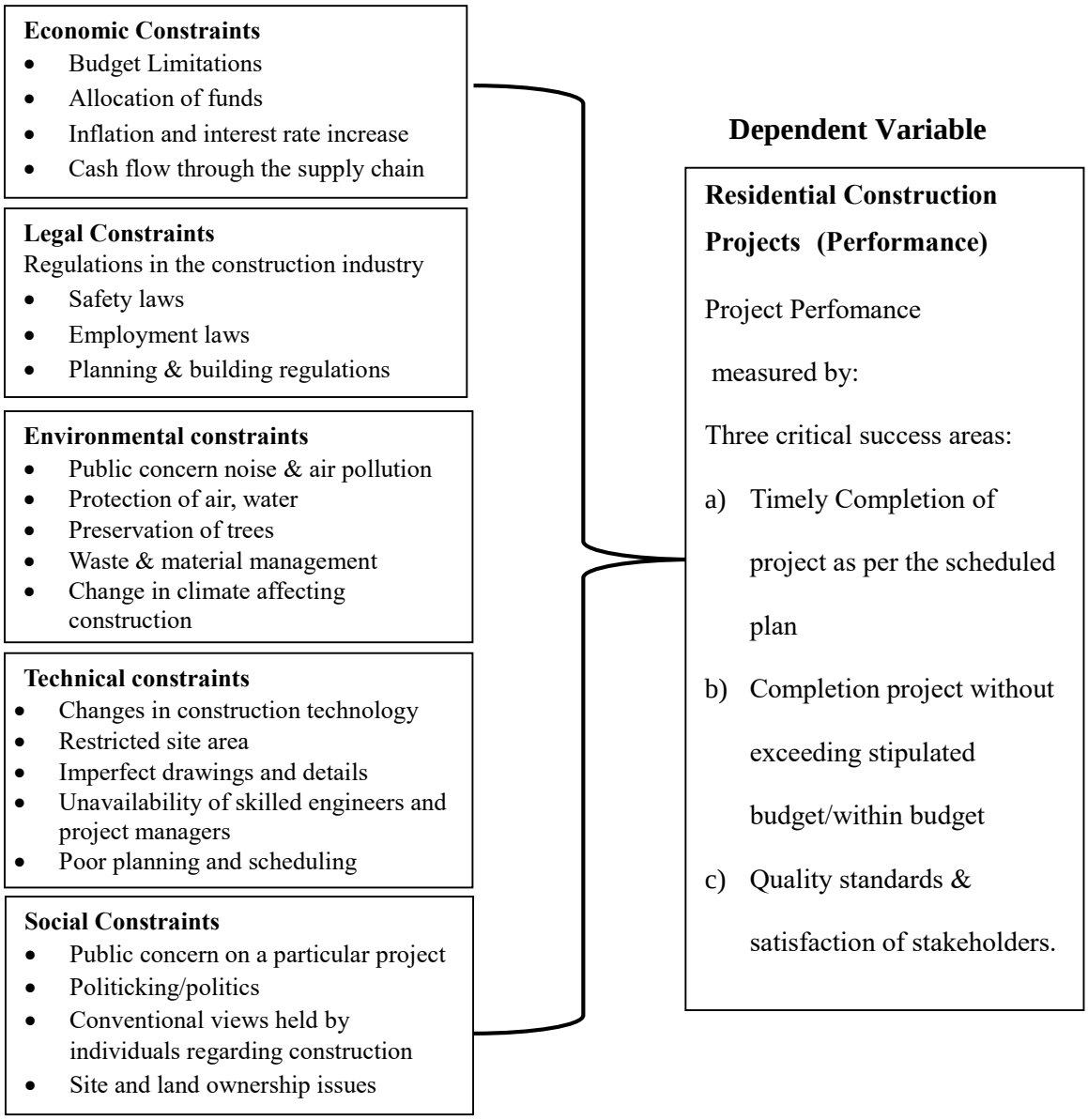

Figure 2.2: **Conceptual Framework**

Source: Researcher (2023

CHAPTER THREE

RESEARCH DESIGN AND METHODOLOGY

3.1 Introduction

The researcher used a variety of methods to conduct the study, which are detailed in this chapter. Ethical issues, research tools, data gathering, and analysis, population, sampling, and sample size are among the topics covered.

3.2 Research Design

This study employed a descriptive-correlational research design, which facilitated both a detailed portrayal of residential construction project performance and an examination of the relationships between project limitations and performance outcomes. Descriptive research provides an accurate depiction of phenomena as they naturally occur, without manipulating variables, making it particularly appropriate for real-world construction projects where experimental control is impractical (Mishra, 2022).

The correlational component enables the identification and quantification of associations between well-managed and poorly managed project constraints and project performance indicators, offering insights into the strength and direction of these relationships (Pubrica, 2023). By integrating descriptive and correlational approaches, the study ensures a comprehensive understanding of the current context while supporting rigorous statistical analysis, thereby providing a solid methodological foundation for evaluating residential construction projects in Nairobi County (Consortia Academia, 2022).

3.3 Target Population

The target population for this study comprised project managers in the construction industry with experience overseeing residential building projects in Nairobi County.

According to Kombo and Tramp (2006), the target population consists of individuals selected to participate because they are essential to achieving the study's objectives. Project managers were considered ideal respondents because they are involved in all stages of a project—from planning and design to execution and completion—and are responsible for critical aspects such as schedules, budgets, resource allocation, and stakeholder communication. In this study, each project manager represented the specific residential project they were in charge of, ensuring that the data reflected actual project experiences and outcomes.

The professional bodies ICPMK and AAK report a total of 334 registered construction project managers in Kenya, overseeing various construction projects.

Table 3.1: Target Population

Construction from Project Managers who are members in:	**Target Population**	**Sample**	**Actual Respondents**
AAK (Architectural Association of Kenya)	205	47	42
ICPMK (Institute of Construction Project Managers)	129	30	23
Total	**334**	**77**	**65**

3.4 Sampling Design and Sample Size

The researcher utilized stratified sampling, a probability sampling technique, to obtain respondents for the investigation. According to Ben-Shomo et al. (2013), stratified sampling involves dividing the population into distinct subgroups or strata based on specific characteristics and then selecting samples proportionally from each stratum. This approach ensures that all key subgroups are adequately represented in the study, increasing the precision and reliability of the results. Stratified sampling is both systematic and efficient, allowing researchers to gather representative data that might otherwise be skewed if only a simple random or convenience sample were used. To

further ensure fairness and minimize bias in this sampling technique, questionnaires were disseminated both online and in physical form at distinct time intervals (Nikolopoulou, 2023).

The study involved 77 respondents selected based on a calculated target population of 334, with a 90% confidence level and a 0.1 margin of error, using the Yamane formula. Yamane formula $n = N / [1 + N (e)^2]$ was used to determine sample size (Yamane, 1967). In this context, the variable "n" represents the sample size, "N" is the population size, and "e" signifies the level of precision. A precision level of 10% is necessary for this task. When utilizing this formula, the resulting sample size for the respondents of the residential construction projects was 77.

$n = N / [1 + N (e)^2]$ $334/[1+334(0.1)^2]$ $n = 77$

Table 3.2: Sample Size

Target Population Construction Project Managers members in:	**Respondents**	**Percentage**	**Sample**
AAK (Architectural Association of Kenya)	205	61%	47
ICPMK (Institute of Construction Project Managers)	129	39%	30
Total	**334**	**100%**	**77**

3.5 Data Collection Procedures

The research project utilised both online and physical questionnaires for data gathering. The acquisition of primary data required the involvement of construction project managers overseeing residential construction projects. The data-collecting procedure involved directly obtaining information from the respondents using both physical and online questionnaires, depending on the respondents' personal preferences. An extensive questionnaire with three parts was be used by the researcher. The first part asked for basic respondent information; the subsequent section concentrated on the present condition of residential construction projects; and the third part assessed how

much of an impact constraints have had on the projects. To facilitate the research process, the researcher acquired requisite authorisation from Kenyatta Unversity and NACOSTI.

3.6 Research Instruments

To gather information from the individuals, the researcher used self-administered questionnaires encompassing open-ended and closed-ended questions. Independent questionnaires can be disseminated digitally or in print, either through direct interaction or via mail delivery. Standardizing questions helps to guarantee that every respondent will answer the same questions (Bhandari, 2023).

The selection of a questionnaire as a research tool was motivated by the significant reliability of the collected information. This resource provides detailed information regarding specific cases of interest, offering a time-efficient and comprehensive approach by pre-formulating inquiries. The questionnaire that was used in this study is presented in Appendix II.

3.7 Pilot Study

A pilot study was conducted in Nairobi County, Kenya, to ensure the viability, reliability, and overall quality of the main research (In, 2017). Conducting a pilot study allows the researcher to test and refine research instruments, such as questionnaires, before they are applied in the full-scale study, thereby enhancing methodological soundness and the efficiency of data collection. Unlike the main study, the pilot study is smaller in scale and serves as a preliminary trial aimed at identifying potential challenges, ambiguities, or limitations in the research design.

In this study, the pilot involved seven construction project managers based in Nairobi County who provided feedback on the clarity, relevance, and comprehensiveness of the

questionnaire items. This feedback enabled the researcher to make necessary adjustments, such as rewording unclear questions or modifying response options, ensuring that the final instrument accurately captured the intended data. Conducting the pilot study also helped verify that the questionnaire was practical and understandable for the target population, reducing the likelihood of errors or misinterpretations in the main study. Importantly, the data collected during the pilot was excluded from the main study to maintain the integrity and independence of the final dataset.

3.7.1 Validity of Research Instruments

Validity refers to the criteria used to evaluate the quality and accuracy of research measurements. As noted by Middleton (2023), validity concerns the extent to which a measurement reflects what it is intended to measure. Similarly, Cohen et al. (2017) define validity as the degree to which a research instrument accurately captures the data it is designed to collect.

To ensure validity in this study, the researcher applied several strategies. First, a critical and questioning approach was maintained when reviewing responses from construction project managers. This involved cross-checking the information provided to detect inconsistencies or potential bias, given that respondents may sometimes provide misleading or incomplete answers due to various circumstances.

In addition, content validity was employed to assess whether the research instruments adequately covered all relevant aspects of the concepts under investigation. This process involved comparing the questionnaire to instruments used by other scholars in previously published studies, ensuring that all essential dimensions of the topic were incorporated and that the tool was comprehensive and aligned with established academic standards.

3.7.2 Reliability of the Research Instrument

Reliability, as Middleton (2023) explains, relates to the degree of consistency in measurement. It is the capability of a research instrument to consistently generate identical results when the same instrument is applied in similar conditions. Interrater reliability assesses consistency across respondents by determining if similar outcomes are obtained when various individuals are exposed to the same measurement, and this tests reliability. According to Noble & Smith (2015), a coefficient equal to or greater than 0.7 is the recommended threshold. Since it ensures the validity and dependability of the research tool, the coefficient of 0.87 in this study was judged to be appropriate.

Table 3.3: Reliability Test Results

Variable	Alpha Value	Remarks
Economic Constraints	0.925	Reliable
Legal Constraints	0.898	Reliable
Environmental Constraints	0.913	Reliable
Technical Constraints	0.819	Reliable
Social Constraints	0.836	Reliable
Aggregate Score	**0.878**	**Reliable**

Source: Pilot Study (2024)

$$Y=\beta0+\beta1EC+\beta2LC+\beta3ENC+\beta4TC+\beta5SC+\varepsilon$$

Aggregate Scor e = β0 + β1 (Economic Constraints) +β2 (Legal Constraints) + β3 (Environmental Constraints) +β4(Technical Constraints) +β5(Social Constraints) +ε

Where:

- **Y** = Aggregate Score (dependent variable)
- **EC** = Economic Constraints
- **LC** = Legal Constraints
- **ENC** = Environmental Constraints
- **TC** = Technical Constraints
- **SC** = Social Constraints
- **β_0** = Intercept

- $\beta_1 \ldots \beta_5$ = Regression coefficients
- ε = Error term

3.9 Data Analysis and Presentation

After examining the responses from the questionnaire data, the researcher arrived at conclusions and developed a hypothesis. To verify their completeness, the questionnaires were compiled and cross-verified. Using quantitative approaches, the data analysis process quantified numerical values and produced descriptive statistics including the mean, median, and standard deviation. The data was methodically arranged and categorized as either continuous or discrete variables.

Data coding and analysis was conducted using SPSS version 23. The summarised data was presented using tables, graphs, and charts. This study utilised the correlation coefficient to evaluate the data and ascertain the extent and direction of the link between variables. The statistical metric is suitable for examining the relationship between project limitations and the effectiveness of projects for residential construction in Nairobi (Bhandari, 2023).

3.10 Ethical Considerations

Ethical considerations, according to Bhandari (2023), are guiding principles that shape and direct the procedures and designs of research. While conducting interviews to obtain data from individuals researchers to go by a set of guidelines. Research ethics calls for consideration of participants' rights, the validity and trustworthiness of study findings, and adherence to academic honesty among other factors. A permit from NACOSTI abbreviation for (National Commission for Science, Technology & Innovation Headquarters) was obtained, and to secure participant anonymity, their names were omitted from the questionnaires in order to comply with ethical research guidelines. There was no instance of coercion in the study, and participation was

entirely voluntary. Only responders who explicitly agreed to participate were given questionnaires.

CHAPTER FOUR

RESEARCH FINDINGS AND DISCUSSIONS

4.1 Introduction

This section analyses data and presents conclusions regarding the interaction between several project constraints and the execution of residential construction projects in Nairobi County, Kenya. The investigation's precise aims were to ascertain the impact of legal, economic, environmental, social, and technological constraints on residential construction projects. The analysis encompassed the research results, beginning with the response rate, demographic details of the respondents, correlation findings, and data interpretation. The gathered data was encoded and input into SPSS, an acronym for Statistical Package for Social Sciences, to produce the necessary statistical parameters for analysis. The data was examined employing statistical methods that were descriptive and presented as occurrence tables, accompanied by clear descriptions to explain and summarise the study's conclusions.

4.2 Response Rate

77 construction project managers selected from The Architectural Association of Kenya (AAK) and the Institute of Construction Project Managers (ICPMK) was the focused sample for this study. Online questionnaires were distributed to these construction project managers. Out of the questionnaires that were sent out, 73 were returned. Incomplete/incorrect data from 8 questionnaires rendered them unsuitable for inclusion in the study. 65 participants completed their questionnaires correctly, which was deemed to be the acceptable response rate and this formed a response rate of 85%. Taherdoost (2019) sets a response rate of 75% as the suitable threshold for social science study, upon which analysis can be conducted. The response rate for the research study was considered excellent based on the aforementioned assertion.

Table 4.1: Response Rate

Response	No.	Pct. %
Responded Complete Forms	65	85%
Responded Incomplete Forms	8	10%
Non Responded	4	5%
Total	**77**	**100%**

4.3 General Information on Respondents

4.3.1 Gender

The research intended to decide the gender of the participants. The results are illustrated in the figure below;

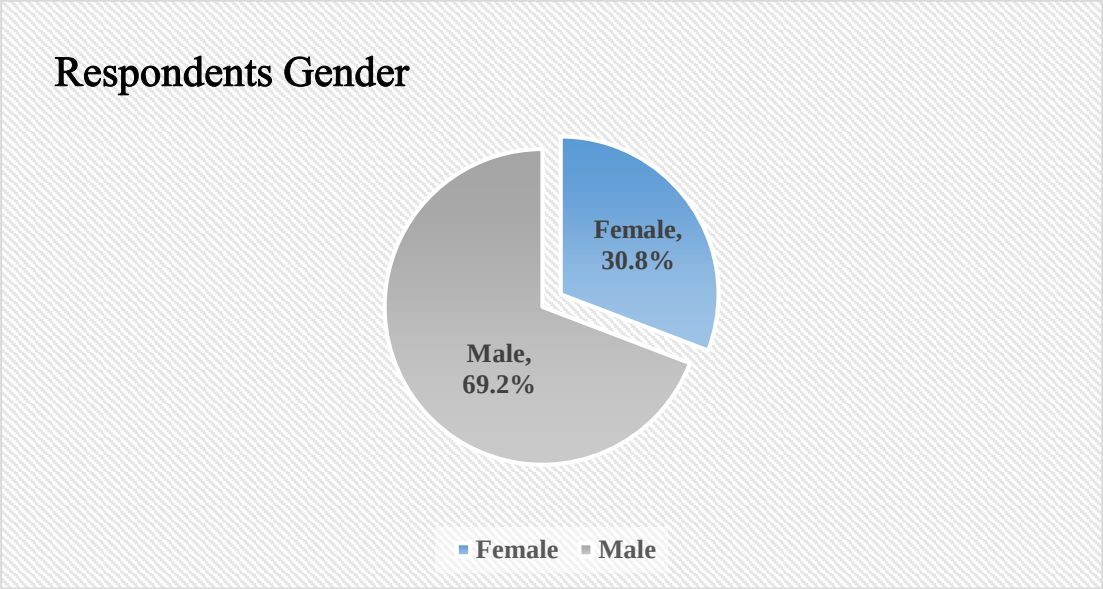

Figure 4.1: Respondents Gender

The outcomes of the research revealed that most of the respondents reached at the time of the study were male as shown by 69.2%, while the female rate was 30.8%. This strongly suggests that the predominant workforce in construction projects within Nairobi County is male.

4.3.2 Construction Project Professional Membership Body

The research project aimed to identify the professional membership body of the construction project managers. The outcomes of the research are put forward in figure 4.2.

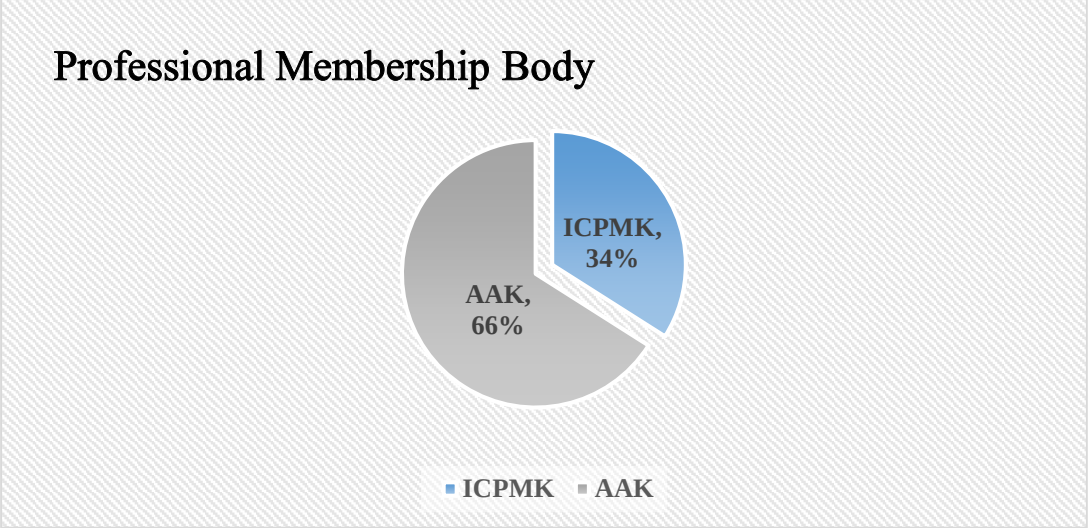

Figure 4.2: Professional Membership Body

The outcome of the research showed that the majority of the participants to the research indicated that they were members of the AAK (Architectural Association of Kenya) as shown by 66%. From the findings, 34% of the respondents were members of ICPMK (Institute of Construction Project Managers).

4.3.3 Years of Experience in Construction Project Management

The research study targeted to establish the duration of years that the participants had been engaged in construction projects. A significant portion of the respondents, specifically 34%, possessed over 7 years of experience in the realm of construction project management. Closely followed by construction Project Managers with over 5 - 7 years of experience at 32%, 25% had 3 - 5 years of experience, while 9% of the respondents had 1 - 3 years of experience.

The study outcomes are exhibited in table 4.2;

Table 4.2: Years of Experience

No. of Years of Experience	No.	Pct. %
1 - 3 Years of Experience	6	9%
3 - 5 Years of Experience	16	25%
5 - 7 Years of Experience	21	32%
Above 7 Years of Experience	22	34%
Total	**65**	**100%**

4.3.4 Number of Residential Construction Projects Managed to Completion

Table 4.3 presents a detailed analysis of the frequency of residential construction projects that have been successfully completed. The results of the research illustrate that a majority of the participants indicated that they had completed 10 - 20 residential construction projects as shown by 63%. 17% of the respondents had completed 1 – 10 residential construction projects, 12% of the respondents indicated that they had completed 20 - 30 residential construction projects. 8% of the respondents indicated that they had completed above 30 residential construction projects. This serves as a definitive indication that most of the construction project managers had gained adequate experience in management of residential construction projects.

Table 4.3: Number of Projects

Number of Projects	No.	Pct. %
1 - 10 Residential Construction Projects	11	17%
10 - 20 Residential Construction Projects	41	63%
20 - 30 Residential Construction Projects	8	12%
Above 30 Residential Construction Projects	5	8%
Total	**65**	**100%**

4.4 Performance of Residential Construction Projects

Establishing the efficacy of residential construction projects in Nairobi County in relation to projects timelines, budget and quality of completed projects was the main aim of this section.

4.4.1 Status of the Most Recent Residential Construction Project

The researcher intended to ascertain the current status of the latest residential construction projects undertaken by the construction project managers interviewed in Nairobi County. The outcomes were outlined in the table 4.4;

Table 4.4 Status of Residential Construction Project

Status	No.	Pct. %
Complete	14	22%
In progress	36	55%
On hold	15	23%
Total	**65**	**100%**

The outcomes of the study showed that a majority of the study participants as shown by 55% indicated that their residential construction projects were still in progress. Additionally, 22% of the respondents reported that their projects were completed, whilst 23% reported that their projects were either on hold or abandoned. These findings imply that a good number of construction projects are in progress and are yet to be completed; however, there is a notable portion of projects is either paused or discontinued.

4.4.2 Timeline for the Most Recent Residential Construction Project Initiation

The investigation aimed to determine from the participants the initiation dates of their most recent projects. The study presented the outcomes of the timeline in table 4.5;

Table 4.5: Timelines for Projects Initiation

Timelines	No.	Pct. %
Before 2000	0	0
Between 2000 – 2010	5	8%
Between 2010 – 2020	18	28%
After 2020	42	65%
Total	**65**	**100%**

From the research results, it is evident that most of those interviewed denoted by a rate of 65% initiated the construction projects after year 2020. A smaller percentage 28% reported projects initiated between the years 2010 and 2020, while 8% noted that their most recent projects began between 2000 and 2010. None of the respondents had their most recent construction project before year 2000. These findings suggest that there has been a significant increase in construction activity post - 2020, because of new

developments, changing economic conditions, or policy reforms driving recent residential construction projects.

4.4.3 Description of Timelines for the Complete Projects

From the data on status of the most recent residential construction project, 14 indicated that the residential construction projects were complete. The researcher intended to establish the timelines for projects that had already been completed, and hence; requested the participants to provide reliable descriptions concerning the projects that they were complete. The evidence is presented in table 4.6;

Table 4.6: Timelines for Complete Projects

Timelines	No.	Pct. %
Residential construction project was completed within timeline	3	21%
Timeline for residential construction project was exceeded	10	71%
Residential construction project was completed before the expected timeline	1	8%
Total	**14**	**100%**

The conclusions of the research demonstrated that most of the participants pointed to the fact that timelines for residential construction projects were exceeded as shown by 71%. Additionally, 21% of the participants indicated that residential construction projects were completed within the timeline, while 8% of those surveyed indicated that residential construction projects were completed before the expected timeline. This implied that most residential projects in Nairobi County often take longer than the estimated periods to be completed, while there are notable projects that are still completed within the required timelines. Negligible projects are completed ahead of the expected timelines.

4.4.4 Description of Timelines for the Projects in Progress

According to the statistics regarding the status of the most recent residential construction projects, 36 construction project managers reported that the residential construction projects were still in progress. This represented the state of the greatest number of projects.

The study requested the respondents to provide descriptions regarding timelines for the projects that were reportedly in progress. For this particular performance metric, the options were only two that is whether the project was within timeline or exceeded unlike for completed projects whose timeline can be ascertained since the project is complete. The information gained is conveyed in table 4.7

Table 4.7: Timelines for Projects in Progress

Timelines	No.	Pct. %
Residential Construction project is still within the timeline	11	31%
Timeline for residential construction project was exceeded	25	69%
Total	**36**	**100%**

The result of the research demonstrated that 69% of the interviewed indicated that timeline for residential construction project was already exceeded even though the projects were still in progress, while 31% reported that their projects were still within the planned timeline. This suggests that a significant proportion of projects in Nairobi County experience delays, attributed to various technical, legal, economic, social or environmental constraints.

4.4.5 Description of Timelines for the Projects on Hold

Based on the statistics regarding the status of the most recent residential construction projects, 15 construction project managers reported that the residential construction projects were on hold/abandoned.

The study sort to find out the timelines for residential construction projects that were on hold. The information is displayed in table 4.8;

Table 4.8: Timelines for the Projects on Hold

Timelines	No.	Pct. %
Residential Construction project was still within the timeline	3	20%
Timeline for the residential construction project was exceeded	12	80%
Total	**15**	**100%**

The study results demonstrated that only 20% of those surveyed whose projects were on hold or abandoned reported that their residential construction projects were still within the planned timeline. However, the majority, 80%, stated that their projects had exceeded the timeline. This indicates that delays significantly contribute to projects being halted or abandoned, alongside setbacks in construction resulting from project constraints.

4.4.6 Description of Budget for the Complete Projects

Based on findings on the current status of the most recent construction project 14 residential construction projects were found to be complete. The research solicited the participants to furnish descriptions relating to the budget of residential projects that were complete. The insights are outlined in the table 4.9;

Table 4.9: Budget for the Complete Projects

Budget Description	No.	Pct. %
Budget for the residential construction project was exceeded/overspent	10	71%
Budget for the residential construction project was sub seeded/underspent	1	8%
Budget for the residential construction project was within/on (neither overspent)	3	21%
Total	**14**	**100%**

The outcome of the study clearly pointed to a substantial number of the respondents as shown by 71% indicated that the budget for their residential construction project was exceeded or overspent. 21% of the participants reported that the project budget was

within or on target, while only 8% stated that their project was underspent. These findings imply that most of the completed projects experienced overruns, which is a common challenge in residential construction projects, potentially due to unexpected costs or poor budget forecasting.

The results correlate with those of Ingle & Mahesh (2022) in their research on identifying the critical performance areas affecting the Indian construction industry. Construction projects typically experience extended timelines, when the initial project schedule established during planning is surpassed, corresponding with the current study.

4.4.7 Description of Budget for Projects in Progress

According to the data regarding the status of residential construction projects, 36 projects were identified as still in progress. The research was designed to ascertain the views of the study participants concerning the budget for projects in progress. The findings are presented below;

Table 4.10: Budget for the Projects in Progress

Budget Description	No.	Pct. %
Budget for the residential construction project has been exceeded/overspent	23	64%
Budget for residential construction project is underspent/sub seeded	5	14%
Residential Construction project is still within/on budget	8	22%
Total	**36**	**100%**

The results reveal that a considerable majority, 64%, of those who responded indicated that the budget allocated for their residential construction project had been surpassed or exceeded. Additionally, 22% mentioned that their projects are still within budget, while only 14% stated that their projects were underspent. This suggests that budget management is a considerable challenge for most residential construction projects, with overspending being the most prevalent issue.

4.4.8 Description of Budget for Projects on Hold

Given the data regarding the status of residential construction projects, 15 projects were found to be on hold. The investigation sought to determine the respondents' perspectives regarding the budget for suspended projects. The outcomes are disclosed in table 4.11;

Table 4.11: Budget for the Projects on Hold

Budget Description	No.	Pct. %
Budget for the residential construction project was exceeded/overspent	12	80%
Budget for the residential construction project was sub seeded/underspent	1	7%
Budget for the residential construction project was within/on (neither overspent /underspent	2	13%
Total	**15**	**100%**

From the outcomes of the study, it was evident that many of the respondents as shown by 80%, and whose projects were on hold or abandoned indicated that the budget for their residential construction project were exceeded or overspent. 7% reported that the budget was sub seeded or underspent, and another 13% stated that their project remained within or on budget. These findings imply that for projects that are on hold or abandoned, exceeded budget was the main cause of stalling the project and this could be due to emerging constraints in incomplete project execution.

This analysis indicates that most construction project budgets are surpassed, corroborating the conclusions of Masoetsa et al. (2022). Their research on the impact of construction constraints on project performance in the construction sector revealed that economic constraints correlate with resource allocation and financial limitations within a project. The existence of constraints of any sort resulted in cost overruns that affected the budgeted plan.

4.4.9 Description of Quality of Complete Projects

The quality of a project is most accurately assessed upon its completion, at which point stakeholder feedback can be obtained, and results may be evaluated against the initial plan. Based on data gathered on status of the most recent residential projects 14 were found to be complete. The research sought to assess the respondents' evaluations of the quality of completed projects. The results are detailed in table 4.12.

Table 4.12: Description of Quality

Quality	No.	Pct. %
Satisfied with the quality of the residential construction project	4	29%
Not satisfied with the quality of the residential construction project	10	71%
Total	**14**	**100%**

The outcomes of the examination revealed that a significant portion of the participants at 29% indicated their satisfaction with the quality of their residential construction projects, while 71% expressed dissatisfaction. This suggests that most of the individuals involved felt the quality did not meet their expectations, although a notable minority were content with the projects' outcomes.

Ullah et al. (2017) assert that quality standards and scope specification are crucial functions in the construction process, guiding the project manager in planning the execution of the construction activities. Success of the project is contingent upon the fulfilment of quality standards and scope parameters. Romzi and Shu Ing (2022) in their study titled "Key Constraints in the Construction Industry," discovered that the condition of building projects was negatively impacted by the existence of restrictions, similar to findings in the conducted study.

4.5 Constraints Level of Impact on Residential Construction Projects

This section sought to establish the level of impact of constraints on the performance of residential construction projects in Nairobi County. The statistics will include mean and standard deviation.

4.5.1 Economic Constraints

The study sought to determine the degree to which economic limitations affect the performance of residential construction projects. The participants were requested to indicate their degree of agreement with statements addressing the impact of economic constraints on the implementation of residential construction projects in Nairobi County.

Using the Likert scale 4 – extremely impactful, 3 - impactful, 2 - least impactful, 1 – did not impact the project. The outcomes are displayed in table 4.13;

Table 4.13: Economic Constraints

Description	N	Mean	Std. Dev.
Difficulties in obtaining loans from banks and financial institution	65	3.862	0.348
Improper allocation of resources to various activities	65	3.631	0.651
Inflation and Interest rate increase	65	3.846	0.364
Limited resources / Budget limits/Cash flow challenges	65	3.723	0.451
Inappropriate project cost estimation	65	3.677	0.533
Average		**3.748**	**0.469**

The mean score averaged at 3.748, suggesting that respondents predominantly concurred on the significant influence of economic constraints on the performance of residential construction projects. With a standard deviation of 0.497, responses showed very little fluctuation, implying a consensus and little difference of opinion.

Given a mean score of 3.862 (Std Dev = 0.348), the research results revealed that one of the most major limitations among those who participated was experiencing difficulties getting loans from banks and financial institutions. Furthermore, inflation

and interest rates represented a notable limitation, with a mean of 3.846 (Std Dev = 0.364). Participants additionally observed that constraints related to resources, budgetary limitations, and cash flow difficulties presented a significant challenge, with a mean of 3.723 (Std Dev = 0.451). With a mean of 3.677 (Standard Deviation = 0.533), the deemed inaccurate estimate of project expenses was clearly seen to have a major influence. A mean of 3.631 (Std Dev = 0.651) shows that, although having the least influence, the misallocation of resources to various activities is nonetheless a limitation.

The results of this study line up with those of Chin Foo, L. (2021) on " Management factors affecting time and cost performance of construction projects," which found that performance of construction projects depends critically on economic constraints. Romzi and Shu Ing (2022) evaluated major construction industry constraints and noted that economic constraints seriously hinder the performance of construction projects. The outcomes of their study coincide with this research, indicating that economic constraints significantly affect the performance of construction projects.

The study also required the respondents to state any other economic constraints encountered in the construction project that have impact on the residential construction projects. The response to this was optional and the question was open-ended meaning varied answers were expected. The conclusions of the research are laid out in table 4.14;

Table 4.14: Additional Economic Constraints

Economic Constraints	Level of Impact
Cost escalation in building materials resulting in increased project expenditures.	Impactful
To stay abreast of the constantly evolving sustainable building methods, extra funds are necessary.	Impactful
Currency depreciation against the dollar leading to increased material costs and overall increased project costs	Impactful
Theft of resources on the premises will result in exceeding the budget and causing delays, as the process of replacing the materials is time-consuming.	Extremely Impactful
Deterioration of the project owner's economic condition may impede project advancement, resulting in project delays.	Extremely Impactful
Advancements in construction technology necessitating specialized knowledge with potentially higher costs to hire.	Extremely Impactful
Heightened pressure from project owners to expedite project completion will necessitate extra expenditures.	Extremely Impactful
The construction industry is under more pressure than ever to follow new environmental laws and regulations, which drives higher costs.	Impactful
Projects have been suspended due to non-compliance with regulations controlling the residential construction industry, consequently delaying their progress.	Impactful

Based on the data shown in both table 4.13 and table 4.14, the participants agreed that economic constraints were significant and greatly affect the effectiveness of residential construction projects. It was found that the influence of financial constraints on the success of residential development projects proved to be extremely impactful.

4.5.2 Legal Constraints

The study sought to ascertain how much legal constraints influence the successful execution of residential construction projects. The participants were asked to indicate their degree of agreement on how legal constraints affect the execution of residential construction projects in Nairobi County. Using the Likert scale 4 – extremely impactful, 3 - impactful, 2 - least impactful, 1 – did not impact the project. The outcome results are laid out in Table 4.15.

Table 4.15: Legal Constraints

Description	N	Mean	Std. Dev.
Safety regulations relating to construction projects	65	3.815	0.391
Work/Labour Laws (of the current government)	65	3.385	0.490
Construction permits (Drawings/Designs)	65	3.708	0.551
Land acquisition regulations	65	3.123	0.748
Disputes related to contractual documents	65	3.246	0.919
Average		**3.455**	**0.620**

With an average score of 3.455, respondents mostly agreed on the major impact of legal constraints on the implementation of residential construction projects. Having a minimum variance of 0.620, their responses show little change, suggesting a strong agreement in views. A combination of a mean score of 3.815 and (Std Dev = 0.391), the results of the survey showed that a good number of the respondents named safety rules related to building projects as one of the most important limitations. A mean value of 3.708 and a standard deviation of 0.551, the issuing of building permits which include drawings and designs—also proved to be a clear constraint. With a mean score of 3.385 (Standard Deviation = 0. 490), participants also noted that the incumbent government's current work and labour policies clearly limited them. Conflicts about contractual papers were also considered as a major constraint, with a mean of 3.246 and (Std Dev = 0.919). Given a mean of 3.123 (Std Dev = 0.748), land acquisition rules were ultimately identified as a constraint with minimal but noticeable impact.

The study conducted by Bhavsar and Solanki (2020) on identifying restrictions in construction projects demonstrated that legislation significantly affects project performance. The allocation of both time and financial resources is essential for adherence to all legal requirements. Consequently, the results reported in this investigation are congruent with the research by Ochieng and Kiarie (2021) in their recent study that legal constraints greatly influenced the operation of residential projects in Kitengela-Kajiado County, Kenya.

The research additionally required the respondents to state any other legal constraints encountered in the construction project that have impact on the residential construction projects. The response to this was optional and the question was open-ended meaning varied answers were expected. Table 4.16 lists the results of the study.

Table 4.16: Additional Legal Constraints

Legal Constraints	Level of Impact
The long procedure of permit approval delays the project.	Impactful
Delays in project approvals increase the compliance cost.	Extremely Impactful
Prevalent corruption in the permit approval process that leads to cost overruns.	Extremely Impactful
Dynamic shifts in the legal landscape necessitating rigorous compliance due to the emergence of new construction regulations can result in delays and eventual cost overruns to achieve complete compliance. It is therefore important to have an allowance in your plans to ensure that such changes do not impact the project greatly.	Impactful
Successfully negotiating with several regulatory authorities and acquiring required permits can be a laborious and expensive process.	Extremely Impactful
Inconsistent implementation of regulations results in an unequal competitive environment, where certain enterprises may circumvent specific rules while others shoulder the whole burden of compliance expenses.	Impactful
Implementing new building management systems to enhance energy efficiency, embrace natural ventilation, adopt renewable energy systems, and incorporate water-saving measures like grey water systems and rainwater tanks can significantly increase the total project expenses.	Impactful
The acquisition of building permits can be challenging and could potentially impede the advancement of a project.	Impactful

The participants agreed that legal constraints were considerable and had a profound effect on the efficacy of residential construction projects, as demonstrated by the results presented in both table 4.15 and table 4.16. The influence of legal constraints on the efficacy of residential construction projects has demonstrated significant ramifications.

4.5.3 Technical Constraints

The research aimed to evaluate the influence of technical constraints on the efficacy of residential construction projects. Participants were requested to indicate their level of agreement concerning the influence of technical constraints on the efficacy of residential construction projects in Nairobi County.

Using the Likert scale 4 – extremely impactful, 3 - impactful, 2 – least impactful, 1 – did not impact the project. The findings are illustrated in table 4.17;

Table 4.17: Technical Constraints

Description	N	Mean	Std. Dev.
Imperfect/ Changes in drawings & details	65	3.662	0.509
Poor planning, coordination & scheduling of work	65	3.415	0.527
Restrictive site area/Congested surroundings	65	3.754	0.434
Inadequate storage & handling areas	65	3.677	0.471
Practicality of building methods & standards	65	2.600	0.746
Average		**3.422**	**0.537**

The mean score averaged at 3.422, suggesting that respondents predominantly concurred on the significant impact of technical constraints on the performance of residential construction projects. The standard deviation of 0.537 indicated that the variations in their responses were minimal.

The conclusions of the study research specify that the limitations imposed by restricted site areas and congested environments were significantly influential, as displayed by a mean score of 3.754 (Standard Deviation = 0.434). Furthermore, the research exposed that a substantial percentage of the participants expressed that insufficient storage and handling areas in the workplace had a profound effect, as evidenced by a mean score of 3.677 (Std Dev=0.471). Moreover, the research revealed that a significant portion of the participants expressed that imperfections or alterations in drawings and details were notably influential, as evidenced by a mean score of 3.662 (Standard Deviation = 0.509). The analysis revealed that inadequate planning, coordination, and scheduling of

work had a significant impact, evidenced by a mean of 3.415 (Standard Deviation= 0.527). In conclusion, the study's results revealed that most respondents perceived the practicality of building methods and standards to be the least significant technical constraint, as evidenced by a mean score of 2.600 (Standard Deviation = 0.746).

The results of this study research align with those of Masoetsa et al. (2022) in their research titled “An Assessment of Construction Constraints on Project Performance in South Africa,” which identified numerous technical constraints, including modifications in drawings and design, insufficient planning and scheduling, and delays in addressing design issues, as significantly affecting the performance of construction projects, consistent with the results presented herein.

The research study additionally necessitated that the respondents articulate any supplementary technical constraints faced during the construction project that may influence the residential construction endeavours. The response to this inquiry was not mandatory, and the question itself was framed in an open-ended manner, thereby allowing for a diverse range of answers. Table 4.18 summarises the results of the study;

Table 4.18: Additional Technical Constraints

Technical Constraints	Level of Impact
Using a green building rating tool to set energy efficiency criteria calls for an extra expense on the project.	Impactful
The assessment of climate resilience in buildings necessitates the requirement of adherence to sophisticated technological building standards, which will be an additional cost to the project.	Impactful
Unreliable supply of building materials causing delays in the project	Extremely Impactful
Inferior construction materials available in the market, challenges in locating suppliers of authentic materials result in project delays and escalated project expenses.	Extremely Impactful
Insufficient availability of essential building materials, such as clinker used in cement manufacturing, resulting in project delays.	Extremely Impactful
Communication shortcomings are responsible for a significant proportion of construction issues. These inadequacies lead to complications such as unrealistic expectations, which in turn cause construction delays and increased cost overruns.	Impactful
The lack of sufficient access to sophisticated machinery, contemporary construction methods, and digital tools impedes both productivity and innovation and may lead to cost overruns and delays.	Impactful
Digital construction tools such as Building Information Modelling (BIM) are still in their early stages of development in Kenya. While these technologies have the potential to greatly improve project planning, execution, and management, their implementation is impeded by the substantial initial investment costs and the requirement for highly trained personnel.	Impactful
A number of project owners have obtained land sited on the periphery of the city, and gaining access to the site or transportation to it can present difficulties that are both expensive and time-consuming. Some areas have imposed restrictions on transportation using trucks, which could potentially impede the progress of construction projects.	Impactful
Dependence on obsolete machinery and labor-intensive manual procedures, resulting in inefficiencies and increased operational expenses.	Impactful
In Nairobi County, the majority of residential land is small and therefore during the construction period the space is limited and material would have to be crammed up on site.	Impactful

As the data in tables 4.17 and 4.18 show, the participants agreed that legal constraints significantly affected the effectiveness of residential construction projects. It was determined that technical constraints significantly affected the success of residential construction projects.

4.5.4 Environmental Constraints

The investigation intended to evaluate the impact of environmental constraints on the efficacy of residential construction initiatives. The research participants were asked to articulate their scale of concurrence regarding the impact of environmental constraints on the performance of residential construction initiatives in Nairobi County.

Using the Likert scale 4 – extremely impactful, 3 - impactful, 2 – least impactful, 1 – did not impact the project. The conclusions are outlined in table 4.19;

Table 4.19: Environmental Constraints

Description	N	Mean	Std. Dev.
Noise pollution/permits	65	2.969	1.131
Water and waste management regulation	65	2.969	0.935
Unforeseen climate changes	65	3.615	0.630
Traffic & transportation challenges	65	2.938	1.059
Energy consumption & carbon emissions	65	2.277	0.905
Average		**2.954**	**0.932**

The mean score averaged at 2.954, indicating that respondents largely agreed that environmental constraints had a notable impact on the performance of residential construction projects, though to a somewhat lesser degree. The standard deviation of 0.932 showed that the responses exhibited minimal variation, although some degree of variability was present.

The study results have revealed that unexpected climate changes have been significantly impactful, as evidenced by a mean of 3.615 (Std Dev=0.630). Furthermore, the research revealed that a significant portion of the participants acknowledged the influence of noise pollution permits and regulations concerning water and waste management, as evidenced by a mean score of 2.969 (Std Dev= 1.131 & 0.935). Moreover, the research discovered that a meaningful portion of the research participants acknowledged the influence of traffic and transportation challenges,

evidenced by a mean score of 2.938 (Standard Deviation = 1.059). With a mean score of 2.277 (Std Dev=0.905), the results of the study ultimately showed that a good number of the respondents thought energy consumption and carbon emissions had little effect. The standard deviation shows that the participants replied to these particular constraints with diverse responses.

The conclusion of this study is coherent with those of Gichamba and Kithinji (2019), who explored how environmental policies affected the effectiveness of building projects in Nairobi County, Kenya. Their research indicated that the effectiveness of construction projects in Nairobi County is substantially affected by water governance and waste management laws. Jadhav and Patil (2020) conducted an investigation to ascertain the influences that lead to cost overruns in residential construction projects in India. The investigation's findings indicated that environmental constraints were a substantial factor contributing to cost overruns, consequently impacting performance.

The study additionally necessitated that respondents articulate any other technical constraints faced during the construction project that may influence residential construction endeavours. The reply to this inquiry was not mandatory, and the question itself was framed in an open-ended manner, thereby inviting a range of diverse responses. The end result of the research project are encapsulated in table 4.20;

Table 4.20: Additional Environmental Constraints

Environmental Constraints	Level of Impact
Recent flooding in Nairobi posed a great challenge as it was not anticipated given the environmental climate that is expected in Nairobi.	Impactful
Recent floods in Nairobi caused a delay to most projects since construction was halted.	Impactful
Some areas in Nairobi have restricted the usage of lorries/heavy construction vehicles and this delays transportation to site area.	Extremely Impactful
Disorganized urban growth and inadequate industrial planning policies have led to significant environmental deterioration and urban waste pollution, which may provoke retaliatory actions from the community and consequently incur extra expenses to satisfy them.	Impactful
Prioritising the use of natural, environmentally friendly building materials, construction methods that reduce environmental harm, responsible waste management, and environmental sustainability by certain project owners may necessitate technical proficiency and ultimately result in higher project expenses.	Impactful
Adoption of sustainable building practices may necessitate additional expenses.	Impactful

The respondents agreed that environmental constraints were considerable and had a major effect on the performance of residential construction projects, as seen by the results in both table 4.19 and table 4.20. The impact of environmental constraints on the effectiveness of residential construction projects was significant, albeit relatively minimal.

4.5.5 Social Constraints

The aim of the research project was to assess how social constraints upset the success of residential building projects. The research participants were invited to rate their level of understanding on how social constraints affect the success of Nairobi County's residential construction projects. Using the Likert scale 4 – extremely impactful, 3 - impactful, 2 - least impactful, 1 – did not impact the project. Table 4.21 displays the findings;

Table 4.21: Social Constraints

Description	N	Mean	Std. Dev.
Ownership issue regarding land and construction site	65	3.385	0.678
Political dynamics within a region	65	3.785	0.414
Conventional views held by individuals	65	2.031	0.809
Community acceptance and cultural sensitivity	65	2.062	0.808
Prior engagement with community stakeholders before undertaking a project.	65	2.015	0.718
Average		**2.655**	**0.685**

With an average score of 2.655, respondents mostly felt that social constraints had little consequence on the outcome of the construction projects. Having a standard deviation of 0.685, their responses' differences were quite minimal.

Combining a mean of 3.785 (Std Dev = 0.414), the consequences of the study revealed that a significant proportion of respondents believed the political climate in a region was one of the most impactful social constraints.

Moreover, with a mean of 3.385 (Std Dev = 0.678), the issue of ownership over land and building sites was considered as a major social constraint. The least impactful social constraints identified by respondents were their own conventional viewpoints, community acceptability, cultural sensitivity, and past interaction with community stakeholders. The performance of Nairobi County, Kenya's residential construction projects was not influenced much by these constraints. The data indicates a mean of 2.031 (Standard Deviation = 0.809), 2.062 (Standard Deviation = 0.808), and 2.015 (Standard Deviation = 0.718) for the three least impactful social constraints, respectively.

Similar to this study, Sagar et al. (2022) investigated the constraints in modest construction projects in India and identified social constraints. The researchers noted that these social constraints appeared as common beliefs individuals held about construction projects. The social restrictions received a poor assessment for their

probability of occurrence and their impact on the overall performance of the overall project. Although important, social constraints had the least influence on the performance of residential construction projects in Nairobi County, Kenya.

The questionnaire required respondents to describe any other social constraints they encountered during the constructing process that could influence efforts residential construction projects. The answer to this question was not required, hence the open-ended nature of the topic invited a spectrum of different responses. Table 4.22 shows the results of the research;

Table 4.22: Additional Social Constraints

Social Constraints	Level of Impact
The project owners could be reluctant to follow all environmental laws and regulations in order to cut costs, therefore creating a destructive social environment.	Impactful
Given Nairobi's status as a metropolitan city, obtaining land is challenging and costly. Consequently, construction project expenses may need to be limited in order to account for the expenses incurred in acquiring the land.	Extremely Impactful
Lawsuits and legal disputes concerning land ownership have the potential to impede the advancement of projects.	Extremely Impactful
Incitement by activists can generate public apprehension even after a project has already begun, resulting in the suspension of project advancement and consequently causing delays in the project.	Extremely Impactful
If members of the social community perceive that their needs are being infringed upon by the ongoing construction, such as noise pollution, oil spillages, or air pollution, they may impede the progress of the building program and cause delays.	Impactful
Political instability in the form of strikes also delays the project progress as there is insecurity during that time	Impactful
Failure to comply with occupational and safety hazards can result in public concern if an incident or accident occurs at the construction site.	Impactful
Inability to comply with safety and environmental obligations can result in public outcry, as it presents a potential danger to the public and may contribute to accidents.	Impactful

The respondents largely concurred that social constraints were significant and had a notable impact on the successful completion of residential construction projects, albeit to a limited degree, as evidenced by the findings presented in both table 4.21 and table

4.22. It was noted that the extra social constraints the respondents pointed out had a significant impact.

4.6 Correlation Analysis

The degree and orientation of the relationship between the independent and dependent variables was assessed using the Pearson Correlation Analysis. P-values used at a significance level of 0.10 helped one to assess the relevance of the association.

The results show (0.925) the correlation coefficient connecting project performance to economic restrictions. This implies a positive correlation. With a p-value of 0.001<0.10, stakeholder management and project performance clearly showed a significant link.

Moreover, the correlation coefficient between project performance and legal constraints came out to be (0.898). This implies a positive relationship. With a p-value of 0.001< 0.10 legal constraints and project performance showed a notable association.

Furthermore, the link between environmental constraints and project performance was 0.913. This suggests a favourable relationship. With a p-value of 0.001<0.10, environmental constraints and project performance showed a clear relationship. Additionally, the correlation coefficient between project performance and technical constraints was 0.819. This suggests a positive correlation. With a p-value of 0.001< 0.10 technical constraints clearly showed a strong link with project performance. The correlation coefficient observed between social constraints within the project and its performance was calculated to be 0.836.This suggests a positive correlation. Project performance and social constraints with a p-value of 0.001 demonstrated a direct relationship.

Sagar et al. (2022), who pointed out under the title "Identification of constraints in small construction projects in India," clearly found that technical, legal, and financial constraints clearly impacted the performance of residential projects. Consistent results of this study, in line with Sagar et al. (2022), reveal that the increase in the number of constraints favourably related with the performance of residential projects, so negatively affecting performance.

Table 4.23: Correlation Results

		Project Performance	Economic Constraint	Legal Constraint	Environmental Constraints	Technical Constraint	Social Constraints
Project Performance	Pearson Correlation	1					
	Sig. (2-tailed)						
	N	65					
Economic Constraint	Pearson Correlation	0.925	1				
	Sig. (2-tailed)	.001					
	N	65					
Legal Constraint	Pearson Correlation	0.898	0.900	1			
	Sig. (2-tailed)	.001	.001	.001			
	N	65	65	65			
Environmental Constraints	Pearson Correlation	0.913	0.896	0.964	1		
	Sig. (2-tailed)	.001	.001	.001	.001		
	N	65	65	65	65		
Technical Constraint	Pearson Correlation	0.819	0.843	0.946	0.941	1	
	Sig. (2-tailed)	.001	.001	.001	.001	.001	
	N	65	65	65	65	65	
Social Constraints	Pearson Correlation	0.836	0.822	0.930	0.962	0.927	1
	Sig. (2-tailed)	.001	.001	.001	.001	.001	.001
	N	65	65	65	65	65	65

4.7 Regression Analysis

Regression analysis is a set of statistical techniques applied to determine the correlation between a dependent variable and one or more independent variables. A comprehensive multiple regression analysis was undertaken to gage the influence of particular project constraints on the success of housing building projects within Nairobi

County, Kenya. The findings of the regression analysis are meticulously presented in table 4.24, 4.25 and 4.26

Table 4.24: Model Summary

Regression Statistics					
Model	**R**	**R Square**	**Adjusted R Square**	**Standard Error**	**Observations**
1	0.955[a]	0.912	0.904	0.186	65

a. Independent Variable – Economic, Legal, Environmental, Technical and Social Constraints
b. Dependent Variable – Residential Construction Project Performance in Nairobi County Kenya

An R-squared value of 0.7 or above is usually considered as suggestive of a strong fit, suggesting that a significant portion of the variance in the performance of residential construction projects in Nairobi County, Kenya, can be clarified by economic, legal, environmental, technical, and social constraints, as Sarstedt et al. (2019) note. Subsequently, an R-squared value of 0.904 indicates that 90.4% of the variability in the dependent variable is explained by the independent variables within the regression model. Consequently, economic, legal, environmental, technical, and social constraints account for 90.4% of the variations in residential construction project performance in Nairobi County. Unexamined variables in this research account for 9.6% of the efficacy of housing development initiatives in Nairobi County.

Bertinetto et al. (2020) elucidate that an analysis of variance serves as a statistical technique utilised for the comparison of means across multiple groups. Finding if the means of these groups reveal statistically significant differences is the main goal.

The general regression model has statistical relevance as shown by an analysis of variance resulting in an F-statistic of 121.55 and a p-value (Significance F) of 9.61519E-30. The independent variables within the model significantly contribute to the overall variation observed in the dependent variable. The research results are delineated in table 4.25.

Table 4.25: Analysis of Variance

ANOVA					
	df	**SS**	**MS**	**F**	**Significance F**
Regression	5	20.9524	4.1904	121.550	9.61519E-30
Residual	59	2.03404	0.0344		
Total	64	22.9865			

The ANOVA table reveals that the regression model is statistically significant and accounts for a substantial percentage of the variation in the dependent variable. This signifies that the economic, legal, environmental, technical, and social constraints employed in the model are adept at predicting the efficacy of residential construction initiatives in Nairobi County.

Table 4.26: Regression Coefficients

	Coefficients	**Standard Error**	**t Stat**	**P-value**
Intercept	-0.4186	0.4422	-0.9467	0.34765947
Economic Constraints	1.2962	0.0672	19.2977	3.86836E-28
Legal Constraints	0.9779	0.0604	16.1928	3.90821E-24
Environmental Constraints	0.6327	0.0357	17.7317	3.53502E-26
Technical Constraints	1.0485	0.0927	11.3112	8.22139E-17
Social Constraints	0.8108	0.0670	12.0944	4.48847E-18

The regression model was as follows:

$$\mathbf{Y}=-0.4186+\ 1.2962\ \mathbf{X_1}\ +\ 0.9779\ \mathbf{X_2}+\ 0.6327\mathbf{X_3}+\ 1.0485\mathbf{X_4}+0.8108\mathbf{X_5}\ +0.128$$

$$\mathbf{Y=\beta_0+\ \beta_1\ X_1\ +\ \beta_2\ X_2+\ \beta_3\ X_3+\ \beta_4\ X_4+\beta_5\ X_5\ +\varepsilon}$$

Where:

Y = Project Performance

β_0 = Intercept

$\beta 1$ = Regression Coefficient relating to X_1

β_2 = Regression Coefficient relating to X_2

β_3 = Regression Coefficient relating to X_3

β_4 = Regression Coefficient relating to X_4

β_5 = Regression Coefficient relating to X_5

X_1 = Economic Constraints

X_2 = Legal Constraints

X_3 = Environmental Constraints

X_4 = Technical Constraints

X_5 = Social Constraints

ε - Error Term

According to Piepho (2019), coefficients represent the anticipated change in the dependent variable associated with a one-unit increase in the corresponding independent variable, assuming all other predictors remain unchanged. The t-statistics evaluates the null hypothesis—that the coefficient is equal to zero. A higher absolute value of the t-statistic indicates a more significant relationship between the success of residential construction projects in Nairobi County, Kenya, and the project constraints. Assuming a null hypothesis is valid, the p-value indicates the likelihood of obtaining a t-statistic either equally or more extreme.

Usually set at 0.05, a lower p-value denotes that the economic, legal, environmental, technical, and social constraints have statistical significance at the selected alpha level. The estimation indicates that the efficacy of residential construction projects in Nairobi County is projected to rise by 1.2962 with a one-unit increase in the economic variable, assuming all other predictors are held constant. The observed increase is of statistical significance, with a p-value of less than 0.0001. Assuming all other predictors are kept constant, the expected change in the dependent variable is 0.9779 with a one-unit rise in the legal variable. With a p-value less than 0.0001, the noted rise is of considerable statistical significance. The forecast indicates that the performance of residential construction projects is expected to rise by 0.6327 with a one-unit increase in the environmental variable, assuming all other predictors are held constant. The observed increase is of considerable statistical significance (p-value < 0.0001). Assuming all other variables are kept constant, a one-unit increment in the technical variable corresponds with an expected increase of 1.0485 in the performance of residential construction projects in Nairobi County. With a p-value of less than 0.0001, the noted rise is of statistical significance. If all other factors hold constant, the performance of residential construction projects is projected to rise by 0.8108 with a one-unit rise in

the social variable. With a p-value of less than 0.0001, the noted rise is of statistical relevance.

This study illustrates that the performance of residential projects shows notable relationships with all economic, legal, environmental, technical, and social constraints. Since all coefficients are positive, it follows that increasing these variables contributes to rise in the dependent variable. Comparing the t-statistics and p-values helps one to evaluate the strength of the associations. The outcomes match those of Bhavsar & Solanki (2020) in their analysis of construction project constraints, which shows that the performance of projects is considerably impacted by project constraints.

CHAPTER FIVE

SUMMARY OF FINDINGS, CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction

The current segment presents a comprehensive overview of the summary of findings for the study, drawn recommendations and conclusions. This section aims to summarize the significant results derived from the research, interpret their implications for performance of residential construction projects, and offer practical guidance according to the research's results.

5.2 Summary of Findings

5.2.1 Performance of Residential Construction Projects

The study's findings concerning the execution of residential construction projects indicated that a significant number of construction activities in Nairobi County remain ongoing. The research revealed a noteworthy equilibrium between the projects that were completed and those that remained on hold or were abandoned, as they exhibited a comparable quantity. The findings suggested that several factors may be affecting the rate of project completion in the county.

Additionally, the outcomes of the research indicated that the majority of construction projects commenced post-2020, with a lesser proportion initiated during the period from 2010 to 2020, while a few were established prior to the years 2000 and 2010. The implications of these findings suggest a notable escalation in construction activity following 2020, attributable to new developments, evolving economic conditions, or policy reforms that are propelling recent residential construction projects.

Further, the conclusions of the academic research revealed that the timelines for residential construction projects were often surpassed, with several being completed

ahead of schedule, while a select few adhered to the anticipated timelines. This suggests majority of housing developments in Nairobi County frequently exceed their anticipated completion periods, although there are distinguished projects that are still finalised within or ahead of the designated timelines. The academic research outcomes indicated that the majority of residential construction projects adhered to the planned timeline, although a minority had surpassed it. This indicates that the majority of residential construction activities in Nairobi County are executed within their anticipated timelines; however, a notable fraction of these projects encounter delays, potentially attributable to a range of technical, legal, or environmental factors.

Moreover, the findings of the study demonstrated that most projects that were on hold or abandoned were still within the planned timeline, while some had had exceeded the timeline. This suggests that delays are a major factor contributing to projects being put on hold or abandoned. From the study finding, it was evident that the budget for most residential construction projects was exceeded or overspent; some were within the set budget, while a few projects was had operated below the set budget. These findings imply that most of the completed projects experienced overruns, which is a common challenge in residential construction projects, potentially due to unexpected costs or poor budget forecasting. Lastly, the results of the study demonstrated that most of the contractors were satisfied with the quality of their residential construction projects, although a few expressed dissatisfaction. This signals that the bulk of the participants felt the quality met their expectations, although a notable minority were not content with the projects' outcomes.

5.3 Project Constraints

The investigator sought to measure the influence of project constraints on the effectiveness of residential construction projects in Nairobi County. The project examined constraints related to economic, environmental, social, technical, and legal factors. The economic constraints observed significantly influenced the performance of residential construction projects in Nairobi County. Legal, technical, and environmental constraints subsequently emerged as significant influencing factors. The influence of social constraints on the performance of residential construction projects was negligible.

5.3.1 Economical Constraints

The research indicated that economic constraints exert a considerable bearing on the successful execution of residential construction projects. The outcomes of the study showed that difficulties in obtaining loans from banks and financial establishments was one of the most impactful constraints. Additionally, inflation and interest rate increase as well as limited resources/ budget limits were noted to be significant constraints, improper allocation of resources to various activities posed great economic challenges on performance of residential construction projects in Nairobi County. In addition, the findings uncovered that inappropriate project cost estimation was identified as an impactful constraint in performance of residential construction projects.

Respondents were also required to state any other constraints identified in the construction process that were significant. Theft of resources on the premises, cost escalation in building materials, and necessity to stay abreast with constantly evolving sustainable building methods were additional constraints given by the respondents. In addition, heightened pressure from project owners to expedite project completion, and pressure to comply with new regulations were also noted as being extremely impactful

to the successful execution of residential construction projects in Nairobi County, Kenya.

5.3.2 Legal Constraints

The studies demonstrate that the effective conclusion of projects is significantly impacted by legal constraints. The outcomes of the research clearly showed that the key challenges on the successful completion of residential construction projects was safety rules related to construction projects. Furthermore, the findings of the study indicated that conflicts pertaining to contractual documents, construction permits, encompassing drawings and designs; land acquisition regulations, as well as work or labor-related matters under the present administration, were significant. The findings underscored the legal and regulatory challenges encountered in residential construction projects.

The conclusions of the research reported that pervasive corruption in the permit approval process, coupled with its cumbersome and expensive nature, were significant constraints identified by respondents, adversely impacting the effective execution of residential construction projects. The research indicated that the lengthy permit approval process was recognised as a major constraint on the efficient completion of residential construction projects. The results indicate an evident impact on residential construction projects of land-related, environmental, and regulatory issues.

5.3.3 Environmental Constraints

According to the findings of the research, constraints on the environment considerably influence the performance of residential construction projects. The study indicates that unexpected climate changes are the most crucial environmental aspect affecting the successful completion of projects. Furthermore, the findings of the study demonstrated that noise pollution, the process of obtaining permits, and the regulations surrounding water and waste management were recognised as critical factors determining the

performance of residential construction projects. The findings indicated that the challenges associated with traffic and transport, alongside energy consumption and carbon emissions, exerted comparable levels of impact.

The results draw attention to significant environmental and site-specific issues that determine the effective completion of residential construction projects greatly. Moreover, participants in the study pointed out some environmental factors that greatly affect the operation of construction initiatives. These comprise limited road access, hazy urban growth, inadequate industrial planning rules, and the inclusion of sustainable building techniques. The performance of residential projects is considerably influenced by the identified environmental constraints.

5.3.4 Technical Constraints

The findings of this study showed that technical constraints have a material impact on the performance of residential construction projects. The study's findings suggested that limited site space and overcrowded settings were the most significant technical limitation affecting the performance of residential construction projects. Furthermore, the findings of the study demonstrated that deficiencies or alterations in drawings and details, along with insufficient storage and handling areas, emerged as notable constraints that significantly influenced the performance of residential construction projects. Moreover, the study's findings indicated that the practicality of building methods and standards emerged as the least significant technical constraint affecting the performance of residential construction projects.

The participants in the study identified several additional technical constraints, specifically: the unreliable supply of building materials, the use of inferior construction materials, and the imperative to incorporate green building materials for enhanced

energy efficiency, all of which are considered significant technical challenges. Furthermore, limited land areas, outdated machinery, and a lack of essential building materials were noted as significant issues. The participants rated the additional technical constraints as crucial to the success of residential construction projects.

5.3.5 Social Constraints

The study found that social constraints have considerable impact on the performance of residential construction projects. The analysis of the data reveals that the political dynamics within a region exerted the most significant influence on the performance of residential construction projects. The findings further illustrated that matters of ownership pertaining to land and construction sites had a considerable consequence on the efficacy of residential construction projects. Furthermore, the findings revealed that traditional perspectives held by individuals, community acceptance, cultural sensitivity, and prior interactions with community stakeholders prior to project inception were the least influential social constraints and had no material result on the effective execution of residential construction projects.

Additionally, participants in the study were charged with providing more constraints encountered during the project process. The following social constraints were identified as having a significant impact: difficulties in acquiring suitable land for construction, legal disputes and lawsuits concerning land ownership, political instability manifested through strikes, and agitation by activists regarding specific projects. The findings indicate that social concerns impacting projects can have a major impact on their successful execution.

5.4 Conclusions of the Study

The study sought to understand the impact of project constraints on the execution of residential construction projects in Nairobi County, Kenya. The study's insights revealed that project restrictions had a noticeable impact on the proper execution of residential construction projects in Nairobi County, Kenya. Many construction project managers interviewed indicated that residential construction projects remain ongoing and have faced various constraints that have affected their performance regarding timeline, budget, and quality. Completed projects had also encountered constraints that led to exceeded budget and timeline and substandard quality upon completion. A significant number of projects remained in a state of suspension, having surpassed both the anticipated timeline and financial allocations due to challenges faced during the construction phase.

Based on the observations economic constraints create instability in project timelines and financial planning, legal constraints contribute to inefficiencies in residential construction projects, environmental constraints lead to project delays and disrupt construction activities, technical constraints result in project delays and suboptimal performance and social constraints to delays as community acceptance and engagement become crucial in determining project progress.

It is clear that to a large extent performance of construction projects was greatly impacted by economic, legal, social, technical and environmental project constraints as seen by the substandard performance.

5.5 Recommendations of the Study

Based on this research's outcomes, multiple suggestions have been proposed; This study recommends that more precise and comprehensive project cost estimation techniques should be adopted during the planning phase to reduce the risk of budget overruns. It is important to guarantee stable cash flow over the project and to find several financing possibilities. Construction companies should also constantly check labour availability and pay adjustments to prevent shortages or unanticipated cost increases compromising project performance. Develop plans to deal with changes in interest rates and inflation.

Early in the project, construction companies should interact with legal professionals to guarantee adherence to land acquisition rules and safety standards. Before start, projects should be carefully examined for zoning permission and environmental compliance to prevent delays. Clear contracts and extensive documentation could also help to reduce conflicts over labor-related concerns, designs, or construction permits. Maintaining knowledge of local building code revisions helps to avoid mid-project interruptions.

To handle important issues including soil erosion, air quality control, and noise pollution, construction firms should apply thorough environmental management strategies. These designs should guarantee that the site is ready to manage unfavourable weather conditions and incorporate proactive steps for water drainage. Reducing noise pollution and guaranteeing adherence to environmental rules by involving nearby communities would also help to minimise disturbance during building. Using sustainable methods helps to improve long-term project success even more.

Investing in technical capabilities by giving enhanced training to skilled labour and implementing new construction procedures. Improving team coordination and site access for machines and materials can help to considerably reduce delays. Project

management systems should be utilised to streamline the workflow and guarantee that all materials satisfy quality requirements, hence reducing defects. Modernizing construction equipment and ensuring that building procedures are practical will have a favorable result on project outcomes.

The study suggests that construction businesses should participate in early engagement with local communities and stakeholders to promote trust and acceptance. Addressing concerns about land ownership, cultural sensitivity, and displacement should be prioritised to avoid social disputes that could cause project delays. Understanding political realities in the region and adjusting project techniques accordingly can help to reduce disruptions. Incorporating community feedback and demonstrating a commitment to social responsibility will help the project achieve success.

5.6 Recommendations for Further Studies

While this study yielded important results, some areas remained untouched. This research suggests that future studies examine the effects of policy changes and regulatory reforms on the execution of residential construction projects in Kenya, since this will aid in understanding how legal adjustments affect project outcomes. More research might also look into how climate change affects residential construction projects, particularly in terms of responding to adverse weather and sustainable practices in Africa. Such research could look into how construction processes and materials should improve to better manage environmental constraints.

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APPENDICES

Appendix I: Letter of Introduction

28th February 2024

Dear Sir/Madam,

RE: QUESTIONNAIRE; PROJECT CONSTRAINTS AND PERFORMANCE OF RESIDENTIAL CONSTRUCTION PROJECTS IN NAIROBI COUNTY, KENYA

Sarah Waigumo Muiru is currently pursuing a Master of Business Administration with a specialisation in Project Management at Kenyatta University. In order to satisfy the MBA requirements, she is obligated to conduct a research study on the performance and project constraints of residential construction projects in Nairobi County, Kenya. The questionnaire is to be filled out by construction project managers who are registered with the Architectural Association of Kenya (AAK) and the Institute of Construction Project Managers (ICPMK).

I am writing to formally request your assistance in facilitating the student's ability to conduct this research. All academic uses of the data will be strictly limited to this study. Kindly note that your availability to assist with survey responses is essential to the success of the research.

Your support in this regard would be greatly appreciated by Kenyatta University. If you require any additional information, please do not holdback from contacting Kenyatta University.

Yours Sincerely,

Chair, Department of Business Administration.

Appendix II: Questionnaire

Confidentiality

All responses will be treated confidentially. We would appreciate you providing the construction project details to facilitate better analysis and conclusion of the study.

The comprehensive effectiveness of residential construction efforts in Nairobi and the realisation of anticipated constraints can be enhanced by having knowledge of construction project performance and constraints during the planning and execution phases.

PROJECT CONSTRAINTS AND PERFORMANCE OF RESIDENTIAL CONSTRUCTION PROJECTS IN NAIROBI COUNTY, KENYA

SECTION 1: **GENERAL INFORMATION ON RESPONDENTS**

(Tick appropriate)

1. Gender
    - Male
    - Female
2. Construction Project Professional Membership Body
    - ICPMK (Institute of Construction Project Managers)
    - AAK (Architectural Association of Kenya)
3. Years of experience in construction project management
    - 1 - 3 Years of experience
    - 3 - 5 Years of experience
    - 5 – 7 Years of experience
    - Above 7 Years of experience

4. Number of residential construction projects managed to completion.
    - 1 – 10 Residential Construction Projects
    - 10 – 20 Residential Construction Projects
    - 20 – 30 Residential Construction Projects
    - Above 30 Residential Construction Projects

SECTION 2: PERFORMANCE OF RESIDENTIAL CONSTRUCTION PROJECTS IN NAIROBI COUNTY *(For residential construction projects in Nairobi only*)

5. Status of the most recent residential construction project you are managing in Nairobi.
    - In progress
    - Complete
    - On hold/Abandoned
6. **Timeline:** When was your most recent residential construction project in Nairobi initiated?
    - Before Year 2000
    - Between Year 2000 – 2010
    - Between Year 2010 – 2020
    - After Year 2020
7. **Timeline:** Where the project is complete; Select the appropriate timeline description.
    - Residential construction project was completed within timeline
    - Timeline for residential construction project was exceeded
    - Residential construction project was completed before the expected timeline

8. **Timeline:** Where the project is in progress; select the appropriate timeline description
    - Residential Construction project is still within the timeline
    - Timeline for the residential construction project is exceeded
9. **Timeline:** Where the project is on-hold/abandoned; Select the appropriate timeline description.
    - Residential Construction project was still within the timeline
    - Timeline for the residential construction project was exceeded
10. **Budget:** Where the project is complete; Select appropriate description for the residential construction project.
    - Budget for the residential construction project was exceeded/overspent
    - Budget for the residential construction project was subseeded/underspent
    - Budget for the residential construction project was within/on (neither overspent /underspent)
11. **Budget:** Where the project is in progress; Select appropriate description for the residential construction project.
    - Budget for the residential construction project has been exceeded/overspent
    - Budget for residential construction project is underspent/subseeded
    - Residential Construction project is still within/on budget

12. **Budget:** Where the project is in on hold/abandoned; Select appropriate description for the residential construction project.
    - Budget for the residential construction project was exceeded/overspent
    - Budget for the residential construction project was subseeded/underspent
    - Budget for the residential construction project was within/on (neither overspent

      /underspent
13. **Quality**: Where the project is complete; Rate satisfaction with the quality of the residential construction project.
    - Satisfied with the quality of the residential construction project
    - Unsatisfied with the quality of the residential construction project.

SECTION 3: CONSTRAINTS LEVEL OF IMPACT ON RESIDENTIAL CONSTRUCTION PROJECTS

14. **Economic Constraints** are limitations imposed as a result of financial factors it mainly happens within budget limits and allocation of resources. Below are economic constraints related to residential construction projects, rate them according to level of impact on performance of construction project.

(1 - Did not Impact the project; 2 - Least Impactful; 3 - Impactful and 4 - Extremely Impactful)

Description	***1***	***2***	***3***	***4***
Difficulties in obtaining loans from banks and financial institution				
Improper allocation of resources to various activities				
Inflation and Interest rate increase				
Limited resources / Budget limits/Cash flow challenges				
Inappropriate project cost estimation				

15. State any other economic constraints encountered in the construction project that have not been captured in the list above and indicate the level of impact on the residential construction project.

(1 - Did not Impact the project; 2 - Least Impactful; 3 - Impactful and 4 - Extremely Impactful)

Description	***1***	***2***	***3***	***4***

16. **Legal Constraints** are limitations imposed as a result of regulations governing a particular area and the occasional enactment of new laws in an area relating to construction projects. Below are legal constraints related to residential construction projects, rate them according to level of impact on performance of construction project.

(1 - Did not Impact the project; 2 - Least Impactful; 3 - Impactful and 4 - Extremely Impactful)

Description	***1***	***2***	***3***	***4***
Safety regulations relating to construction projects				
Work/Labour (of the current government)				
Construction permits (Drawings/Designs)				
Land acquisition regulations				
Disputes related to contractual documents				

17. State any other legal constraints encountered in the construction project that have not been captured in the list above and indicate the level of impact on the residential construction project.

(1 - Did not Impact the project; 2 - Least Impactful; 3 - Impactful and 4 - Extremely Impactful)

Description	***1***	***2***	***3***	***4***

18. **Environmental Constraints** are limitations imposed as a result of public concerns and regulation requiring the environment to be protected. Below are environmental constraints related to residential construction project, rate them according to level of impact on performance of construction project.

(*1 - Did not Impact the project; 2 - Least Impactful; 3 - Impactful and 4 - Extremely Impactful)*

Description	***1***	***2***	***3***	***4***
Noise pollution/permits				
Water and waste management regulation				
Unforeseen climate changes				
Traffic & transportation challenges				
Energy consumption & carbon emissions				

19. State any other environmental constraints encountered in the residential construction project that has not been captured in the list above and indicate the level impact on the residential construction project.

(1 - Did not Impact the project; 2 - Least Impactful; 3 - Impactful and 4 - Extremely Impactful)

Description	***1***	***2***	***3***	***4***

20. **Technical Constraints** are limitations imposed as a result of project design, site area, space, work coordination and practicality of building methods and standards. Below are technical constraints related to residential construction project, rate them according to level of impact on performance of construction project.

(1 - Did not Impact the project; 2 - Least Impactful; 3 - Impactful and 4 - Extremely Impactful)

Description	***1***	***2***	***3***	***4***
Imperfect/ Changes in drawings & details				
Poor planning, coordination & scheduling of work				
Restrictive site area/Congested surroundings				
Inadequate storage & handling areas				
Practicality of building methods & standards				

21. State any other technical constraints encountered in the construction project that has not been captured in the list above and indicate the level of impact on the residential construction project.

(1 - Did not Impact the project; 2 - Least Impactful; 3 - Impactful and 4 - Extremely Impactful)

Description	***1***	***2***	***3***	***4***

22. **Social Constraints** are limitations imposed as a result of human resistance, emotional constraint and problem ownership. Below are social constraints related to residential construction project, rate them according to level of impact on performance of construction project.

(1 - Did not Impact the project; 2 - Least Impactful; 3 - Impactful and 4 - Extremely Impactful)

Description	***1***	***2***	***3***	***4***
Ownership issue regarding land and construction site				
Political dynamics within a region				
Conventional views held by individuals				
Community acceptance and cultural sensitivity				
Prior engagement with community stakeholders before undertaking a project.				

23. State any other social constraints encountered in the construction project that has not been captured in the list above and indicate the level of impact on the residential construction project.

(1 - Did not Impact the project; 2 - Least Impactful; 3 - Impactful and 4 - Extremely Impactful)

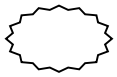
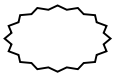
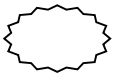
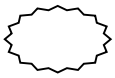
Description	***1***	***2***	***3***	***4***

Appendix III: Research Program

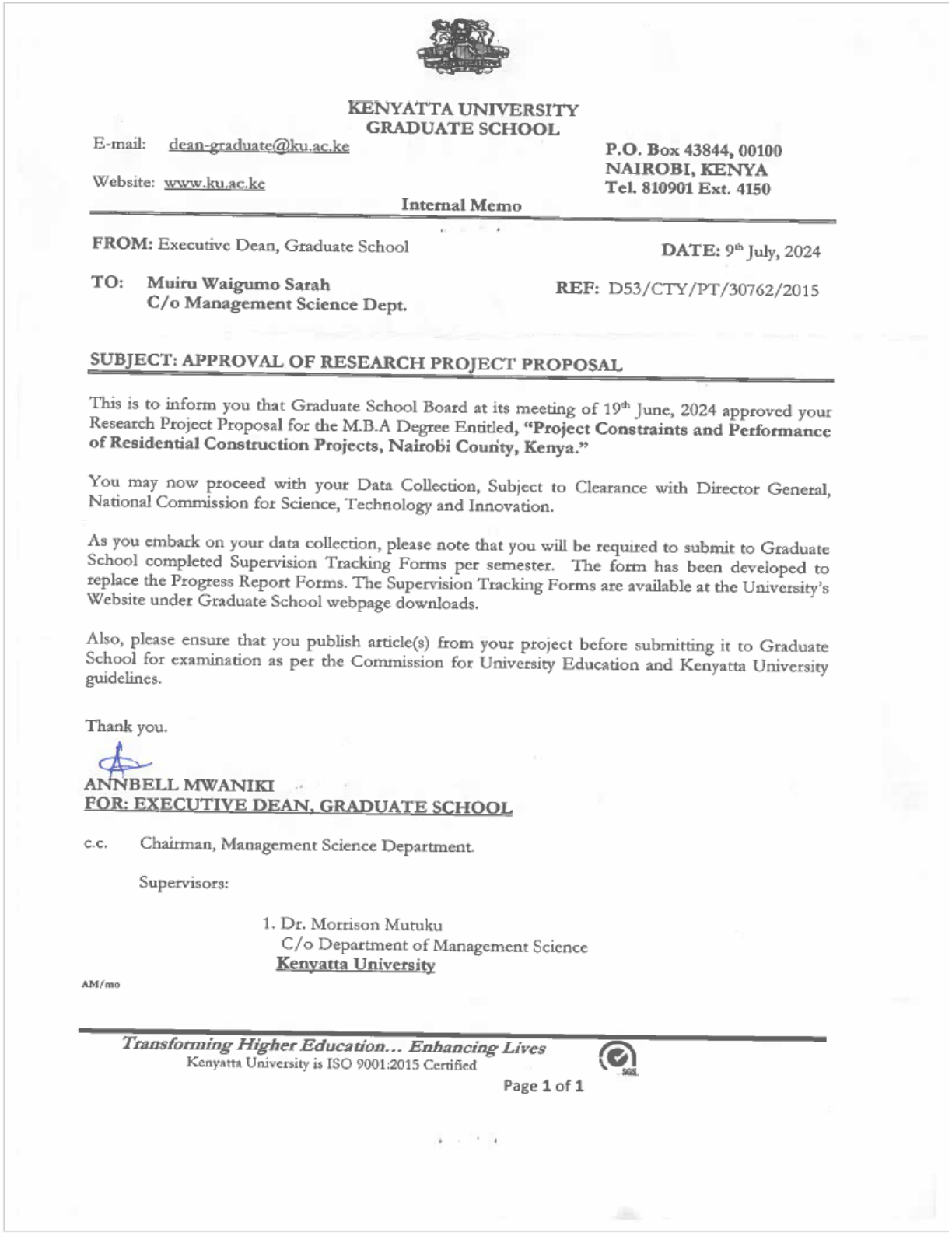
This study will take approximately one months due to the enormous work involved in going to collect data from the sample construction projects and documentation of the findings

The following table shows the work schedule plan for this study. The dates on which the specific activity will be conducted are indicated by the shaded area.

Table 1.12 Work Schedule Plan

Days / **Activities**	3rd - 5th Sept 2024	6th – 17th Sept 2024	18th – 20th Sept 2024	23rd – 27th Sept 2024	27th Nov 2024
Recruitment of research assistants					
Data Collection					
Data Organization and Analysis					
Writing of the Conclusion and Recommendation					
Presentation of the Project					

Appendix IV: Research Approval Letter



KENYATTA UNIVERSITY
GRADUATE SCHOOL

E-mail: dean-graduate@ku.ac.ke
Website: www.ku.ac.ke

P.O. Box 43844, 00100
NAIROBI, KENYA
Tel. 810901 Ext. 4150

Internal Memo

FROM: Executive Dean, Graduate School

DATE: 9th July, 2024

TO: **Muiru Waigumo Sarah**
C/o Management Science Dept.

REF: D53/CTY/PT/30762/2015

SUBJECT: APPROVAL OF RESEARCH PROJECT PROPOSAL

This is to inform you that Graduate School Board at its meeting of 19th June, 2024 approved your Research Project Proposal for the M.B.A Degree Entitled, **"Project Constraints and Performance of Residential Construction Projects, Nairobi County, Kenya."**

You may now proceed with your Data Collection, Subject to Clearance with Director General, National Commission for Science, Technology and Innovation.

As you embark on your data collection, please note that you will be required to submit to Graduate School completed Supervision Tracking Forms per semester. The form has been developed to replace the Progress Report Forms. The Supervision Tracking Forms are available at the University's Website under Graduate School webpage downloads.

Also, please ensure that you publish article(s) from your project before submitting it to Graduate School for examination as per the Commission for University Education and Kenyatta University guidelines.

Thank you.

ANNBELL MWANIKI
FOR: EXECUTIVE DEAN, GRADUATE SCHOOL

c.c. Chairman, Management Science Department.

Supervisors:

1. Dr. Morrison Mutuku
C/o Department of Management Science
Kenyatta University

AM/mo

Transforming Higher Education... Enhancing Lives
Kenyatta University is ISO 9001:2015 Certified

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Appendix V: Research Authorization Letter

KENYATTA UNIVERSITY
GRADUATE SCHOOL

E-mail: dean-graduate@ku.ac.ke
Website: www.ku.ac.ke

P.O. Box 43844, 00100
NAIROBI, KENYA
Tel. 8710901 Ext. 57530

Our Ref: D53/CTY/PT/30762/2015

DATE: 9th July, 2024

Director General,
National Commission for Science, Technology
and Innovation
P.O. Box 30623-00100
NAIROBI

Dear Sir/Madam,

RE: RESEARCH AUTHORIZATION FOR MUIRU WAIGUMO SARAH – REG. NO. D53/CTY/PT/30762/2015

I write to introduce **Muiru Waigumo Sarah** who is a Postgraduate Student of this University. He is registered for M.BA degree programme in the **Department of Management Science.**

Muiru intends to conduct research for a M.BA Project Proposal entitled, **"Project Constraints and Performance of Residential Construction Projects, Nairobi County, Kenya."**

Any assistance given will be highly appreciated.

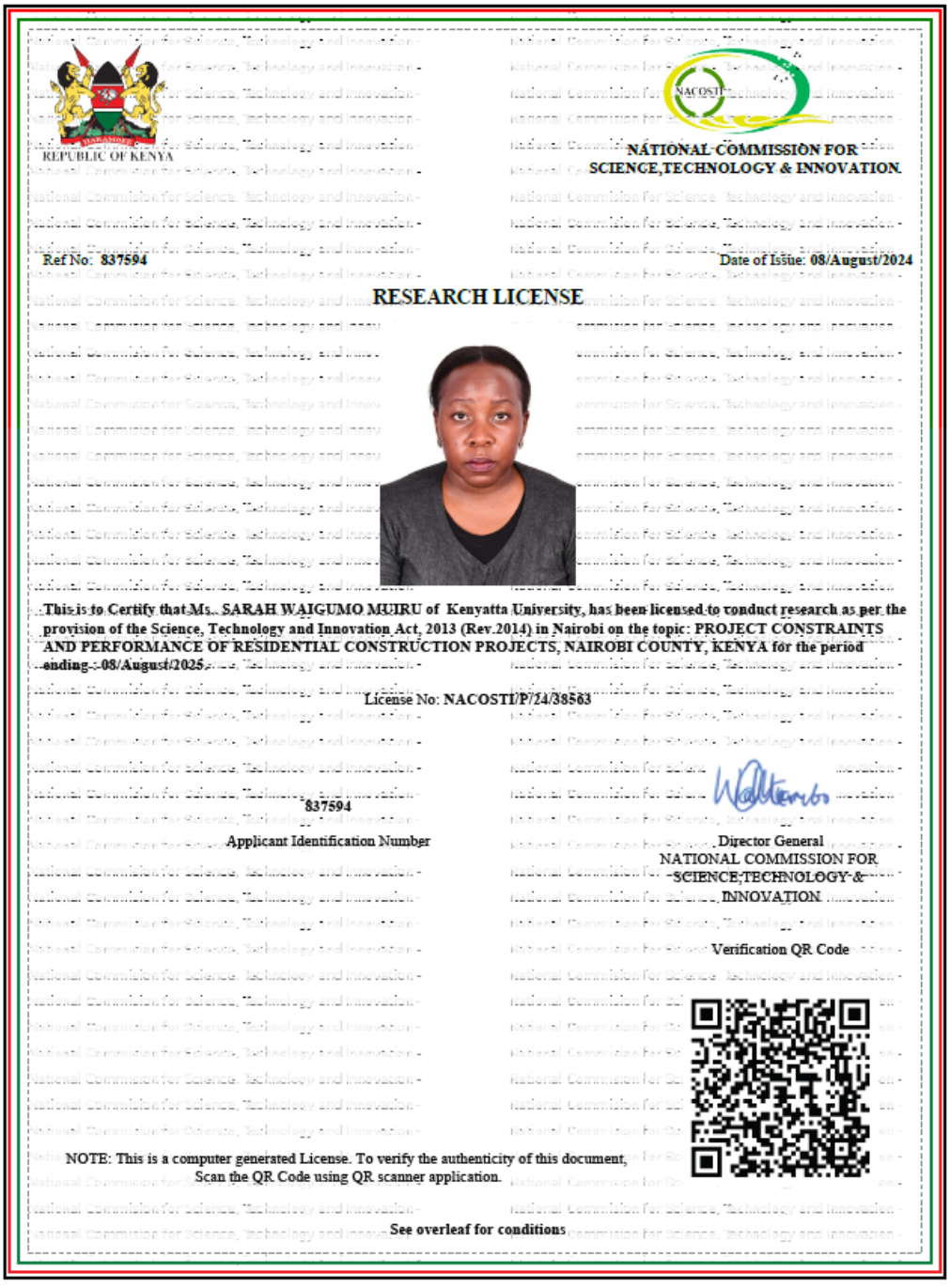
Yours faithfully,

PROF. ELIUD NJAGI
EXECUTIVE DEAN, GRADUATE SCHOOL

AM/mo

c

Appendix VI: NACOSTI Research Permit



REPUBLIC OF KENYA

NATIONAL COMMISSION FOR SCIENCE,TECHNOLOGY & INNOVATION

Ref No: 837594

Date of Issue: 08/August/2024

RESEARCH LICENSE

This is to Certify that Ms.. SARAH WAIGUMO MUIRU of Kenyatta University, has been licensed to conduct research as per the provision of the Science, Technology and Innovation Act, 2013 (Rev.2014) in Nairobi on the topic: PROJECT CONSTRAINTS AND PERFORMANCE OF RESIDENTIAL CONSTRUCTION PROJECTS, NAIROBI COUNTY, KENYA for the period ending : 08/August/2025.

License No: NACOSTI/P/24/38583

837594

Applicant Identification Number

Director General
NATIONAL COMMISSION FOR SCIENCE,TECHNOLOGY & INNOVATION

Verification QR Code

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See overleaf for conditions