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EFFECT OF DIGITIZATION OF TAX SERVICES ON REVENUE COLLECTION EFFICIENCY IN KENYA

Beatrice Nduku Kituli

078382

A DISSERTATION SUBMITTED TO STRATHMORE UNIVERSITY IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE DEGREE OF MASTER OF SCIENCE IN DEVELOPMENT FINANCE

Strathmore Business School

Strathmore University

Nairobi, Kenya

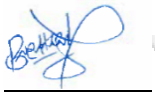
June 2026

Declaration and Approval

Declaration

I Declare that this dissertation is my original work and has not been presented for a degree or any other award in Strathmore University or to any other institution. To the best of my knowledge the dissertation contains no material previously published except where due reference is made.

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Signature:  Date: 24/06/2026

Name: Beatrice Nduku Kituli

Reg. No. 078382

Approval

This dissertation has been reviewed and approved for examination by the following:

Signature:  Date: 24/06/2026

Dr. Farida Abdul

Strathmore Business School

Strathmore University

Abstract

Revenue collection efficiency remains a major concern for governments seeking to enhance domestic resource mobilization while minimizing administrative costs. Despite substantial investments in digital tax administration reforms, many developing countries continue to face challenges associated with tax compliance, revenue leakages, and administrative inefficiencies. In Kenya, the Kenya Revenue Authority (KRA) has implemented several digitization initiatives, including iTax, the Tax Invoice Management System (TIMS), eTIMS, and digital payment platforms, to improve efficiency within tax administration. However, empirical evidence regarding the effectiveness of these digital reforms on revenue collection efficiency remains limited. This study therefore examined the effect of digitization of tax services on revenue collection efficiency in Kenya. Specifically, the study assessed the effect of electronic tax filing, digital payment platforms, digital invoice management systems, and digital taxpayer education on revenue collection efficiency. The study was anchored on the E-Governance Theory and the Technology Acceptance Model (TAM). It adopted a positivist research philosophy and employed a longitudinal time-series research design. The study utilized secondary data obtained from KRA administrative records covering the period 2013–2025. Monthly data comprising 156 observations for each variable were analyzed using descriptive statistics, correlation analysis, diagnostic tests, and Generalized Least Squares (GLS) regression analysis. The data were log transformed before analysis to improve model stability and interpretation. The findings revealed that electronic tax filing, digital payment platforms, digital invoice management systems, and digital taxpayer education all have positive and statistically significant effects on revenue collection efficiency in Kenya. Among the variables examined, digital payment platforms exhibited the strongest positive influence on revenue collection efficiency. The study concludes that digitization of tax services significantly enhances efficiency, transparency, compliance monitoring, and accountability within tax administration systems. The study recommends strengthening digital payment infrastructure, enhancing integration among digital tax platforms, expanding taxpayer education programs, improving digital infrastructure, and investing in advanced technological innovations such as data analytics and artificial intelligence to further improve tax administration efficiency in Kenya. The findings provide important policy insights for KRA, policymakers, and development partners seeking to strengthen domestic revenue mobilization through digital transformation initiatives.

Key Terms: Digitization of tax services, revenue collection efficiency, electronic tax filing, digital payment, digital invoice, digital taxpayer education, Kenya revenue authority.

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List of Abbreviations and Acronyms

CBK:	Central Bank of Kenya
EBM:	Electronic Billing Machine
GDP:	Gross Domestic Product
IMF:	International Monetary Fund
IRS:	Internal Revenue Service
ITAS:	Integrated Tax Administration System
ITMS:	Integrated Tax Management System
KRA:	Kenya Revenue Authority
MTD:	Making Tax Digital
OECD:	Organization for Economic Co-operation and Development
PAYE:	Pay As You Earn
RRA:	Rwanda Revenue Authority
SARS:	South African Revenue Service
TIMS:	Tax Invoice Management System
VAT:	Value Added Tax

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Operational Definition of Terms

Digitization of Tax Services

Digitization of tax services refers to the transformation of traditional tax administration processes including registration, filing, payment, assessment, and enforcement into electronic and automated systems that leverage information and communication technologies to improve efficiency, compliance and transparency. This includes platforms such as iTax, TIMS, eTIMS, and other online service portals aimed at minimizing manual intervention, reducing compliance costs, and enhancing taxpayer convenience (Njeri, 2022; Muceke, 2021).

Revenue Collection Efficiency

Revenue collection efficiency is operationalized as the ratio of total revenue collected to the total administrative cost incurred in collecting that revenue, indicating how effectively tax administration resources are used to mobilize funds (Martínez et al., 2022).

Electronic Tax Filing

Electronic tax filing is the process by which taxpayers submit their tax returns via online systems (e.g., iTax), allowing for automated verification, reduced human error and faster processing times (Rokhman et al., 2023; Efriyenti, 2018).

Digital Payment Platforms

Digital payment platforms refer to electronic systems through which taxpayers remit tax payments using online banking, mobile money (e.g., M-Pesa PayBill), real-time gross settlement (RTGS), or integrated payment gateways. These platforms enable real-time reconciliation of payments, reduce leakages, and improve convenience for taxpayers, ultimately enhancing compliance and accelerating revenue realization (Mustapha & Obid, 2015).

Digital Invoice Management System (TIMS/eTIMS)

A digital invoice management system, such as Kenya's TIMS and eTIMS, is an electronic platform that generates, transmits and validates tax invoices in real-time, linking business transactions directly with the tax authority. It improves VAT compliance, minimizes

invoice fraud, and ensures accurate reporting by automating data capture and submission (Tanui et al., 2025; Mo et al., 2023).

Digital Taxpayer Education

Digital taxpayer education encompasses structured programs delivered through online channels including webinars, e-learning modules and virtual workshops aimed at improving taxpayer knowledge, awareness and compliance behavior. It helps reduce information asymmetry, improves voluntary compliance, and ensures that taxpayers can effectively use digital systems (Martínez et al., 2022; OECD, 2021).

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Chapter One: Introduction

1.1 Background of the Study

Revenue collection efficiency remains a critical challenge for tax administrations, as governments aim to mobilize adequate resources at minimal cost. Globally, advanced economies demonstrate superior revenue mobilization capacity, with the average tax-to-GDP ratio among OECD countries reaching 33.5% in 2023, supported by high compliance levels and efficient tax administration systems (OECD, 2023). Many of these countries have achieved collection cost ratios as low as 0.7 cents per dollar collected, owing to robust e-filing systems, real-time e-invoicing and automated compliance monitoring (Martínez et al., 2022). For instance, Romania's national e-payment gateway boosted local tax revenues by 15% within two years of implementation, underscoring the role of digitalization in enhancing efficiency (Grichawat, 2022). Similarly, Singapore's Inland Revenue Authority achieved a 98% e-filing rate, reducing manual filing error rates from 18% to 1% and cutting processing costs by US$ 4.93 per tax form (Teo & Wong, 2005).

In contrast, developing economies, especially in sub-Saharan Africa, exhibit lower efficiency. The regional average tax-to-GDP ratio stands at 16%, well below the OECD benchmark, leaving significant fiscal gaps (Okunogbe & Santoro, 2023). High administrative costs and compliance gaps persist; some African revenue authorities spend 2–3% of each dollar collected on administration, more than double the cost ratios observed in developed economies (Olaoye et al., 2019). Although countries such as Rwanda, Tanzania, and Nigeria have introduced e-filing and mobile payment solutions, uptake remains uneven due to digital literacy barriers and inadequate infrastructure (Iddrisu, 2023). Consequently, while digital tools have potential, empirical evidence on their impact on cost-efficiency and compliance in African contexts is still limited and fragmented.

Kenya illustrates both the progress and the challenges of tax digitization. The Kenya Revenue Authority (KRA) has invested heavily in technological reforms, including the Integrated Tax Management System (ITMS) in 2007, iTax in 2013, TIMS in 2022, and eTIMS in 2023 (Kenya Revenue Authority [KRA], 2023). As of 2023, over 7.3 million taxpayers were registered on iTax, with e-filing coverage exceeding 90% for VAT and PAYE returns, contributing to a rise in ordinary revenue collections from KSh 963 billion

in FY 2013/14 to KSh 2.4 trillion in FY 2022/23 (KRA, 2023). Mobile tax payments have surged, with M-Pesa tax remittances accounting for more than 40% of small taxpayer transactions (Central Bank of Kenya, 2023). The tax-to-GDP ratio in Kenya increased from 16.8% in 2022 to 17.2% in 2023, reflecting modest progress in revenue mobilization following ongoing digitization efforts (World Bank, 2023; OECD, 2023).

However, despite these investments in digital infrastructure and administrative reforms, Kenya's tax-to-GDP ratio remains below several African peers and the global average. For instance, South Africa's ratio stood at 27.1%, Morocco's at 29.9%, and the Asia-Pacific regional average at 19.3% in 2023 (OECD, 2023; International Monetary Fund [IMF], 2022). These comparative figures underscore that Kenya still lags behind both upper-middle-income African economies and emerging Asian economies in terms of revenue collection efficiency. This disparity raises important questions about the actual impact of digitization on tax performance, whether technological investments have translated into proportionate efficiency gains or whether structural, behavioral, and compliance factors continue to constrain Kenya's fiscal capacity. It is against this backdrop that the current study sought to empirically investigate the causal effect of tax service digitization on revenue collection efficiency in Kenya, thereby filling a crucial knowledge gap in the country's digital tax reform discourse.

1.1.1 Global Perspective of Digitization of Tax Services and Revenue Collection Efficiency

Globally, digitization of tax services has emerged as a cornerstone of modern public finance reform, enabling tax authorities to enhance efficiency, transparency, and compliance through automation and data integration. Developed countries have led this transformation by adopting advanced technologies such as e-filing, e-invoicing, and digital payment systems, resulting in significant improvements in administrative efficiency and revenue mobilization. According to the OECD (2023), the average tax-to-GDP ratio among member countries stood at 33.5% in 2023, compared to the global average of 26% and the 16% average in sub-Saharan Africa (Okunogbe & Santoro, 2023). These economies demonstrate how digitization reduces compliance costs, improves voluntary compliance, and enhances audit capabilities.

For instance, in the United States, the Internal Revenue Service (IRS) achieved 94% e-filing coverage in 2022, cutting the cost of processing each return by more than half from US$5.60 for paper to less than US$2.60 for e-filed returns (IRS, 2023; OECD, 2021). Similarly, Singapore's Inland Revenue Authority (IRAS) reported 98% e-filing uptake, achieving one of the lowest administrative cost ratios globally 0.6 cents per dollar collected and compliance rates exceeding 95% (Teo & Wong, 2005). Across Europe, digital reforms have transformed tax collection efficiency. Italy's 2019 mandatory e-invoicing system increased VAT compliance by 15%, while Spain reduced filing errors by 80% (European Commission, 2021; Petras, 2021). The United Kingdom's Making Tax Digital *(MTD)* initiative reduced filing errors and helped close the tax gap by £2.9 billion between 2019 and 2024 (HMRC, 2024). Such outcomes illustrate how digitization enhances transparency and taxpayer accountability while reducing administrative overheads.

In developing regions, particularly sub-Saharan Africa, the adoption of digital tax systems has gained momentum, though progress remains uneven due to infrastructural and digital literacy constraints. Rwanda's use of electronic billing machines (EBMs) and e-filing platforms increased its tax-to-GDP ratio from 15.8% in 2018 to 16.9% in 2023, improving compliance by over 12 percentage points (Kagarama, 2019). Similarly, Tanzania's rollout of electronic fiscal devices (EFDs) led to an 18% increase in VAT collections and reduced compliance costs by nearly 20% (Waiswa & Ngoma, 2021). Nigeria's Integrated Tax Administration System (ITAS) expanded e-filing and online payment adoption, contributing to an increase in non-oil tax revenue from ₦4.6 trillion in 2019 to ₦7.5 trillion in 2023 (Mohammed et al., 2023). South Africa remains the regional leader, with a 27% tax-to-GDP ratio, supported by 90% e-filing coverage and rapid refund processing times (IMF, 2022).

In Kenya, the Kenya Revenue Authority (KRA) has implemented successive digital reforms, including ITMS in 2007, iTax in 2013, TIMS in 2022, and eTIMS in 2023 (KRA, 2023). As of 2023, over 7.3 million taxpayers were registered on iTax, with e-filing coverage exceeding 90% for VAT and PAYE returns. Revenue collections rose from KSh 963 billion in FY 2013/14 to KSh 2.4 trillion in FY 2022/23 (KRA, 2023). The tax-to-GDP

ratio increased modestly from 16.8% in 2022 to 17.2% in 2023, reflecting gradual improvement (World Bank, 2023). However, Kenya's ratio remains below South Africa (27.1%), Morocco (29.9%), and the Asia-Pacific average of 19.3% (OECD, 2023; IMF, 2022). Despite heavy investment in iTax, TIMS, and eTIMS, administrative costs remain high, signaling possible inefficiencies in leveraging technology for optimal revenue collection. This persistent gap underscores the need to empirically examine whether Kenya's digitization efforts are translating into measurable gains in revenue collection efficiency.

1.1.2 Digitization of Tax Services

Digitization of tax services refers to the systematic adoption and integration of information and communication technologies (ICTs) into tax administration systems with the objective of enhancing operational efficiency, transparency, compliance, and overall taxpayer satisfaction. It involves replacing traditional manual and paper-based processes with digital platforms that facilitate real-time data capture, processing, and exchange among tax administrators, taxpayers, and other stakeholders (OECD, 2021). According to Muceke (2021), tax digitization encompasses several functional dimensions such as electronic tax filing, e-payment systems, e-invoicing, taxpayer registration, and digital taxpayer education. These digital tools collectively improve the speed, accuracy, and convenience of tax administration by reducing physical interactions and minimizing opportunities for human error or corruption. The concept is anchored in e-governance and digital transformation theories, which assert that the integration of technology into public administration enhances accountability, reduces administrative costs, and fosters inclusivity in service delivery (Petras, 2021).

Digitization has been operationalized through multiple frameworks, reflecting its multidimensional nature. Martínez, Bird, and Vazquez (2022) identify three primary components; electronic filing, electronic payments, and electronic invoicing as the backbone of modern tax digitization. These elements facilitate administrative efficiency by automating compliance monitoring and reducing filing errors, thereby increasing the accuracy of tax assessments and collections. Njeru (2022) expanded this view by emphasizing digital taxpayer education and online advisory platforms as additional

enablers that enhance voluntary compliance, particularly in developing economies where awareness and literacy gaps hinder compliance. Similarly, Okunogbe and Santoro (2023) conceptualized digitization as a multidimensional construct that improves information accuracy, expands the tax base, and enhances enforcement capacity through data analytics and integrated information systems. Collectively, these perspectives underline that digitization is not merely a technological shift but an institutional transformation that reshapes taxpayer behavior, administrative efficiency, and revenue performance.

Empirical studies across jurisdictions have employed various indicators to measure the extent and effectiveness of tax digitization. Aaron and Slemrod (2019) quantified digitization using the share of electronically filed returns relative to total filings, demonstrating that higher e-filing rates are associated with improved compliance and reduced administrative costs. Waiswa and Ngoma (2021) evaluated the effect of electronic fiscal devices (EFDs) and the proportion of e-payments processed annually on revenue outcomes, finding that automation enhances collection transparency and limits underreporting. In sub-Saharan Africa, Iddrisu (2023) assessed the adoption of e-filing systems among small and medium-sized enterprises (SMEs), concluding that digital adoption positively influences compliance behavior and revenue performance.

In the Kenyan context, Tanui, Kiprop, and Kiptoo (2025) developed a comprehensive framework that captures both the transactional and behavioral dimensions of tax digitization, identifying four key constructs: electronic tax filing, digital payment platforms, digital invoice management systems, and digital taxpayer education. This approach integrates both process automation and taxpayer engagement, reflecting the Kenya Revenue Authority's holistic strategy to enhance compliance and cost-efficiency. These dimensions serve as measurable proxies for evaluating how digitization affects revenue collection efficiency through improved reporting, transparency, and taxpayer empowerment.

1.1.3 Revenue Collection Efficiency

Revenue collection efficiency refers to the effectiveness with which a tax authority mobilizes government revenue at minimal administrative and compliance costs while

maintaining high levels of taxpayer compliance and service quality. It captures the balance between the cost of administering taxes and the revenue yield achieved from those efforts (OECD, 2021). Efficient revenue collection is therefore achieved when a tax administration maximizes revenue generation without proportionate increases in administrative expenditure, leakages, or taxpayer burden. According to Martínez, Bird, and Vazquez (2022), efficiency in tax collection is a key indicator of institutional performance and fiscal sustainability, as it reflects how well tax systems convert tax potential into actual collections.

From a theoretical standpoint, revenue collection efficiency is rooted in public finance and administrative efficiency theories, which posit that effective fiscal systems should optimize resource utilization while minimizing administrative and compliance costs (Aaron & Slemrod, 2019). The OECD (2023) identifies three core dimensions of tax administration efficiency: revenue productivity (actual collections relative to potential), administrative efficiency (cost per unit of revenue collected), and compliance efficiency (ease and timeliness of taxpayer compliance). Collectively, these dimensions determine how effectively a revenue authority translates policy design into tangible fiscal outcomes.

Several studies have operationalized revenue collection efficiency using quantitative performance ratios derived from tax administration data. The most common measure is the administrative cost-to-revenue ratio, which assesses how much it costs to collect one unit of tax revenue (OECD, 2021). For instance, in OECD economies, the average cost of collection is less than 1 cent per dollar of revenue mobilized, while in developing economies, it often exceeds 3 cents per dollar (Okunogbe & Santoro, 2023). This disparity reflects differences in institutional capacity, digital infrastructure, and compliance levels. Aaron and Slemrod (2019) used this ratio to compare the efficiency of advanced and developing tax administrations, concluding that digital reforms significantly lower administrative costs by reducing manual processing and human discretion. Similarly, Grichawat (2022) found that Romania's adoption of a national e-payment gateway reduced administrative expenses by 12% and improved the efficiency ratio within two years of implementation.

Other scholars have proposed alternative proxies for revenue collection efficiency. Olaoye, Ayeni-Agbaje, and Alaran-Ajewole (2019) evaluated Nigeria's Federal Inland Revenue Service using a composite index that includes total tax revenue as a percentage of GDP, tax effort ratios, and collection cost ratios. Meanwhile, Waiswa and Ngoma (2021) assessed the Tanzanian Revenue Authority's efficiency using trends in VAT gap reduction and cost of administration per taxpayer. Although such indicators provide complementary insights, most studies emphasize that the administrative cost-to-revenue ratio remains the most objective and universally comparable metric, as it directly reflects operational efficiency and resource utilization (Martínez et al., 2022; OECD, 2023).

In the context of this study, revenue collection efficiency will be measured as the ratio of total revenue collected to total administrative cost. This metric provides a scientifically robust and quantifiable measure of how effectively the Kenya Revenue Authority (KRA) transforms its operational expenditures into revenue outcomes. A higher ratio indicates better efficiency, meaning the authority is collecting more revenue for each unit of administrative cost incurred. This approach aligns with the methodology used in empirical assessments by the OECD (2021), Okunogbe and Santoro (2023), and Tanui, Kiprop, and Kiptoo (2025), who emphasize the need to anchor tax efficiency analysis on measurable cost-performance relationships.

1.2 Statement of the Problem

Revenue collection efficiency is vital to Kenya's fiscal stability and development financing. Although ordinary revenue increased from KSh 963 billion in FY 2013/14 to KSh 2.4 trillion in FY 2022/23, Kenya's revenue administration costs remain relatively high compared to international benchmarks. According to the Kenya Revenue Authority (KRA), the administrative cost of revenue collection averages approximately 2.9 cents for every Kenya shilling equivalent of revenue collected, compared to OECD countries, which typically spend between 0.6 and 1.0 cents per dollar collected. Emerging economies spend an average of 1.2 to 1.5 cents per dollar collected, while many sub-Saharan African countries incur costs ranging between 2.5 and 3.5 cents per dollar collected. These comparisons suggest that Kenya still faces efficiency gaps in revenue administration despite significant improvements in tax collection performance. Consequently, there is a

need to evaluate whether ongoing tax digitization reforms have translated into more cost-effective revenue mobilization. To address these challenges, the Kenya Revenue Authority (KRA) has invested heavily in digital reforms, including iTax, the Tax Invoice Management System (TIMS), eTIMS, and integration with mobile payment platforms, with the objective of streamlining tax administration, reducing compliance costs, improving transparency, and enhancing revenue collection efficiency (OECD, 2023; KRA, 2023).

However, questions persist regarding whether these digital reforms have led to measurable improvements in revenue collection efficiency (Okunogbe & Santoro, 2023). This uncertainty poses significant policy and operational risks: without rigorous evidence, decision-makers cannot accurately determine if investments in tax technology are yielding commensurate efficiency gains, or if alternative strategies are required. Two key research gaps underscore the need for this study. First is a secondary data gap. Most empirical studies on tax digitization in Kenya and across Africa have relied on primary data collected through questionnaires and interviews to assess taxpayer perceptions, adoption rates, or satisfaction levels (Kwemei & Ng'eno, 2024). While these studies provide useful insights into user experiences, they do not establish a causal link between digitization and objective performance metrics such as revenue collection efficiency.

This study will fill that gap by using longitudinal secondary data from KRA's data bank (2013–2024) to conduct robust time-series analysis, producing empirical evidence that is more objective and generalizable. Second is a scope gap. Many prior studies have focused on specific taxpayer segments such as SMEs, county governments, or individual taxpayers, leaving a gap in understanding the impact of digitization at the national tax administration level (Muceke, 2021; Iddrisu, 2023). By focusing on KRA's system-wide data including total revenue, administrative costs, e-filing uptake, e-payments, e-invoicing, and digital taxpayer education this study offered a comprehensive institutional-level analysis of digitization outcomes, providing a clearer picture of its macro-level effects. By addressing these gaps, the study provided actionable evidence on whether KRA's digitization initiatives were achieving their intended goal of enhancing cost-effective revenue collection. The findings will guide policymakers, the National Treasury, and KRA's

management in refining future digital investments, taxpayer education programs, and compliance strategies, ultimately strengthening Kenya's domestic resource mobilization and fiscal sustainability.

1.3 Research Objectives

The study was guided by the following research objectives:

1.3.1 General Research Objective

The general research objective was to analyze the effect of digitization of tax services on revenue collection efficiency in Kenya.

1.3.2 Specific Research Objectives

i. To determine the effect of electronic tax filing on revenue collection efficiency in Kenya.
ii. To examine the influence of digital payment platforms on revenue collection efficiency in Kenya.
iii. To assess the effect of digital invoice management systems on revenue collection efficiency in Kenya.
iv. To evaluate the influence of digital taxpayer education on revenue collection efficiency in Kenya.

1.4 Research Questions

i. What is the effect of electronic tax filing on revenue collection efficiency in Kenya?
ii. What is the influence of digital payment platforms on revenue collection efficiency in Kenya?
iii. What is the effect of digital invoice management systems on revenue collection efficiency in Kenya?
iv. What is the influence of digital taxpayer education on revenue collection efficiency in Kenya?

1.5 Significance of the Study

The proposed study, carries significant implications for a broad range of stakeholders:

1.5.1 Policy Makers and Government Agencies

This study provides policymakers, the National Treasury, and the Kenya Revenue Authority (KRA) with empirical evidence on the effectiveness of tax digitization initiatives in improving revenue collection efficiency. The findings will support evidence-based fiscal planning, policy formulation, and resource allocation by identifying the digital interventions that generate the greatest efficiency gains. The study also offers an assessment of KRA's digital transformation efforts, highlighting strengths and areas for improvement in electronic tax filing, digital payment systems, digital invoice management, and taxpayer education. The findings will inform future reforms, enhance administrative efficiency, strengthen compliance management, and support Kenya's revenue mobilization and development objectives.

1.5.2 Academic and Research Community

The study makes an important contribution to the body of knowledge in public finance, taxation, and digital governance by providing empirical, secondary-data-based evidence from a developing-country context. Most existing research relies on primary data and perception-based measures, creating a gap in objective, outcome-oriented studies. This study addresses that gap, offering a reference point for future comparative studies in Africa and beyond. It also enriches literature on the causal impact of tax digitization, making it a useful resource for students, researchers, and policy analysts.

1.5.3 Financial Institutions and Businesses

Financial institutions, including banks and mobile money providers, will benefit from understanding how digital payment channels affect revenue collection efficiency and compliance. The findings can inform the development of innovative tax-payment solutions that further reduce transaction costs and enhance user experience. Businesses, on the other hand, will gain insights into how digital tax systems influence compliance obligations and administrative burden, enabling them to plan for efficient tax management and compliance.

1.5.4 Development Partners and International Agencies

Development partners such as the World Bank, IMF and donor agencies supporting domestic resource mobilization initiatives will find the study valuable in assessing the

effectiveness of technology-driven tax reforms. The results can inform technical assistance programs, funding priorities and capacity-building initiatives in Kenya and other developing economies.

1.6. Scope of the Study

This study focused on examining the effect of digitization of tax services on revenue collection efficiency in Kenya, with specific reference to the Kenya Revenue Authority (KRA). The scope was confined to four core dimensions of digitization: electronic tax filing, digital payment platforms, digital invoice management systems, and digital taxpayer education, as they relate to revenue collection efficiency. The study covered the period 2013–2025, a timeframe that coincided with the implementation of key digital reforms, including the rollout of iTax, Tax Invoice Management System (TIMS), eTIMS, and integration with digital payment platforms. The analysis utilized secondary data extracted from KRA's data bank.

1.7 Chapter Summary

Chapter One introduced the study on the Effect of Digitization of Tax Services on Revenue Collection Efficiency in Kenya: Evidence from the Kenya Revenue Authority (KRA). The chapter emphasized that revenue collection efficiency is vital for Kenya's fiscal sustainability and ability to finance development priorities. Despite growth in revenue from KSh 963 billion in FY 2013/14 to KSh 2.4 trillion in FY 2022/23, Kenya's administrative cost-to-revenue ratio (≈2.9%) remains above global benchmarks of 0.6–1.0% (OECD, 2023). The background presented global, regional and local trends, showing that developed economies such as the U.S., Singapore, and the U.K. have achieved superior efficiency through digitization, while African countries like Rwanda and South Africa are progressing unevenly. The chapter discussed digitization of tax services; including e-filing, e-payments, e-invoicing and digital taxpayer education as tools to enhance compliance, transparency, and cost-effectiveness. Revenue collection efficiency was operationalized as the ratio of total revenue collected to total administrative cost, forming the study's key metric. The problem statement identified gaps in secondary data use and national scope in prior studies. Chapter One concludes by outlining objectives, research questions, and the

study's significance to policymakers, KRA, scholars, and development partners, establishing the foundation for empirical analysis.

Chapter Two: Literature Review

2.1 Introduction

This chapter presents a review of the relevant literature. The chapter covers: theoretical background, conceptual framework, empirical review and summary of research gaps.

2.2 Theoretical Background

This section presents the theoretical foundations underpinning the study on the Effect of Digitization of Tax Services on Revenue Collection Efficiency in Kenya. Theoretical grounding is essential for explaining how and why digitization influences the efficiency of tax administration. By linking technology adoption, taxpayer behavior, and institutional performance, the theories reviewed provide a conceptual lens through which the study examines the causal relationship between technological reforms and revenue collection outcomes. The study was guided by two key theories: E-Governance Theory and the Technology Acceptance Model (TAM), both of which emphasize the transformative role of technology in enhancing public sector performance, accountability, and user compliance.

2.2.1 E-Governance Theory

The E-Governance Theory provides the conceptual foundation for understanding how the integration of information and communication technologies (ICTs) into public sector management enhances administrative efficiency, transparency, and accountability. The theory was first conceptualized in the late 1990s and early 2000s through the works of scholars such as Heeks (1999) and Fang (2002), who viewed e-governance as the digital transformation of government operations to improve public service delivery and citizen engagement. Over time, the theory evolved beyond basic automation to encompass institutional transformation, emphasizing ICT as a catalyst for efficient, transparent, and participatory governance (OECD, 2021; Petras, 2021). The underlying principle of the theory is that digitization minimizes transaction costs, reduces bureaucratic inefficiencies, and enhances accessibility of government services, leading to improved governance outcomes (Grichawat, 2022).

According to Petras (2021), e-governance aims to leverage technology to optimize service delivery processes, foster accountability, and strengthen institutional performance. In the context of taxation, e-governance enables revenue authorities to automate core functions such as taxpayer registration, filing, invoicing, and payment thereby minimizing opportunities for tax evasion and corruption. The Organisation for Economic Co-operation and Development (OECD, 2023) supports this view, observing that e-governance reforms have led to significant reductions in administrative costs and compliance burdens among member countries. For instance, the United Kingdom's "Making Tax Digital" initiative and Singapore's e-filing systems demonstrate how e-governance principles translate into efficient tax administration through real-time data integration, compliance monitoring, and enhanced taxpayer convenience (Teo & Wong, 2005; HMRC, 2024).

In Africa, Okunogbe and Santoro (2023) argue that e-governance is reshaping public finance management by expanding the tax base, enhancing compliance through automation, and improving data-driven decision-making. Similarly, Muceke (2021) and Njeru (2022) highlight that digital governance reforms in sub-Saharan Africa, including the adoption of online tax systems and e-payment platforms, have improved tax collection transparency and reduced administrative inefficiencies. The Kenya Revenue Authority's (KRA) digitization initiatives such as iTax (2013), TIMS (2022), and eTIMS (2023) are practical embodiments of e-governance theory in action. These platforms have enabled real-time transaction monitoring, seamless taxpayer interaction, and integration with financial institutions, thereby improving revenue collection efficiency (KRA, 2023).

Despite its strengths, the e-governance theory faces several critiques. Heeks (2003) and Fang (2002) caution that successful implementation depends on institutional readiness, digital infrastructure, and user capacity. In developing economies, challenges such as limited internet access, low digital literacy, and resistance to change often undermine the intended benefits of e-governance (Iddrisu, 2023). Additionally, Okunogbe and Santoro (2023) note that digitization alone cannot resolve deep-rooted structural challenges such as tax policy design, administrative fragmentation, or weak enforcement frameworks. Hence, the theory's effectiveness is contingent on complementary reforms in governance, capacity building, and stakeholder engagement.

The relevance of E-Governance Theory to this study lies in its ability to explain how technology-driven reforms can enhance revenue collection efficiency through improved administrative processes and compliance. By automating taxpayer services, digitization reduces the cost of collection, minimizes leakages, and strengthens audit trails (OECD, 2021; Martínez, Bird, & Vazquez, 2022). In this study, the theory provided a foundation for examining how KRA's digital initiatives specifically electronic tax filing, digital payment platforms, digital invoice management systems, and digital taxpayer education contribute to operational efficiency and cost-effectiveness in tax administration. The theory guided the analysis of how automation and data integration under KRA's systems translate into measurable improvements in the ratio of total revenue collection to administrative costs.

2.2.2 Technology Acceptance Model (TAM)

The Technology Acceptance Model (TAM), originally proposed by Fred Davis (1986–1989), is one of the most influential theories explaining individual adoption and utilization of technology-based systems. Grounded in the Theory of Reasoned Action (TRA) developed by Fishbein and Ajzen (1975), TAM posits that an individual's behavioral intention to use a technology is primarily determined by two key constructs: Perceived Usefulness (PU), defined as the degree to which a person believes that using a particular system will enhance performance, and Perceived Ease of Use (PEOU), which refers to the degree to which a person believes that using a system will be free of effort. These perceptions shape attitudes toward technology use and subsequently influence actual adoption behavior (Davis, 1989). TAM has been widely applied in studies examining the adoption of information and communication technologies across sectors such as e-government, e-banking, e-commerce, and e-taxation. Within tax administration, TAM is particularly useful in explaining taxpayers' willingness to adopt and utilize digital tax services such as electronic filing, digital payment platforms, and electronic invoicing systems (Muceke, 2021; Iddrisu, 2023).

According to Njeru (2022), taxpayers are more likely to use electronic tax systems when they perceive them as reliable, accessible, and capable of reducing compliance burdens. Similarly, Tanui, Kiprop, and Kiptoo (2025) argue that high levels of perceived usefulness

and ease of use increase taxpayer adoption of digital tax platforms, thereby improving filing accuracy, payment timeliness, and voluntary compliance. The relevance of TAM to tax digitization lies in its ability to explain the behavioral mechanisms through which taxpayers interact with digital tax systems. While E-Governance Theory explains how government institutions deploy digital technologies to improve service delivery and administrative efficiency, TAM explains how taxpayers respond to and utilize those technologies. OECD (2021) and Petras (2021) note that even well-designed digital systems may fail to achieve their intended outcomes if taxpayers perceive them as difficult to use or lacking value. In the Kenyan context, where levels of digital literacy and tax awareness vary across taxpayer groups, TAM provides a useful framework for understanding variations in the uptake and utilization of digital tax services provided through platforms such as iTax, TIMS, and eTIMS.

Despite its explanatory strengths, TAM has been criticized for oversimplifying the broader social, institutional, and environmental factors that influence technology adoption. Venkatesh and Davis (2000) and Heeks (2003) argue that the model focuses heavily on individual perceptions while giving limited attention to contextual variables such as regulatory frameworks, organizational support, trust, digital infrastructure, and cultural influences. In developing countries, Iddrisu (2023) observes that inadequate internet access, technical challenges, and limited digital literacy may constrain adoption even when users perceive a system as useful. Similarly, Okunogbe and Santoro (2023) argue that the success of tax digitization reforms depends not only on taxpayer acceptance but also on institutional capacity, system integration, and regulatory effectiveness. This study applies TAM solely to explain taxpayer adoption and utilization of digital tax services, rather than the organizational adoption of technology by the Kenya Revenue Authority. Specifically, the theory helps explain how taxpayers' perceptions of the usefulness and ease of use of electronic filing systems, digital payment platforms, electronic invoicing systems, and online taxpayer education initiatives influence their willingness to utilize these services. Increased taxpayer adoption and utilization of digital tax platforms are expected to enhance compliance, improve reporting accuracy, reduce administrative burdens, and ultimately contribute to improved revenue collection efficiency.

While E-Governance Theory and the Technology Acceptance Model (TAM) operate at different levels of analysis, they are complementary in explaining the effectiveness of digital tax administration reforms in Kenya. E-Governance Theory provides the institutional perspective by explaining how government agencies such as the Kenya Revenue Authority (KRA) leverage digital technologies to improve service delivery, transparency, accountability, and administrative efficiency. However, the success of these digital reforms ultimately depends on taxpayers' willingness to adopt and use the digital platforms provided. This is where TAM becomes relevant by explaining how users' perceptions of the usefulness and ease of use of systems such as iTax, TIMS, eTIMS, and digital payment platforms influence their acceptance and utilization. In the Kenyan context, therefore, the efficiency gains anticipated by E-Governance Theory can only be fully realized when taxpayers embrace and effectively use the digital tax systems as predicted by TAM. The two theories are thus interrelated, with E-Governance Theory explaining the supply of digital tax services and TAM explaining taxpayer adoption and utilization, which collectively determine the overall impact of digitization on revenue collection efficiency.

2.3 Empirical Review

The section covers the empirical review:

2.3.1 Electronic Tax Filing and Revenue Collection Efficiency

Electronic tax filing (e-filing) has emerged as a central component of digital tax reforms globally, aimed at simplifying compliance procedures, reducing administrative costs, and improving revenue collection efficiency. Numerous empirical studies have examined this relationship from both developed and developing-country perspectives, for instance Martínez, Bird, and Vazquez (2022) conducted a comparative study titled "Tax Administration in the Digital Era: Measuring Efficiency Gains from E-Filing and E-Payments" across 34 OECD and middle-income countries. Using panel regression analysis (2010–2020), they evaluated how e-filing adoption influenced administrative cost-to-revenue ratios. The study found that e-filing reduced collection costs by an average of 0.8 cents per tax dollar and improved voluntary compliance. However, the study mainly used aggregate OECD and World Bank secondary indicators, which, while useful, obscure contextual variations in developing countries such as Kenya where implementation

capacity and infrastructure differ markedly. This creates a contextual scope gap a lack of institution-level evidence from African tax administrations. The current study addresses this by focusing specifically on the Kenya Revenue Authority (KRA) and using disaggregated secondary data from 2013–2024 to establish a causal relationship between e-filing and revenue collection efficiency.

Olaoye, Ayeni-Agbaje, and Alaran-Ajewole (2019) investigated the "Effect of Electronic Tax Systems on Tax Administration Efficiency in Nigeria." Employing a descriptive survey design, they collected primary data from 150 Federal Inland Revenue Service (FIRS) employees and used correlation and regression analyses to test associations between e-filing and efficiency. The study reported that e-filing significantly reduced compliance time and administrative overheads, enhancing overall collection performance. Despite these insights, the reliance on self-reported primary data limits objectivity and the ability to infer causality between e-filing and measurable efficiency indicators such as the cost-to-revenue ratio. The present study remedies this secondary-data gap by applying time-series analysis on objective institutional data from KRA records, thereby improving empirical robustness and generalizability.

Iddrisu (2023) examined "Digital Tax Systems and Taxpayer Compliance in Sub-Saharan Africa" using cross-sectional survey data from 421 small and medium-sized enterprises (SMEs) in Ghana and Nigeria. The study employed structural equation modelling to test how perceptions of e-filing usefulness affected compliance behaviour. Results showed that user trust and perceived ease of use were strong predictors of adoption, which in turn improved filing compliance. However, the study's focus on SMEs and behavioral variables rather than objective efficiency metrics reveals both a scope gap and a measurement gap. By contrast, the current research evaluates e-filing from an institutional performance perspective using macro-level data on KRA's total revenue collections and administrative costs to determine whether e-filing translates into quantifiable efficiency gains.

Njeru (2022) explored "The Role of Tax Digitalization in Enhancing Revenue Mobilization in Developing Countries," focusing on Kenya, Tanzania, and Rwanda. The study used survey questionnaires and descriptive statistics to assess taxpayers' perceptions of e-filing

and e-payment adoption. Findings indicated that digital tools improved convenience and transparency, yet infrastructure limitations and low digital literacy constrained full efficiency realization. The study concluded that digitization enhanced compliance but did not empirically test the effect on actual revenue collection efficiency. Consequently, there exists a methodological gap: the absence of econometric analysis linking e-filing usage levels to measurable fiscal outcomes. The present study bridges this by employing longitudinal econometric modelling based on KRA's administrative dataset covering 2013–2024 to provide evidence on the efficiency effect of e-filing over time.

Tanui, Kiprop, and Kiptoo (2025) conducted an empirical assessment titled "Technological Reforms and Tax Compliance Behaviour in Kenya." Using a mixed-methods approach combining surveys and secondary data from selected regional KRA offices, the authors analyzed the impact of e-filing, TIMS, and eTIMS on compliance among registered taxpayers between 2013 and 2023. The study established that e-filing significantly enhanced voluntary compliance, reduced processing delays, and improved tax revenue performance at the regional level. However, it was limited by its regional scope and did not model efficiency using nationwide cost and revenue data. The current study extends this work by employing a national institutional scope, integrating KRA-wide administrative data to evaluate the effect of e-filing on overall revenue collection efficiency, thus addressing the scope gap inherent in previous research.

2.3.2 Digital Payment Platforms and Revenue Collection Efficiency

Digital payment platforms have become a critical pillar of modern tax administration systems, facilitating real-time remittance, reducing leakages, and improving accountability. They encompass mobile money systems, internet banking, electronic fund transfers, and integrated payment gateways that link taxpayers directly with revenue authorities. Empirical studies have increasingly explored their influence on revenue collection efficiency, for instance Grichawat (2022) examined "Public Sector Digitalization and Local Tax Revenue Performance: Evidence from Romania's National e-Payment Gateway (ghiseul.ro)." The study used a quasi-experimental design analyzing administrative data from 2009–2021 to evaluate how the introduction of a centralized e-payment platform affected tax revenue and collection costs. Findings revealed a 15%

increase in local tax collections and a 12% reduction in administrative expenditure within two years of implementation. While this study provides strong evidence of efficiency gains from digital payment systems, its focus on a European middle-income context limits applicability to developing countries like Kenya, where infrastructural and behavioral dynamics differ. This underscores a contextual gap that the present study addresses by using institution-level data from Kenya Revenue Authority (KRA) to assess how digital payment platforms such as M-Pesa PayBill and iTax-linked e-payments influence collection efficiency.

Olaoye, Ayeni-Agbaje, and Alaran-Ajewole (2019) conducted a survey-based study on "Effect of Electronic Tax Systems on Tax Administration Efficiency in Nigeria." Among other digital components, they evaluated the influence of electronic payment systems on revenue outcomes using data collected from 150 tax officers. Results showed that electronic payment platforms improved transparency, reduced cash handling, and minimized revenue leakages. However, the study's reliance on self-reported primary data and descriptive methods limited its ability to determine causal relationships between e-payments and objective efficiency metrics. The current study addresses this secondary-data gap by employing longitudinal secondary data from KRA's administrative records (2013–2024), allowing for robust econometric testing of whether digital payment integration has measurably improved revenue efficiency ratios.

Muceke (2021) explored "Digitalization of Tax Administration and Revenue Performance in Sub-Saharan Africa." Using panel data from 11 African countries (2010–2019), the study analyzed the impact of e-payment and e-filing adoption on total revenue performance using a fixed-effects regression model. Findings showed that countries adopting e-payment systems experienced an average 8% annual growth in tax revenue, with reduced compliance time and enhanced data accuracy. However, the study emphasized total revenue performance rather than revenue collection efficiency, leaving a conceptual gap between increased revenue and cost-effectiveness. The present study addresses this limitation by focusing specifically on efficiency the ratio of total revenue collected to administrative cost providing a more precise measure of how digital payment platforms affect fiscal performance at the institutional level.

Iddrisu (2023) analyzed “Digital Tax Systems and Taxpayer Compliance in Sub-Saharan Africa” using a structural equation model based on data from 421 SMEs in Ghana and Nigeria. The study found that digital payment platforms significantly improved taxpayer convenience and compliance but were hindered by low financial literacy and intermittent network connectivity. While the study contributed behavioral insights, it primarily examined compliance intentions rather than administrative efficiency, using perception-based data instead of empirical cost-performance measures. The current research thus fills a methodological gap by using quantitative secondary data to analyze actual revenue and cost outcomes linked to digital payment systems under KRA.

Tanui, Kiprop, and Kiptoo (2025) assessed “Technological Reforms and Tax Compliance Behaviour in Kenya” by combining survey data from 384 respondents with secondary revenue statistics from KRA regional offices. The study concluded that mobile payment solutions, particularly through M-Pesa, significantly enhanced filing timeliness and reduced transaction costs for both taxpayers and administrators. However, the authors acknowledged that the study’s regional focus did not capture the national fiscal efficiency effect of digital payments. The current study expands this scope by analyzing nationwide KRA data from 2013–2024, integrating variables on digital payment transaction volumes, total revenue collected, and administrative costs to assess the system-wide efficiency implications.

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2.3.3 Digital Invoice Management Systems and Revenue Collection Efficiency

Digital invoice management systems often implemented through e-invoicing and electronic fiscal devices (EFDs) play a critical role in modern tax administration by promoting real-time transaction reporting, minimizing under-declaration of sales, and improving audit traceability. By linking taxpayer systems directly to revenue authorities, these tools strengthen transparency and reduce compliance costs. Several empirical studies have examined the relationship between digital invoice systems and revenue performance, for instance the European Commission (2021) conducted a comprehensive evaluation titled “The Economic Impact of Mandatory E-Invoicing on VAT Compliance in the European Union.” Using panel data from 22 EU member states between 2015 and 2020, the study

analyzed the introduction of real-time electronic invoicing systems such as Italy's Sistema di Interscambio and Spain's Suministro Inmediato de Información (SII).

Results showed that mandatory e-invoicing reduced the VAT compliance gap by over €3.5 billion in Italy within the first year and by 15% across the EU average. Although the study demonstrates strong causal evidence linking digital invoice management to improved efficiency, its context in highly digitized economies limits generalization to developing countries like Kenya. The current study extends this line of inquiry to a low-middle-income context by examining whether KRA's Tax Invoice Management System (TIMS) and eTIMS have produced similar efficiency outcomes, using institution-level time-series data.

Waiswa and Ngoma (2021) examined "The Effect of Electronic Fiscal Devices on Value-Added Tax Compliance and Efficiency in Tanzania." Using a mixed-method approach with survey data from 300 traders and secondary VAT collection data, they found that EFDs improved VAT revenue by 18% and reduced administrative costs through automation. However, the study focused primarily on SMEs and compliance outcomes rather than measuring the cost-effectiveness of the reforms. This reveals a scope gap, as it excludes institutional-level efficiency indicators. The present study builds upon this by using KRA's aggregated administrative data to assess how Kenya's digital invoice systems contribute to efficiency measured as the ratio of revenue collected to administrative cost.

Rwanda Revenue Authority (RRA) was analyzed by Kagarama (2019) in the study "Evaluating the Impact of Electronic Billing Machines (EBMs) on Tax Compliance and Administration Efficiency in Rwanda." The research employed a quasi-experimental design comparing pre- and post-adoption data (2013–2018). The findings indicated a 12% increase in VAT compliance and a 9% reduction in audit-related administrative expenses after EBM adoption. Despite these encouraging outcomes, the study's narrow focus on VAT transactions, rather than total revenue efficiency, limits its generalizability. The current study addresses this conceptual gap by incorporating digital invoice data into a broader institutional framework that examines total revenue mobilization and administrative cost interactions across multiple tax heads.

Okunogbe and Santoro (2023) conducted a macro-level study on "Increasing Tax Collection in African Countries: The Role of Information Technology." Using panel data from 27 African countries (2005–2020), they investigated how digital reporting tools, including e-invoicing and fiscal receipt systems, affect tax yields and efficiency. The results indicated that countries with automated invoice management experienced 10–15% higher revenue productivity and lower administrative cost ratios than those without. However, the study aggregated country-level data, which masks micro-level operational differences across tax administrations. The current study addresses this granularity gap by focusing exclusively on Kenya Revenue Authority (KRA) data from 2013–2024 to provide more precise, organization-level insights.

Tanui, Kiprop, and Kiptoo (2025) investigated "Technological Reforms and Tax Compliance Behaviour in Kenya," emphasizing the introduction of the Tax Invoice Management System (TIMS) and eTIMS. Using both primary and secondary data from KRA regional offices, they reported that TIMS improved accuracy in VAT reporting, reduced fake invoicing, and enhanced audit traceability. However, their study measured compliance and satisfaction outcomes rather than fiscal efficiency. Moreover, it was limited to select regions, excluding national-level cost-to-revenue dynamics. The present study expands on this by integrating nationwide KRA administrative data to quantify whether the adoption of TIMS and eTIMS has led to measurable improvements in Kenya's overall revenue collection efficiency addressing both scope and secondary-data gaps.

2.3.4 Digital Taxpayer Education and Revenue Collection Efficiency

Digital taxpayer education refers to the use of information and communication technologies (ICTs) such as webinars, e-learning portals, online tutorials, and social-media campaigns to improve taxpayers' understanding of tax laws, filing procedures, and compliance obligations. It is an essential dimension of tax digitization, complementing e-filing, e-payments, and e-invoicing by fostering voluntary compliance and reducing administrative burdens. Several empirical studies have analyzed the effect of taxpayer education on revenue performance, they include; Teo and Wong (2005) examined "E-Government and Citizen Engagement: The Case of the Singapore Inland Revenue Authority (IRAS)" to evaluate how online taxpayer education improved compliance

outcomes. Using administrative and survey data between 1998 and 2004, they found that integrating e-learning modules and online support services increased voluntary filing by 20 percent and reduced help-desk inquiries by 35 percent, saving the authority approximately US $4.9 per tax return. The study demonstrated the financial benefits of digital taxpayer education but was confined to a highly digitized economy, limiting its applicability to developing contexts like Kenya. The current study extends this by examining how Kenya Revenue Authority's (KRA's) online education initiatives such as iTax tutorials and e-learning webinars affect cost-efficient revenue collection using longitudinal secondary data.

Njeru (2022) explored "The Role of Tax Digitalization in Enhancing Revenue Mobilization in Developing Countries," focusing on Kenya, Tanzania, and Rwanda. Using a cross-sectional survey of 300 taxpayers and 50 officers, the study revealed that digital taxpayer education improved compliance intentions and filing accuracy, particularly among SMEs. However, the study relied on perception-based data, making it difficult to link educational interventions to measurable efficiency outcomes. The present study addresses this secondary-data gap by employing time-series administrative data from 2013 to 2024 to analyze the empirical relationship between digital taxpayer education and KRA's revenue collection efficiency.

Iddrisu (2023) conducted a study titled "Digital Tax Systems and Taxpayer Compliance in Sub-Saharan Africa" using survey data from 421 SMEs in Ghana and Nigeria. Findings indicated that awareness and digital literacy campaigns increased e-filing adoption and compliance by 25 percent. Despite its relevance, the study concentrated on behavioral compliance and not institutional performance metrics such as cost-to-revenue ratios, revealing both a conceptual and scope gap. The current research broadens this focus by quantifying how KRA's digital taxpayer education efforts measured through the number of online training sessions conducted per year affect efficiency outcomes at the national level.

Olaoye, Ayeni-Agbaje, and Alaran-Ajewole (2019) examined "Effect of Electronic Tax Systems on Tax Administration Efficiency in Nigeria." Although their study primarily

assessed electronic tax systems, they highlighted that training and taxpayer sensitization were key mediators between technology adoption and improved efficiency. The study, based on survey data from 150 FIRS officers, concluded that limited taxpayer knowledge constrained the potential of digital systems. However, because it relied on qualitative perceptions and lacked longitudinal data, causal inferences about efficiency improvements remained speculative. The current study fills this methodological gap by linking digital taxpayer education directly to quantifiable revenue-efficiency ratios using objective secondary data from KRA's records.

Tanui, Kiprop, and Kiptoo (2025) investigated "Technological Reforms and Tax Compliance Behaviour in Kenya," focusing on digital education under KRA's iTax platform. Using mixed methods and regional data, the authors found that continuous online taxpayer training improved filing accuracy and reduced return-processing time by 40 percent. Nevertheless, the study concentrated on compliance outcomes at regional levels without exploring national-level efficiency metrics or the cost implications of digital learning programs. This presents both a scope and data gap, which the current study addresses through institution-wide secondary data covering 2013–2024 to assess whether digital taxpayer education enhances KRA's cost-effective revenue mobilization.

2.4 Summary of Research Gaps

The section summarizes studies done and research gaps in the area of digitization of tax services and revenue collection efficiency in Kenya.

Table 2.1: Summary of Research Gaps

Author/Year	Title	Objective of the Study	Methodology	Research Findings	Research Gaps	Type of Research Gap
Grichawat (2022)	Public Sector Digitalization and Local Tax Revenue Performance: Evidence from Romania's National e-Payment Gateway (ghiseul.ro)	To evaluate the impact of national e-payment systems on tax revenue and administrative efficiency.	Quasi-experimental design using administrative data (2009–2021).	E-payment gateway increased local tax revenues by 15% and reduced administrative costs by 12%.	Focused on developed European context; lacks applicability to developing economies like Kenya.	Contextual & Scope gap
Olaoye et al. (2019)	Effect of Electronic Tax Systems on Tax Administration Efficiency in Nigeria	To determine how electronic systems (including e-payments) affect tax efficiency.	Descriptive survey of 150 tax officers.	E-systems improved transparency and reduced leakages but relied on perceptions.	Relied on primary data; did not empirically measure cost-efficiency.	Secondary-data gap

Muceke (2021)	Digitalization of Tax Administration and Revenue Performance in Sub-Saharan Africa	To assess the impact of e-filing and e-payment adoption on revenue performance.	Panel data analysis (11 African countries, 2010–2019).	E-payment adoption increased tax revenue by 8% annually.	Focused on total revenue, not revenue collection efficiency; macro-level aggregation.	Conceptual & Scope gap
Iddrisu (2023)	Digital Tax Systems and Taxpayer Compliance in Sub-Saharan Africa	To assess the impact of digital platforms on compliance behavior.	Structural Equation Modeling (421 SMEs in Ghana & Nigeria).	Digital systems improved compliance but limited by literacy and infrastructure.	Examined compliance, not efficiency; relied on self-reported data.	Secondary-data & Conceptual gap
Tanui et al. (2025)	Technological Reforms and Tax Compliance Behaviour in Kenya	To analyze effects of KRA's digital reforms (iTax, TIMS, M-Pesa) on compliance.	Mixed methods using survey and secondary regional data.	Digital reforms improved filing timeliness and reduced transaction costs.	Focused on compliance, not efficiency; limited to regional data.	Scope & Secondary-data gap
European Commission (2021)	The Economic Impact of Mandatory E-Invoicing on VAT Compliance in the EU	To measure how mandatory e-invoicing affects VAT compliance and revenue.	Panel data (22 EU countries, 2015–2020).	VAT gap reduced by €3.5 billion; compliance improved by 15%.	High-income context limits generalization to Africa.	Contextual gap

Waiswa & Ngoma (2021)	Effect of Electronic Fiscal Devices on VAT Compliance in Tanzania	To assess effect of EFDs on compliance and efficiency.	Mixed methods: surveys & VAT data.	VAT collections rose 18%, compliance costs dropped 20%.	Focused on SMEs; did not measure efficiency formally.	Scope gap
Kagarama (2019)	Impact of Electronic Billing Machines on Tax Administration Efficiency in Rwanda	To evaluate EBMs' role in compliance and administrative costs.	Quasi-experimental (2013–2018).	Compliance increased 12%; admin costs reduced 9%.	Focused only on VAT; lacked institution-wide analysis.	Scope gap
Okunogbe & Santoro (2023)	Increasing Tax Collection in African Countries: Role of Information Technology	To explore IT tools' effect on tax productivity and efficiency.	Panel data (27 African countries, 2005–2020).	Digital tools improved productivity by 10–15%.	Country-level aggregation; lacked organizational detail.	Scope & Granularity gap
Njeru (2022)	Role of Tax Digitalization in Enhancing Revenue Mobilization in Developing Countries	To assess digital education and e-filing on compliance.	Cross-sectional survey (Kenya, Tanzania, Rwanda).	Digital education improved compliance intentions.	Relied on perception data; did not measure efficiency.	Secondary-data gap

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Teo & Wong (2005)	E-Government and Citizen Engagement: Singapore IRAS Case	To examine impact of online taxpayer education on compliance.	Administrative & survey data (1998–2004).	E-education increased voluntary filing by 20% and cut costs by US$4.9 per return.	Conducted in a developed economy; limited to compliance.	Contextual & Scope gap
Olaoye et al. (2019)	Effect of Electronic Tax Systems on Tax Administration Efficiency in Nigeria	To explore how e-systems and education affect efficiency.	Survey of FIRS officers.	Education mediates effect of digitization on efficiency.	Relied on perceptions; lacked longitudinal data.	Secondary-data gap
Iddrisu (2023)	Digital Tax Systems and Taxpayer Compliance in Sub-Saharan Africa	To evaluate role of digital literacy and awareness in compliance.	Survey of SMEs in Ghana & Nigeria.	Awareness improved e-filing adoption by 25%.	No institutional efficiency measurement.	Scope gap
Tanui et al. (2025)	Technological Reforms and Tax Compliance Behaviour in Kenya	To assess role of iTax training and digital education.	Mixed methods (Kenya regional offices).	Online taxpayer education improved filing accuracy.	Focused on compliance only; lacked national efficiency analysis.	Scope & Secondary-data gap

Source (Author, 2025)

2.5 Conceptual Framework

The conceptual framework comprises four independent variables; electronic tax filing, digital payment platforms, digital invoice management systems, and digital taxpayer education and one dependent variable, revenue collection efficiency in Kenya. The relationship was expected to be positive but with a lag effect, as the benefits of digital tax systems may take time to materialize due to system adjustments, taxpayer adaptation, and gradual behavioral changes. Thus, improvements in revenue efficiency emerge progressively as digital adoption and compliance increase over time.

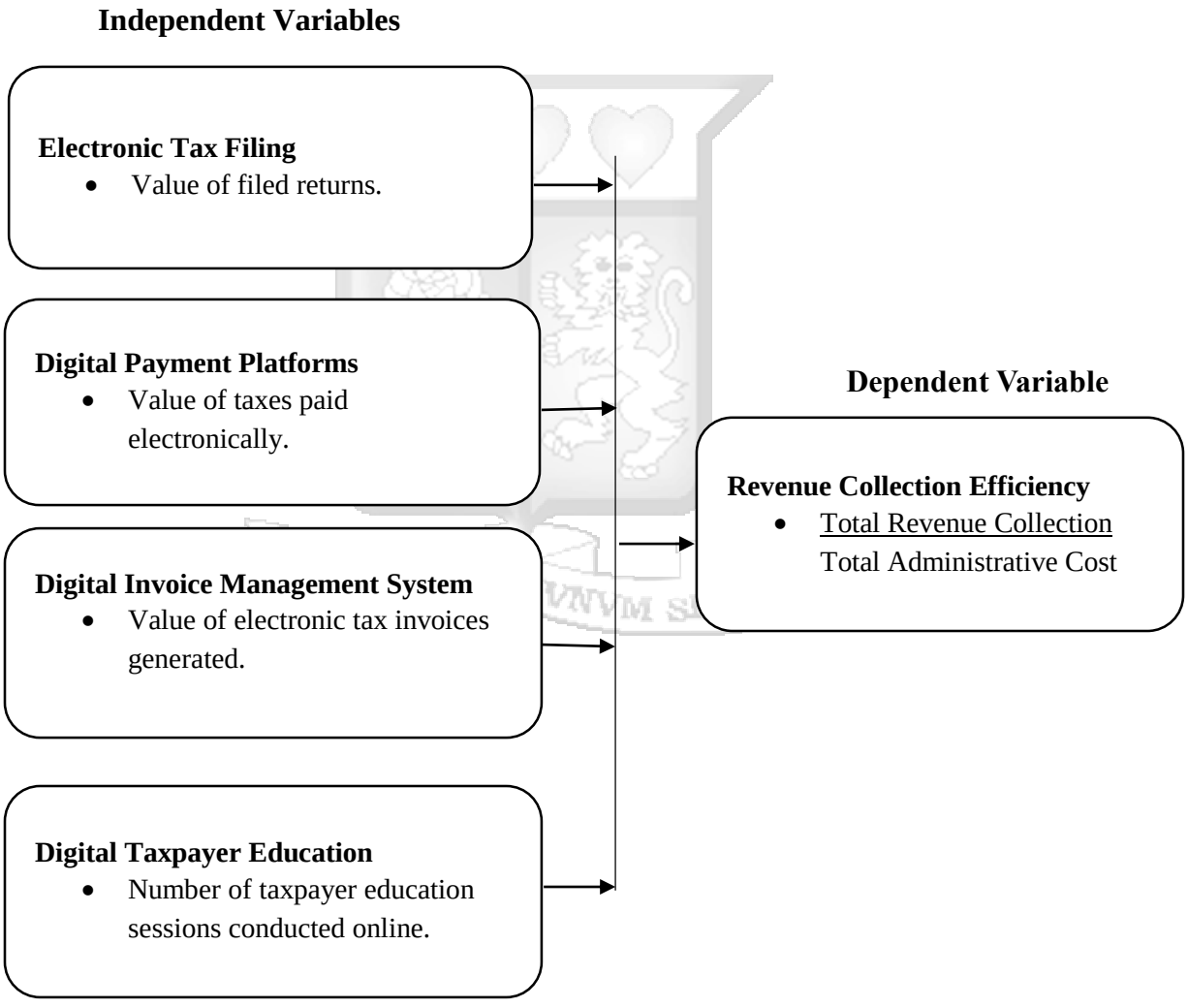


Figure 1.1: Conceptual Framework

Source (Author, 2025)

2.6 Operationalization of Variables

This section outlines how the study's key constructs are translated into measurable variables for empirical testing. The study examined the effect of digitization of tax services captured through; electronic tax filing, digital payment platforms, digital invoice management systems and digital taxpayer education on revenue collection efficiency at KRA. Each variable's indicators and measures were derived from literature and grounded in the E-Governance Theory and Technology Acceptance Model (TAM). Table 2.2 presents the key study variables, their abbreviations, indicators, supporting citations, and underpinning theories guiding the analysis of the Effect of Digitization of Tax Services on Revenue Collection Efficiency in Kenya.

Table 2.2: Operationalization of Variables

Variable	Abbreviation	Indicators	Citations	Underpinning Theory
Revenue Collection Efficiency (Dependent Variable)	RCE	Ratio of total revenue collected to total administrative cost per year (efficiency ratio).	OECD (2021); Okunogbe & Santoro (2023); Martínez, Bird & Vazquez (2022); KRA (2023)	E-Governance Theory; Technology Acceptance Model (TAM)
Electronic Tax Filing	ETF	Annual Value of electronically filed returns by tax head (VAT, PAYE, Income Tax, Excise).	Teo & Wong (2005); Muceke (2021); Njeru (2022); Tanui, Kiprop & Kiptoo (2025)	E-Governance Theory; Technology Acceptance Model (TAM)
Digital Payment Platforms	DPP	Annual value of taxes paid electronically.	Grichawat (2022); Olaoye et al. (2019); Waiswa & Ngoma (2021); Tanui et al. (2025)	E-Governance Theory
Digital Invoice Management Systems	DIMS	• Annual value of electronic	European Commission (2021);	E-Governance Theory

		tax invoices generated.	Kagarama (2019); Okunogbe & Santoro (2023); Tanui et al. (2025)	
Digital Taxpayer Education	DTE	Number of taxpayer education sessions conducted online per year.	Teo & Wong (2005); Njeru (2022); Iddrisu (2023); Olaoye et al. (2019)	Technology Acceptance Model (TAM)

Source (Author, 2025)

2.7 Chapter Summary

This chapter reviewed literature relevant to the Effect of Digitization of Tax Services on Revenue Collection Efficiency in Kenya. It established that e-governance and the Technology Acceptance Model (TAM) provide strong theoretical foundations for understanding how digital reforms enhance efficiency, transparency and user adoption in tax administration. Empirical evidence from global, regional and Kenyan contexts shows that digital tools such as e-filing, e-payments, e-invoicing and online taxpayer education improve compliance and reduce administrative costs, though findings remain fragmented and context-specific. Identified research gaps include the secondary data gap, where most studies rely on perception-based primary data, and the scope gap, where prior research focuses on specific taxpayer groups rather than institutional-level efficiency. This study addresses these limitations using longitudinal secondary data from KRA (2013–2024) to empirically assess digitization's impact on revenue collection efficiency.

Chapter Three: Research Methodology

3.1 Introduction

This chapter presents the research methodology that will be used. It presents the research philosophy, research design, target population, sampling techniques, data type and source, data collection instrument, validity and reliability of research instrument, empirical model and data analysis procedure.

3.2 Research Philosophy

A research philosophy defines the underlying system of beliefs and assumptions that guide how a study is designed, conducted, and interpreted (Creswell, 2023). It shapes the researcher's worldview regarding the nature of reality, knowledge, and the methods appropriate for investigating a phenomenon (Saunders et al., 2019). Several philosophies such as interpretivism, pragmatism, and positivism can guide empirical inquiry. However, this study adopted the positivist research philosophy, which emphasizes objective measurement and the use of empirical evidence to establish causal relationships. Positivism was most appropriate because the study sought to quantify the effect of digitization of tax services (electronic tax filing, digital payment platforms, digital invoice management systems and digital taxpayer education) on revenue collection efficiency using secondary data from the Kenya Revenue Authority (KRA) between 2013 and 2025. This approach aligned with positivist principles that rely on observable, measurable variables and statistical analysis to test theoretical propositions (Mwita, 2024).

3.3 Research Design

A research design refers to the overall blueprint that outlines how a study is structured and executed, including procedures for data collection, measurement and analysis to address the research objectives effectively (Jansen et al., 2023). It provides a logical framework that links the research problem with the methods used to generate empirical evidence (Creswell, 2023). Various designs exist such as; descriptive, correlational, experimental, and longitudinal, however, the choice depends on the nature of the research questions and data availability. Given that this study sought to analyze the effect of digitization of tax services on revenue collection efficiency in Kenya, a longitudinal time-series research design was the most appropriate. This design facilitates the examination of changes and

causal relationships over time using secondary data from the Kenya Revenue Authority (KRA) covering the period 2013–2025. The longitudinal time-series design enables observation of trends, patterns, and the direction of causality between digitization indicators and revenue collection efficiency without manipulating variables or influencing the research environment (Judith et al., 2022).

3.4 Target Population

The target population refers to the entire group of entities or institutions from which a researcher intends to draw information and make inferences (Etikan, 2023). For this study, the target population was the Kenya Revenue Authority (KRA), which serves as the primary institution responsible for tax administration, collection and enforcement in Kenya. In Kenya we have KRA as the only institution mandated with tax administration, collection and enforcement. This population was appropriate because the study sought to analyze the effect of digitization of tax services on revenue collection efficiency. KRA's digital transformation initiatives such as iTax, TIMS, and eTIMS form the core of Kenya's tax modernization efforts. The authority also maintains comprehensive administrative and financial records necessary for longitudinal time-series analysis (2013–2025).

3.5 Sampling Technique

Sampling technique refers to the procedure used to select a portion of the population for analysis, ensuring that the chosen data accurately represents the study population (Taherdoost, 2023). However, since this study focused on the Kenya Revenue Authority (KRA) as the sole national tax administration agency, the study employed a census approach. Census involves the inclusion of the entire population under investigation rather than selecting a subset, thereby eliminating sampling bias and ensuring comprehensive data coverage (Bolarinwa et al., 2024). This approach was most appropriate for the current study because KRA's administrative data encompass all digitized tax services including electronic tax filing, digital payment platforms, digital invoice management systems and digital taxpayer education across all tax heads and taxpayer categories. By utilizing KRA's complete institutional dataset covering the period 2013–2025, the study ensured full representation of all relevant variables necessary for examining the causal relationship between tax digitization and revenue collection efficiency. The census approach also

enhances the accuracy, validity, and generalizability of findings since it uses comprehensive administrative records rather than sampled data (Creswell, 2023).

3.6 Data Type and Source

This study used secondary data obtained from the Kenya Revenue Authority (KRA) to evaluate the effect of digitization of tax services on revenue collection efficiency in Kenya. Secondary data was appropriate because it provides credible, cost-effective and comprehensive information collected by a reputable public institution (Johnston, 2017). The dataset covered the period 2013–2025, corresponding with key digitization milestones such as iTax, TIMS, and eTIMS. Data analyzed included total revenue collected, total administrative cost, value of electronically filed returns, digital payments, electronic invoices, and online taxpayer education sessions.

3.7 Data Collection Instrument

A structured data collection sheet (Appendix 1) was developed to systematically extract and organize secondary data from the Kenya Revenue Authority (KRA). The sheet contained clearly defined rows corresponding to the study variables, namely: total revenue collected per year, total administrative cost per year, total value of electronically filed returns by tax head (VAT, PAYE, Income Tax, Excise), total value of taxes paid electronically, total value of electronic tax invoices generated and the number of taxpayer education sessions conducted online per year. Each column in the data collection sheet represented a specific month, covering the period 2013 to 2025, which coincided with the implementation of major KRA digitization initiatives such as iTax, TIMS, and eTIMS. This instrument ensured consistency, completeness and accuracy of data entry, enabling the researcher to efficiently organize KRA's secondary records for subsequent time-series econometric analysis of digitization and revenue collection efficiency.

3.8 Empirical Model for the Study

To analyze the effect of digitization of tax services on revenue collection efficiency in Kenya, this study employed a time-series regression model. Time-series analysis was appropriate because the study relied on monthly secondary data obtained from the Kenya Revenue Authority (KRA) covering the period 2013–2025 and focused on institutional-

level trends. This approach enabled the study to capture temporal dynamics and the relationships between digitization indicators and revenue collection efficiency over time (Hsiao, 2022). The model incorporated time-lagged structures to account for the delayed effects of digitization initiatives. Although major policy reforms may take several months to produce full institutional impacts, the digitization indicators examined in this study electronic tax filing, digital payment platforms, digital invoice management systems, and digital taxpayer education operate within a monthly tax administration cycle.

Tax returns are filed monthly, taxes are remitted monthly, and compliance monitoring activities are undertaken continuously. Consequently, changes in the utilization of digital tax services are expected to influence revenue collection efficiency within the subsequent month through improved compliance, faster processing of returns, enhanced transaction monitoring, and more efficient payment mechanisms. The one-month lag was therefore considered appropriate for capturing the immediate operational effects of digitization on tax administration performance. Furthermore, the use of a shorter lag helps preserve degrees of freedom and minimizes the loss of observations in monthly time-series analysis. While longer lags of three to six months may capture broader policy adjustment effects, the study focused on the short-term administrative transmission mechanisms through which digital tax services influence revenue collection efficiency.

The general functional form of the model is specified as:

$$RCE_t = \alpha + \beta_0 ETF_t + \beta_1 DPP_t + \beta_2 DIMS_t + \beta_3 DTE_t + \beta_4 ETF_{t-1} + \beta_5 DPP_{t-1} + \beta_6 DIMS_{t-1} + \beta_7 DTE_{t-1} + \varepsilon_t \quad \text{.....3.1}$$

Where:

- (RCE_t): Revenue Collection Efficiency at time *t* (ratio of total revenue collected to administrative cost)
- (ETF_t): Electronic Tax Filing at time *t*
- (DPP_t): Digital Payment Platforms at time *t*
- ($DIMS_t$): Digital Invoice Management Systems at time *t*
- (DTE_t): Digital Taxpayer Education at time *t*

- (ETF_{t-1}, DPP_{t-1}, $DIMS_{t-1}$, DTE_{t-1}): One-month lagged effects of the independent variables
- (α): Constant term
- (ε_t): Error term capturing unexplained variations

This time-series regression model enabled the study to examine both the immediate and lagged effects of KRA's digitization initiatives on cost-efficiency in revenue collection. By accounting for time-dependent effects, the model provided a more accurate estimation of how digital transformation enhances fiscal efficiency over time.

3.9 Data Analysis Procedures

The analysis of data in this study adopted a structured time-series econometric approach to examine the effect of digitization of tax services on revenue collection efficiency in Kenya. The analysis used monthly secondary data obtained from the Kenya Revenue Authority (KRA) covering the period 2013–2025. The process involved data preparation, log transformation, model estimation, diagnostic testing and interpretation of results. This systematic approach ensured that the findings are statistically valid, reliable and aligned with established quantitative research practices in fiscal and public sector efficiency studies (Amri et al., 2019; Mikayilov et al., 2018).

3.9.1 Data Preparation and Initial Exploration

In the first stage, data was cleaned, verified and structured chronologically to suit time-series analysis. Each variable including revenue collection efficiency, electronic tax filing, digital payment platforms, digital invoice management systems, and digital taxpayer education were checked for consistency and completeness. Descriptive statistics such as mean, standard deviation, kurtosis and skewness were generated to summarize data characteristics and provide an initial understanding of distribution patterns. Correlation analysis was conducted to examine preliminary relationships between variables and to identify potential multicollinearity problems (Mensah et al., 2018). This phase ensured the data was well-organized and reliable for advanced econometric modeling.

3.9.2 Model Estimation and Analysis

The second phase involved estimating the time-series regression model presented in Section 3.8 to evaluate the immediate and lagged effects of digitization on revenue collection efficiency. Data was log transformed before model estimation. Generalized Least Squares (GLS) estimation technique was employed based on the diagnostic test results and data properties. The inclusion of one-month lagged variables allowed the study to capture delayed effects of technological reforms such as iTax, TIMS, and eTIMS on fiscal performance. This analytical design recognized that improvements in administrative efficiency and compliance behavior often materialize gradually after system implementation. The resulting model established the causal relationship between the degree of digitization and the efficiency with which KRA collects revenue, providing empirical evidence for policy and operational refinement.

3.9.3 Diagnostic Tests

To ensure the reliability and validity of the regression results, several diagnostic tests were conducted. The Augmented Dickey–Fuller (ADF) test was used to check for stationarity and to ensure that the data series are free from unit root problems that may produce spurious results. The Variance Inflation Factor (VIF) tested for multicollinearity among independent variables, ensuring stable coefficient estimates. The Breusch–Pagan identified heteroskedasticity. Additionally, the Durbin–Watson test was used to detect autocorrelation in residuals, and necessary adjustments were made to improve model accuracy and reliability. Normality test was also conducted **(**Shahbaz, Raghutla, & Chittedi, 2019).

3.10 Ethical Considerations

This study adhered to the highest standards of academic and research ethics to ensure integrity, transparency, and accountability throughout the research process. Prior to commencing data collection, formal approval was sought from the Strathmore University Ethical Review Board, and a research permit was obtained from the National Commission for Science, Technology and Innovation (NACOSTI) in compliance with Kenyan research regulations. Given that this study relied on secondary data obtained from the Kenya Revenue Authority (KRA), formal authorization was requested from KRA as the primary

data custodian. The study ensured confidentiality and data protection by anonymizing all sensitive institutional data and securely storing records to prevent unauthorized access or misuse. No individual taxpayer or internal departmental identifiers were disclosed in the analysis or reporting. The research-maintained objectivity and analytical integrity, avoiding data manipulation or selective reporting of findings. All secondary data were used strictly for academic purposes, and results were presented truthfully and transparently. Adherence to the principles of non-maleficence and beneficence guided the study to ensure no harm financial, reputational, or operational occurs to KRA or any other stakeholders involved.

3.11 Chapter Summary

Chapter Three outlined the research methodology adopted to examine the Effect of Digitization of Tax Services on Revenue Collection Efficiency in Kenya. The chapter detailed the philosophical foundation, research design, target population, sampling technique, data sources, data collection instrument, empirical model, analytical procedures, and ethical considerations. The study adopts a positivist philosophy, emphasizing objectivity, quantification, and empirical testing using secondary data. A longitudinal time-series research design was selected to evaluate how digitization initiatives such as iTax, TIMS, and eTIMS affect revenue collection efficiency over the 2013–2024 period. The target population is KRA, as it is the principal custodian of national tax data and the implementing agency for digital tax systems. Since the study focuses on institutional-level performance, a census approach is used to include all relevant data rather than a sample. Data will be extracted from KRA's administrative databases covering total revenue, administrative costs, electronic filings, e-payments, digital invoicing, and taxpayer education. A structured data collection sheet will ensure consistency and accuracy. Analysis will employ a time-series regression model to capture both immediate and lagged effects of digitization, using estimation techniques such as OLS and GLS. Diagnostic tests ADF, VIF, Breusch–Pagan, Durbin–Watson, and normality tests will validate the model's robustness. Ethical compliance will be ensured through approvals from NACOSTI and KRA, safeguarding confidentiality, data protection and academic integrity.

Chapter Four: Data Analysis, Results and Interpretation

4.1 Introduction

This chapter presents the empirical analysis of the effect of digitization of tax services on revenue collection efficiency in Kenya using monthly data from 2013–2025. It begins with the presentation of the study sample size, followed by descriptive statistics to summarize data characteristics. Correlation analysis is then conducted to examine preliminary relationships among variables. The chapter further presents diagnostic tests to ensure the validity and reliability of the model. Finally, the regression model is estimated and interpreted to evaluate the impact of digitization initiatives on revenue collection efficiency.

4.2 Sample Description

The study utilized monthly time-series data obtained from the Kenya Revenue Authority (KRA) covering the period from 2013 to 2025. This time span provided a total of 156 observations for each variable included in the analysis, thereby offering sufficient data points for reliable time-series econometric estimation. The dataset captured key indicators of tax service digitization and revenue collection efficiency, namely electronic tax filing, digital payment platforms, digital invoice management systems, digital taxpayer education, and revenue collection efficiency. All the required data were available and accessible for the entire study period. During the data preparation stage, the dataset was examined for completeness and consistency, and no missing values were identified. Consequently, the analysis proceeded using the full balanced dataset without the need for data imputation or deletion of observations.

4.3 Descriptive Statistics

This section presents the descriptive statistics of the variables used in the study to provide an initial understanding of their distribution and general behavior over the study period. Descriptive statistics summarize key characteristics of the data, including the mean, standard deviation, minimum, and maximum values. These measures help to reveal the central tendency and variability of the variables before proceeding to advanced

econometric analysis. Table 4.1 presents the descriptive statistics for revenue collection efficiency and the digitization indicators considered in the study.

Table 4.1: Descriptive Statistics

	count	mean	median	std	skewness	kurtosis
RCE	156	39.040	30.221	36.558	2.787	12.630
ETF	156	57357776.77	46772906.96	44850148.99	6.061	48.709
DIMS	156	470298955.5	412972034.9	246839276.8	0.248	-0.538
DPP	156	73530445.03	66472002.3	55673893.44	1.840	4.946
DTE	156	14.115	14.5	5.250	-0.620	0.217

Source (KRA, 2026)

The results presented in Table 4.1 provide the descriptive statistics for the study variables over the period 2013–2024. All monetary values are expressed in thousands ("000") of Kenya Shillings (KES). The findings indicate that revenue collection efficiency (RCE), which is the dependent variable, recorded an average value of KES 39.040 thousand, with a median value of KES 30.221 thousand and a standard deviation of KES 36.558 thousand. The relatively high standard deviation compared to the mean suggests substantial fluctuations in revenue collection efficiency during the study period. This implies that the efficiency with which tax revenues were collected varied considerably across months, likely reflecting the effects of institutional reforms, changes in tax compliance behavior, and macroeconomic adjustments. The skewness value of 2.787 indicates a highly positively skewed distribution, implying that a few months recorded exceptionally high levels of revenue collection efficiency compared to the majority of observations. Additionally, the kurtosis value of 12.630 suggests a leptokurtic distribution characterized by heavy tails and extreme observations. This finding indicates that the data contains outliers or unusual spikes in revenue collection efficiency, possibly associated with major tax reforms, policy interventions, or periods of intensified compliance enforcement.

These findings are consistent with empirical literature on tax administration reforms in developing economies. Okunogbe and Santoro (2023) argue that tax digitization initiatives often produce uneven efficiency outcomes during transition phases because taxpayers and administrators gradually adapt to new systems. Similarly, Martínez et al. (2022) found that electronic tax administration reforms initially generate fluctuations in revenue performance

as institutions undergo structural and operational adjustments. In the African context, Muceke (2021) observed that improvements in revenue performance following digital tax reforms tend to occur intermittently rather than steadily due to variations in enforcement capacity and taxpayer compliance patterns. Furthermore, OECD reports (2021, 2023) emphasize that tax administration efficiency in emerging economies frequently displays episodic improvements associated with technological innovation and institutional reforms.

The descriptive statistics for electronic tax filing (ETF), measured by the value of electronically filed returns, indicate a mean value of approximately KES 57,357,776.77 thousand and a median of KES 46,772,906.96 thousand, with a standard deviation of KES 44,850,148.99 thousand. These findings indicate substantial variability in electronic filing activity over the study period. The relatively high standard deviation suggests that electronically filed returns fluctuated considerably across months, reflecting variations in taxpayer participation and adoption of electronic filing systems. The skewness value of 6.061 indicates a highly positively skewed distribution, implying that a few observations recorded exceptionally high filing volumes. This interpretation is reinforced by the kurtosis value of 48.709, which suggests an extremely leptokurtic distribution characterized by significant outliers and heavy tails. The findings imply that the growth in electronic filing activity was uneven and marked by occasional surges in filing volumes.

The results align with empirical studies reviewed in the literature which indicate that the adoption of electronic filing systems often generates uneven but rapidly increasing filing volumes as taxpayers transition from manual to digital platforms. Martínez et al. (2022) found that electronic filing systems significantly increase the number of submitted tax returns, although adoption patterns tend to exhibit sharp increases following policy reforms and system upgrades. Similarly, Tanui et al. (2025) observed that the implementation of Kenya's iTax platform substantially increased electronically submitted returns, although the adoption process occurred unevenly across taxpayers and over time. Njeru (2022) also noted that electronic filing adoption accelerates gradually as taxpayers become more familiar with digital systems, leading to periodic surges in filing activity. Furthermore, Iddrisu (2023) and Olaoye et al. (2019) emphasize that digital filing systems improve

compliance and administrative efficiency, although the transition process often introduces temporary volatility due to differences in digital literacy and technological accessibility.

The value of invoices generated through digital invoice management systems (DIMS) recorded a mean value of approximately KES 470,298,955.5 thousand and a median of KES 412,972,034.9 thousand, with a standard deviation of KES 246,839,276.8 thousand. The large standard deviation indicates considerable variation in invoice-reporting activities across the study period. However, unlike ETF, the skewness value of 0.248 suggests that the distribution is relatively symmetric, implying that invoice values were fairly balanced around the mean. The kurtosis value of –0.538 indicates a platykurtic distribution, suggesting fewer extreme observations and a flatter distribution relative to normality. These findings imply that digital invoice reporting became relatively stable and standardized within the tax administration system.

The results are broadly consistent with empirical studies reviewed in the literature. The European Commission (2021) reports that electronic invoicing systems improve transparency and consistency in transaction reporting, thereby strengthening compliance monitoring and reducing tax evasion. Similarly, Kagarama (2019) found that electronic billing systems in Rwanda significantly improved the reliability of transaction reporting and reduced administrative inefficiencies associated with audits. Waiswa and Ngoma (2021) also observed that automated invoice-reporting technologies enhanced VAT compliance and improved tax monitoring capacity in East Africa. Furthermore, Okunogbe and Santoro (2023) argue that digital transaction reporting systems improve traceability and reduce opportunities for underreporting through the creation of verifiable electronic transaction records. The relatively symmetric distribution observed in the present study therefore suggests that digital invoice systems became increasingly integrated into routine tax administration processes over time.

Digital payment platforms (DPP), measured by the value of taxes paid electronically, recorded a mean value of approximately KES 73,530,445.03 thousand and a median of KES 66,472,002.3 thousand, with a standard deviation of KES 55,673,893.44 thousand. The relatively high standard deviation reflects substantial variability in electronic tax

payments during the study period. The skewness value of 1.840 indicates a moderately positively skewed distribution, suggesting that a few periods recorded exceptionally high electronic tax payments relative to the majority of observations. In addition, the kurtosis value of 4.946 indicates a leptokurtic distribution characterized by the presence of extreme values and heavier tails than the normal distribution. These findings imply substantial growth in the use of electronic tax payment systems, although the growth occurred unevenly over time.

The findings are consistent with empirical evidence which suggests that digital payment systems significantly improve the efficiency and transparency of tax administration. Muceke (2021) found that electronic tax payment systems in Sub-Saharan Africa enhanced revenue mobilization by reducing transaction costs and minimizing opportunities for revenue leakage. Similarly, Grichawat (2022) reported that digital payment gateways improved tax compliance and government revenue collection by simplifying payment processes and enhancing transaction traceability. In the Kenyan context, Tanui et al. (2025) observed that the expansion of digital payment systems under the iTax framework improved payment timeliness and reduced administrative costs associated with manual processing. Furthermore, Olaoye et al. (2019) emphasize that electronic payment systems strengthen accountability by creating auditable transaction records and minimizing human intervention in payment processes.

Finally, digital taxpayer education (DTE), represented by the number of online taxpayer education sessions, recorded an average value of 14.115 sessions, with a median of 14.5 sessions and a standard deviation of 5.250 sessions. These results indicate moderate variability in taxpayer education activities over the study period. The negative skewness value of –0.620 suggests a slightly left-skewed distribution, implying that relatively higher numbers of taxpayer education sessions occurred more frequently than lower values. In addition, the kurtosis value of 0.217 indicates that the distribution approximates normality with limited extreme observations. These findings suggest that KRA maintained relatively consistent online taxpayer education and sensitization activities throughout the study period.

The findings are consistent with the reviewed empirical literature, which emphasizes that digital taxpayer education functions as a continuous administrative support mechanism aimed at improving taxpayer awareness, filing accuracy, and voluntary compliance. Njeru (2022) found that digital taxpayer education improved compliance intentions and filing accuracy among taxpayers in East Africa, while Iddrisu (2023) reported that awareness campaigns and digital literacy programs significantly enhanced e-filing adoption in Ghana and Nigeria. Similarly, Olaoye et al. (2019) observed that taxpayer sensitization and training were critical to the success of electronic tax systems because inadequate taxpayer knowledge constrained the realization of efficiency gains. In the Kenyan context, Tanui et al. (2025) established that continuous online taxpayer training under the iTax platform improved filing accuracy and reduced return-processing time, indicating that taxpayer education plays a supportive role in tax administration reform.

4.4 Correlation Analysis

This section presents the correlation analysis conducted to examine the degree and direction of association among the variables included in the study. Correlation analysis provides preliminary insights into how the digitization indicators relate to revenue collection efficiency and also helps to detect potential multicollinearity among the explanatory variables. Table 4.2 presents the Pearson correlation coefficients for revenue collection efficiency and the selected digitization variables used in the analysis.

Table 4.2: Correlation Analysis

Variable	RCE	ETF	DIMS	DPP	DTE
RCE	1.000				
ETF	0.587***	1.000			
DIMS	0.640***	0.607***	1.000		
DPP	0.615***	0.607***	0.418***	1.000	
DTE	0.368***	0.001**	0.020**	0.015**	1.000

Note: ***p < 0.01; ***p < 0.05; *p < 0.10*

Source (Author, 2026)

The correlation results presented in Table 4.2 provide preliminary insights into the linear relationships among the study variables. The findings reveal that revenue collection efficiency (RCE) has positive correlations with all the digitization variables included in the study. Specifically, revenue collection efficiency has a moderately strong positive

correlation with electronic tax filing (ETF) at 0.587. This implies that increased adoption and utilization of electronic tax filing systems are associated with improvements in revenue collection efficiency. The positive association suggests that electronic filing systems simplify tax return submission, improve filing accuracy, reduce administrative delays, and enhance taxpayer compliance, thereby contributing to improved efficiency in tax administration. These findings are consistent with the empirical literature reviewed in the study. Martínez et al. (2022) found that electronic filing systems significantly improved tax compliance and increased tax revenues by simplifying filing procedures and reducing administrative costs associated with manual tax processing. Similarly, Tanui et al. (2025) established that the implementation of Kenya's iTax platform improved filing efficiency, enhanced taxpayer compliance, and reduced return-processing time through automated reporting systems. Njeru (2022) further observed that digital filing systems improved filing accuracy and reduced errors in tax submissions, thereby strengthening the efficiency of tax administration. Likewise, Olaoye et al. (2019) argue that electronic tax systems improve transparency and accountability by minimizing human intervention and establishing digital audit trails that facilitate compliance monitoring and revenue administration.

The results further indicate that revenue collection efficiency has a strong positive correlation with digital invoice management systems (DIMS) at 0.640. This suggests that increased use of electronic invoice management systems is associated with improved efficiency in tax collection. The positive relationship implies that digital invoice systems strengthen transaction monitoring, improve transparency in business reporting, and facilitate effective verification of taxable transactions. Electronic invoice systems therefore enhance the ability of tax authorities to monitor value-added tax obligations and reduce opportunities for underreporting and tax evasion. These findings are supported by empirical studies reviewed in the literature. The European Commission (2021) reports that electronic invoicing systems improve consistency and transparency in transaction reporting, thereby strengthening tax compliance and reducing opportunities for tax fraud. Similarly, Kagarama (2019) found that electronic billing systems in Rwanda significantly improved transaction reporting accuracy and reduced administrative inefficiencies associated with tax audits. Waiswa and Ngoma (2021) also established that automated

invoice-reporting technologies enhanced VAT compliance and improved tax monitoring capacity within East African tax systems. In addition, Okunogbe and Santoro (2023) argue that digital transaction reporting systems improve traceability and facilitate real-time monitoring of taxpayer activities, thereby improving the efficiency of revenue administration.

Revenue collection efficiency also exhibits a strong positive correlation with digital payment platforms (DPP) at 0.615. This finding suggests that increased use of electronic tax payment systems is associated with improved efficiency in tax administration. Digital payment systems facilitate timely payment processing, reduce administrative costs, minimize revenue leakages, and enhance the traceability of tax transactions. The positive relationship therefore implies that digital payment systems play an important role in strengthening revenue mobilization and administrative efficiency within modern tax systems. The findings are consistent with empirical evidence reviewed in the study. Muceke (2021) found that electronic tax payment systems in Sub-Saharan Africa significantly improved revenue mobilization by reducing transaction costs and minimizing opportunities for corruption and revenue leakages. Similarly, Grichawat (2022) reported that digital payment gateways enhanced tax compliance and government revenue collection by simplifying payment procedures and improving transaction traceability. In the Kenyan context, Tanui et al. (2025) established that the expansion of digital payment systems under the iTax framework improved payment timeliness and reduced operational inefficiencies associated with manual processing systems. Furthermore, Olaoye et al. (2019) emphasize that electronic payment systems strengthen financial accountability by generating auditable transaction records and minimizing human intervention in payment processing activities.

The results also indicate that revenue collection efficiency has a positive but relatively weaker correlation with digital taxpayer education (DTE) at 0.368. Although the relationship is weaker compared to other digitization variables, the positive coefficient suggests that online taxpayer education programs are associated with improvements in revenue collection efficiency. This implies that taxpayer sensitization and awareness initiatives contribute to improved compliance behavior, filing accuracy, and adoption of

digital tax systems. However, the relatively weaker magnitude of the correlation may suggest that the impact of taxpayer education occurs gradually over time and indirectly through improved utilization of other digital tax administration systems. These findings are consistent with empirical literature which suggests that the effects of taxpayer education on compliance and revenue performance tend to materialize progressively rather than instantaneously. Njeru (2022) found that taxpayer education programs improved compliance behavior primarily by increasing taxpayer awareness and understanding of tax obligations over time. Similarly, Iddrisu (2023) reported that digital taxpayer education indirectly influenced the adoption of electronic tax systems through improvements in digital literacy and taxpayer trust in electronic systems. Olaoye et al. (2019) further observed that taxpayer education acts as a complementary institutional mechanism that supports the effectiveness of electronic tax systems by encouraging voluntary compliance and reducing filing and reporting errors. In the Kenyan context, Tanui et al. (2025) established that online taxpayer sensitization initiatives under the iTax platform improved filing accuracy and taxpayer engagement, although the effects on revenue performance emerged gradually as taxpayers adapted to digital processes.

The correlations among the independent variables are also noteworthy. The findings show that electronic tax filing (ETF) has a strong positive correlation with digital invoice management systems (DIMS) at 0.607 and with digital payment platforms (DPP) at 0.607. These positive relationships indicate that taxpayers who adopt one digital tax administration tool are also likely to adopt other related digital systems. This suggests complementarities among digital tax administration platforms and implies that the implementation of integrated tax systems strengthens overall digital adoption within the tax administration framework. The findings are consistent with empirical literature emphasizing the interconnected nature of digital tax administration systems. Martínez et al. (2022) argue that the effectiveness of digital tax reforms depends heavily on the integration of multiple technological tools such as electronic filing, digital payment systems, and transaction monitoring platforms. Similarly, Okunogbe and Santoro (2023) emphasize that digital tax systems work most effectively when filing, payment, and reporting systems are integrated, enabling tax authorities to monitor taxpayer activities

across multiple stages of the tax administration process. Tanui et al. (2025) also found that Kenya's iTax platform facilitated the simultaneous adoption of electronic filing and digital payment systems, thereby strengthening compliance and improving administrative efficiency.

The correlation between digital invoice management systems (DIMS) and digital payment platforms (DPP) is also positive and moderately strong at 0.418. This suggests that electronic invoicing and electronic payment systems complement each other within the broader digital tax ecosystem. The integration of invoicing and payment platforms improves transaction traceability and enhances the ability of tax authorities to verify reported tax obligations against actual payments. The results further show that digital taxpayer education (DTE) has extremely weak positive correlations with ETF (0.001), DIMS (0.020), and DPP (0.015). These weak correlations suggest that taxpayer education programs may not have an immediate direct relationship with the operational volumes of filing, invoicing, or payment activities. Instead, taxpayer education may influence these systems indirectly through long-term behavioral changes, increased awareness, and gradual improvements in digital literacy and taxpayer confidence.

4.5 Diagnostic Test

This section presents the diagnostic tests conducted to assess the reliability and validity of the econometric model used in the study. Diagnostic testing is an essential step in time-series analysis as it ensures that the underlying assumptions of the regression model are satisfied before interpreting the estimated results. Specifically, the study examines multicollinearity among explanatory variables, stationarity of the time-series data, heteroskedasticity of residuals, autocorrelation and normality of the error terms. These tests help to detect potential econometric problems and guide appropriate model adjustments for robust and reliable estimation.

4.5.1 Multicollinearity Test

This section presents the multicollinearity test conducted to determine whether high correlations exist among the independent variables used in the model. Multicollinearity can lead to unstable coefficient estimates and reduce the reliability of regression results. To

assess this problem, the Variance Inflation Factor (VIF) was employed. The VIF is a widely used diagnostic measure for detecting multicollinearity in regression analysis. As a rule of thumb, VIF values exceeding 10 indicate severe multicollinearity, while values between 5 and 10 may suggest moderate multicollinearity that requires attention. Table 4.3 presents the VIF results for the explanatory variables, which help determine whether multicollinearity is present in the model.

Table 4.3: Variance Inflation Factor

Variable	VIF
const	15.552
Electronic tax filing (ETF)	2.043
Digital payment platforms (DPP)	3.818
Digital invoice management system (DIMS)	2.793
Digital taxpayer education (DTE)	1.186
ETF_lag1	2.113
DPP_lag1	4.185
DIMS_lag1	2.177
DTE_lag1	1.202

Source (Author, 2026)

The results presented in Table 4.3 indicate that all explanatory variables included in the regression model have Variance Inflation Factor (VIF) values well below the commonly accepted threshold of 10, suggesting the absence of severe multicollinearity. Specifically, electronic tax filing (ETF) records a VIF value of 2.043, indicating a low level of correlation with other explanatory variables. Similarly, digital invoice management systems (DIMS) and digital taxpayer education (DTE) record VIF values of 2.793 and 1.186, respectively, suggesting very minimal linear dependence among the regressors. These results imply that each of the digitization variables contributes unique explanatory information in the model and does not introduce instability in the coefficient estimates.

These findings are consistent with the empirical literature reviewed, which suggests that different dimensions of digital tax administration such as electronic filing, digital invoicing, and taxpayer education often operate as complementary but conceptually distinct components of tax system modernization. For example, Martínez et al. (2022) note that while digital tax reforms involve multiple technological tools, each component performs a specific function within the broader tax administration framework, thereby

reducing the likelihood of perfect collinearity among reform indicators. Similarly, Okunogbe and Santoro (2023) emphasize that digital tax systems typically integrate several operational modules such as filing platforms, payment systems, and transaction monitoring tools that function independently while collectively enhancing tax administration performance.

With respect to digital payment platforms (DPP), the VIF value of 3.818 indicates a moderate but still acceptable level of correlation with other explanatory variables. However, the value remains far below the critical threshold of 10, implying that it does not pose a serious multicollinearity problem. This finding aligns with studies such as Tanui et al. (2025) and Olaoye et al. (2019), which highlight that electronic payment systems operate alongside other digital tax tools but remain functionally distinct because they specifically address the tax payment stage rather than the filing or reporting processes. The lagged variables included in the model also exhibit acceptable VIF values. For example, ETF_lag1 (2.113), DIMS_lag1 (2.177), and DTE_lag1 (1.202) all indicate low levels of multicollinearity.

The lagged digital payment variable (DPP_lag1) records the highest VIF value among the regressors at 4.185, although this value still falls below the commonly used threshold of 5 that signals potential multicollinearity concerns. The relatively higher VIF for this variable is expected because time-series models that incorporate lagged variables inherently capture temporal dependence between current and past values of the same variable. Such relationships are commonly observed in dynamic tax administration models where policy interventions and technological adoption often influence outcomes over multiple periods (Martínez et al., 2022; Okunogbe & Santoro, 2023). The constant term (const) records a VIF value of 15.552, which is relatively high. However, this does not present a multicollinearity problem because the VIF associated with the intercept is typically not considered problematic in regression analysis. As emphasized in econometric literature, multicollinearity diagnostics primarily focus on the explanatory variables rather than the intercept, since the constant term merely captures the baseline level of the dependent variable and does not affect the relationships among the regressors.

4.5.2 Stationarity Test

This section presents the stationarity test conducted to determine whether the time-series variables used in the study are stationary. Stationarity is an important requirement in time-series analysis because non-stationary data may lead to spurious regression results. The Augmented Dickey–Fuller (ADF) test was employed to examine the presence of unit roots in the variables. Table 4.4 presents the ADF test results, which indicate whether the variables are stationary at levels or after differencing.

Table 4.4: Augmented Dickey–Fuller (ADF) Test

Variable	ADF Statistic	p-value	Lags Used	Critical Value 1%	Critical Value 5%	Critical Value 10%
d_RCE	-6.887	0.000	11	-3.477	-2.882	-2.578
d_ETF	-9.009	0.000	10	-3.477	-2.882	-2.578
d_DPP	-2.109	0.241	13	-3.478	-2.882	-2.578
d_DIMS	-2.057	0.262	14	-3.478	-2.882	-2.578
d_DTE	-5.440	0.000	13	-3.478	-2.882	-2.578

Source (Author, 2026)

The results presented in Table 4.4 indicate mixed stationarity properties among the study variables after first differencing. The results show that first-differenced revenue collection efficiency (d_RCE) is stationary. The ADF statistic of –6.887 is more negative than the critical values at the 1%, 5%, and 10% significance levels, while the corresponding p-value (0.000) is far below the 0.05 threshold. This implies that the null hypothesis of a unit root is rejected, confirming that the differenced revenue collection efficiency series is stationary. Similarly, the first-differenced electronic tax filing variable (d_ETF) is also stationary. The ADF statistic of –9.009 is significantly lower than all critical values, and the p-value (0.000) provides strong evidence against the presence of a unit root. This result indicates that the electronic tax filing variable becomes stationary after first differencing. In addition, digital taxpayer education (d_DTE) also demonstrates stationarity after differencing. The ADF statistic of –5.440 is more negative than the relevant critical values, and the p-value (0.000) is below the 0.05 significance level, confirming that the null hypothesis of a unit root is rejected. These findings are broadly consistent with the empirical literature on digital tax administration which indicates that certain components of tax digitization tend to stabilize relatively quickly once implemented. For instance,

Tanui et al. (2025) found that electronic filing systems and taxpayer education programs tend to exhibit relatively stable operational patterns once taxpayers adapt to digital platforms. Similarly, Njeru (2022) reported that electronic filing adoption stabilizes over time as taxpayers become familiar with digital systems, resulting in more predictable filing behavior.

However, the results show that the first differences of digital payment platforms (d_DPP) and digital invoice management systems (d_DIMS) remain non-stationary. For d_DPP, the ADF statistic of –2.109 is less negative than the critical value at the 5% significance level (–2.882), and the p-value of 0.241 exceeds the 0.05 threshold, indicating that the null hypothesis of a unit root cannot be rejected. Similarly, the first-differenced digital invoice management systems (d_DIMS) variable records an ADF statistic of –2.057, which is also less negative than the critical value at the 5% level (–2.882), while the p-value of 0.262 remains above the 0.05 significance level. These results indicate that both variables remain non-stationary even after first differencing. Such behavior is consistent with the literature which suggests that digital payment platforms and electronic invoicing systems often experience gradual expansion and structural growth patterns as governments scale up digital infrastructure and taxpayers progressively adopt new technologies. For example, Okunogbe and Santoro (2023) note that digital tax systems often exhibit trending behavior due to continuous technological upgrades and increasing taxpayer participation. Similarly, Martínez et al. (2022) report that digital tax administration tools such as electronic payments and transaction monitoring systems tend to grow steadily as tax authorities expand digital infrastructure and enforcement mechanisms.

The presence of mixed stationarity results implies that some variables are stationary after differencing while others remain non-stationary. In such situations, the use of ordinary least squares (OLS) estimation may produce inefficient or biased estimates due to violations of the classical regression assumptions associated with non-stationary time-series data. To address this econometric challenge and ensure robust estimation, the study adopted the Generalized Least Squares (GLS) estimation technique. GLS is appropriate in this context because it adjusts for potential violations of classical assumptions, including heteroskedasticity and autocorrelation, and provides more efficient parameter estimates

when the error structure of the model deviates from the assumptions of ordinary least squares. The adoption of GLS is consistent with empirical studies examining the impact of digital tax administration reforms, where time-series data often exhibit non-stationarity and structural dynamics that require more flexible estimation techniques (Martínez et al., 2022; Okunogbe & Santoro, 2023).

4.5.3 Heteroskedasticity Test

This section presents the heteroskedasticity test conducted to determine whether the variance of the error terms in the regression model remains constant. The presence of heteroskedasticity can lead to inefficient coefficient estimates and biased standard errors, thereby affecting the reliability of statistical inference. To assess this problem, the Breusch–Pagan test was employed. Table 4.5 presents the results of the Breusch–Pagan test, which indicate whether heteroskedasticity is present in the regression model.

Table 4.5: Breusch Pagan Test

Test	Value
Lagrange Multiplier Statistic	54.299
LM p-value	0.000
F-statistic	9.841
F p-value	0.000

Source (Author, 2026)

The results of the Breusch–Pagan heteroskedasticity test presented in Table 4.5 indicate the presence of heteroskedasticity in the regression model. The Lagrange Multiplier (LM) statistic of 54.299 with a corresponding p-value of 0.000 is significantly below the conventional 0.05 significance level. Similarly, the F-statistic of 9.841 with a p-value of 0.000 also falls well below the 0.05 threshold. These results provide strong statistical evidence to reject the null hypothesis of homoskedasticity, implying that the variance of the error terms is not constant across the observations. In econometric analysis, the presence of heteroskedasticity suggests that the ordinary least squares (OLS) estimator may still remain unbiased but becomes inefficient, and the estimated standard errors may be unreliable, potentially leading to incorrect statistical inference regarding the significance of explanatory variables. The presence of heteroskedasticity in this study is consistent with empirical literature examining tax administration and digitalization reforms. Digital tax

systems often generate uneven patterns in tax payments, filing behavior, and transaction reporting across time, which may lead to unequal variances in regression residuals. For instance, Martínez et al. (2022) observe that the introduction of digital tax administration tools often leads to heterogeneous compliance responses across taxpayers and time periods, which may produce heteroskedastic patterns in econometric models analyzing tax system performance. Similarly, Okunogbe and Santoro (2023) argue that digital tax reforms in developing economies frequently generate variations in compliance levels and revenue performance due to differences in taxpayer adoption rates, technological infrastructure, and administrative enforcement capacity.

To address this econometric challenge and ensure the robustness of the estimated parameters, the study employed the Generalized Least Squares (GLS) estimation technique. GLS is particularly appropriate when the classical assumptions of the OLS model are violated, as it adjusts for heteroskedasticity and improves the efficiency of parameter estimates. By transforming the error structure of the regression model, GLS accounts for unequal variances across observations and produces more reliable coefficient estimates and standard errors. The use of GLS in the context of tax administration studies is supported by empirical research that emphasizes the importance of employing robust estimation techniques when analyzing fiscal performance and digital tax reforms using time-series data (Martínez et al., 2022; Okunogbe & Santoro, 2023).

4.5.4 Autocorrelation Test

This section presents the autocorrelation test conducted to determine whether the residuals of the regression model are correlated across time. In time-series analysis, the presence of autocorrelation violates the assumption of independent error terms and may lead to inefficient parameter estimates and biased statistical inference. To detect this problem, the Durbin–Watson test was employed. Table 4.6 presents the results of the Durbin–Watson test, which indicate whether serial correlation exists in the residuals of the estimated model.

Table 4.6: Durbin–Watson Test

Test	Value
Durbin-Watson	1.859

Source (Author, 2026)

The results reported in Table 4.6 indicate a Durbin–Watson statistic of 1.859 which is close to the benchmark value of 2 but slightly below it. This suggests the presence of a mild degree of positive serial correlation in the regression residuals. In time-series analysis, particularly when dealing with monthly observations, such serial dependence is not uncommon because observations occurring in adjacent periods are often influenced by similar economic, administrative, and institutional conditions. Consequently, the result implies that the assumption of no autocorrelation in the error terms is not fully satisfied. The presence of autocorrelation has important econometric implications because it may cause the ordinary least squares (OLS) estimator to become inefficient and produce biased estimates of the standard errors. As a result, hypothesis testing based on conventional OLS statistics may become unreliable due to incorrect t-statistics and p-values. In the context of the study, which examines the effect of digitization of tax services on revenue collection efficiency over time, the presence of serial correlation may arise from the dynamic nature of digital tax administration reforms.

Empirical studies have shown that tax digitization initiatives such as electronic filing, digital payment systems and transaction monitoring platforms often generate gradual adjustments in compliance behavior and revenue performance across time periods. For example, Martínez et al. (2022) note that digital tax administration reforms often exhibit temporal persistence because taxpayer adoption and administrative adjustments occur progressively rather than instantaneously. Similarly, Okunogbe and Santoro (2023) argue that tax system modernization tends to produce dynamic responses in revenue performance, which can introduce serial dependence in econometric models analyzing tax reforms. To address this econometric issue and improve the reliability of the empirical results, the study adopted the Generalized Least Squares (GLS) estimation technique. GLS is particularly appropriate when autocorrelation is present because it adjusts for the serial dependence in the error structure and produces more efficient and consistent parameter estimates than ordinary least squares. By correcting for correlated residuals, GLS ensures that the estimated coefficients and associated statistical tests remain reliable.

4.5.5 Normality Test

This section presents the normality test conducted to examine whether the residuals of the regression model are normally distributed. Normality of residuals is an important assumption in regression analysis because it ensures the validity of statistical inference and hypothesis testing. To assess this assumption, a normality test was performed on the model residuals. Table 4.7 presents the results of the normality test used to determine whether the residuals follow a normal distribution.

Table 4.7: Normality Test

Test	Value
Shapiro-Wilk Statistic	0.858
p-value	0.000

Source (Author, 2026)

The results presented in Table 4.7 indicate that the Shapiro–Wilk statistic is 0.858, with a corresponding p-value of 0.000, which is significantly lower than the conventional 5 percent significance level. Consequently, the null hypothesis of normally distributed residuals is rejected, indicating that the residuals of the regression model do not follow a normal distribution. The violation of the normality assumption may arise due to the presence of extreme observations, structural shifts in the data, or the inherent volatility commonly associated with fiscal and administrative time-series data. In the context of this study, which examines the effect of digitization of tax services on revenue collection efficiency using monthly data over an extended period, the presence of non-normal residuals is not entirely unexpected. Periods of major policy reforms, technological upgrades, and changes in taxpayer compliance behavior may introduce irregularities in the distribution of the error terms. These findings are consistent with empirical studies on tax administration reforms which suggest that fiscal data often exhibit non-normal characteristics due to structural adjustments and policy interventions. For instance, Martínez et al. (2022) note that digital tax administration reforms frequently generate uneven revenue outcomes during transition periods, as taxpayers gradually adapt to new technological systems. Similarly, Okunogbe and Santoro (2023) observe that tax digitization initiatives often introduce temporary volatility in tax performance due to differences in taxpayer adoption rates, technological infrastructure, and administrative

enforcement capacity. Such transitional dynamics may lead to irregular distributions in econometric models that analyze fiscal performance using time-series data.

When the normality assumption is violated, the reliability of ordinary least squares (OLS) estimation may be affected, particularly with respect to hypothesis testing and statistical inference. Non-normal residuals can result in biased standard errors and unreliable test statistics, which may distort the interpretation of the estimated relationships between variables. To address this econometric issue and enhance the robustness of the empirical results, the study adopted the Generalized Least Squares (GLS) estimation technique. GLS is well suited for situations where classical regression assumptions are violated, including cases involving heteroskedasticity, autocorrelation, and non-normal error distributions. By adjusting the estimation process to account for irregularities in the error structure, GLS produces more efficient parameter estimates and improves the reliability of statistical inference.

4.6 Effect of Digitization of Tax Services on Revenue Collection Efficiency in Kenya

This section presents the empirical results of the regression analysis examining the effect of digitization of tax services on revenue collection efficiency in Kenya. Given the violations identified in the diagnostic tests, the Generalized Least Squares (GLS) estimation technique was adopted to obtain efficient and reliable parameter estimates. The GLS model allows for correction of heteroskedasticity and autocorrelation, thereby improving the robustness of the results. The section discusses the estimated GLS coefficients and the overall model statistics to evaluate the influence of electronic tax filing, digital payment platforms, digital invoice management systems, and digital taxpayer education on revenue collection efficiency.

4.6.1 Generalize Least Square Coefficients

The empirical model initially included both contemporaneous and one-month lagged values of the digitization variables to capture potential delayed effects on revenue collection efficiency. However, preliminary GLS estimations showed that the lagged variables (ETF_lag1, DPP_lag1, DIMS_lag1, and DTE_lag1) were statistically insignificant and did not materially affect the magnitude, direction, or significance of the

contemporaneous coefficients. Additionally, their inclusion did not improve model fit. Consequently, to achieve a more parsimonious and interpretable model, the lagged variables were excluded from the final GLS specification. Table 4.8 therefore presents only the contemporaneous coefficient estimates used for hypothesis testing and interpretation.

Table 4.8: Generalize Least Square Coefficients

Variable	Coefficient	Std Error	t-value	P value	Lower_95CI	Upper_95CI
const	9.843	4.214	2.336	0.021	1.510	18.175
ETF	0.230	0.082	2.792	0.006	0.067	0.393
DPP	0.574	0.068	8.497	0	0.440	0.707
DIMS	0.438	0.119	3.690	0.000	0.203	0.673
DTE	0.074	0.032	2.326	0.022	0.011	0.136

Source (Author, 2026)

The results presented in Table 4.8 show the estimated Generalized Least Squares (GLS) regression coefficients examining the effect of digitization of tax services on revenue collection efficiency in Kenya. The estimated constant term (intercept) has a coefficient of 9.843 with a standard error of 4.214 and a t-value of 2.336. The associated p-value of 0.021 indicates that the intercept is statistically significant at the 5 percent significance level. This finding suggests that even in the absence of the explanatory variables included in the model, there exists a positive baseline level of revenue collection efficiency attributable to other institutional, economic, and administrative factors not explicitly captured in the regression model. The 95 percent confidence interval ranging from 1.510 to 18.175 further confirms the statistical reliability of the intercept estimate. In empirical studies of tax administration, the constant term often reflects the influence of broader macroeconomic conditions, fiscal policy measures, institutional frameworks, and administrative reforms that contribute to revenue performance independently of the explanatory variables (Martínez et al., 2022; Okunogbe & Santoro, 2023).

The coefficient for electronic tax filing (ETF) is 0.230 with a standard error of 0.082 and a t-value of 2.792. The p-value of 0.006 indicates that electronic tax filing has a statistically significant positive effect on revenue collection efficiency at the 1 percent significance level. The positive coefficient implies that an increase in electronic tax filing activity leads to improvements in revenue collection efficiency. Specifically, a unit increase in electronic

tax filing is associated with an increase of approximately 0.230 units in revenue collection efficiency, holding other factors constant. The 95 percent confidence interval ranging from 0.067 to 0.393 does not include zero, further confirming the statistical significance of the variable. This finding suggests that electronic filing systems contribute significantly to improving tax administration efficiency by simplifying tax return submission processes, reducing administrative delays, minimizing filing errors, and strengthening taxpayer compliance. Electronic filing systems also enhance transparency and reduce operational inefficiencies associated with manual processing systems. These findings are consistent with the empirical literature reviewed in the study. Martínez et al. (2022) found that electronic filing systems improve tax administration performance by reducing compliance costs and enhancing processing efficiency. Similarly, Tanui et al. (2025) observed that Kenya's iTax platform significantly improved filing efficiency and taxpayer compliance through automated reporting mechanisms. Njeru (2022) further established that digital filing systems improve filing accuracy and reduce errors in tax submissions, thereby strengthening revenue administration efficiency.

Digital payment platforms (DPP) record a coefficient of 0.574 with a standard error of 0.068 and a t-value of 8.497. The p-value of 0.000 indicates that digital payment platforms have a highly statistically significant positive effect on revenue collection efficiency. The positive coefficient implies that increased use of electronic tax payment systems significantly enhances revenue collection efficiency. Specifically, a unit increase in digital payment platform usage is associated with an increase of approximately 0.574 units in revenue collection efficiency, ceteris paribus. The confidence interval ranging from 0.440 to 0.707 confirms the robustness and precision of the estimate. This finding highlights the critical role of electronic payment systems in strengthening tax administration performance. Digital payment systems improve the speed, transparency, traceability, and accountability of tax transactions while simultaneously reducing opportunities for revenue leakages and corruption. These findings strongly support the empirical literature reviewed in the study. Muceke (2021) found that electronic tax payment systems significantly enhanced revenue mobilization in Sub-Saharan Africa by reducing transaction costs and increasing payment compliance. Similarly, Grichawat (2022) reported that digital payment

gateways improved tax collection efficiency by simplifying payment procedures and strengthening financial accountability within tax administration systems. Cross-country evidence by Martínez et al. (2022) and Okunogbe and Santoro (2023) further demonstrates that digital payment technologies improve revenue performance by increasing transparency and minimizing opportunities for tax evasion and revenue leakages.

The coefficient for digital invoice management systems (DIMS) is 0.438 with a standard error of 0.119 and a t-value of 3.690. The p-value of 0.000 indicates that digital invoice management systems have a statistically significant positive effect on revenue collection efficiency. The coefficient suggests that a unit increase in electronic invoice reporting is associated with an increase of approximately 0.438 units in revenue collection efficiency. The 95 percent confidence interval ranging from 0.203 to 0.673 confirms the reliability and statistical significance of the estimate.This finding implies that electronic invoice management systems improve the efficiency of tax administration by strengthening transaction monitoring, improving transparency in business reporting, and enhancing verification of taxable transactions. The findings align with empirical studies reviewed in the literature. The European Commission (2021) reports that electronic invoicing systems improve tax transparency and strengthen compliance monitoring by standardizing transaction reporting processes. Similarly, Kagarama (2019) found that electronic billing systems in Rwanda significantly improved transaction reporting accuracy and reduced administrative inefficiencies associated with tax audits. Waiswa and Ngoma (2021) also observed that automated invoice-reporting technologies enhanced VAT compliance and strengthened tax monitoring capacity in East African tax systems. Okunogbe and Santoro (2023) further argue that digital transaction reporting systems improve traceability and reduce opportunities for tax evasion by enabling tax authorities to verify taxpayer declarations electronically.

Digital taxpayer education (DTE) records a coefficient of 0.074 with a standard error of 0.032 and a t-value of 2.326. The p-value of 0.022 indicates that digital taxpayer education has a statistically significant positive effect on revenue collection efficiency at the 5 percent significance level. The coefficient suggests that increased online taxpayer education and sensitization activities contribute positively to improvements in revenue collection

efficiency. Specifically, a unit increase in digital taxpayer education is associated with an increase of approximately 0.074 units in revenue collection efficiency, holding other variables constant. The confidence interval ranging from 0.011 to 0.136 further confirms the statistical significance of the estimate. This finding implies that taxpayer education programs improve taxpayer awareness, encourage voluntary compliance, and enhance understanding of tax obligations and digital tax systems. Online taxpayer sensitization initiatives help taxpayers adapt to electronic filing systems, digital payment platforms, and electronic invoicing technologies, thereby improving the overall efficiency of tax administration. These findings are consistent with empirical literature reviewed in the study. Olaoye et al. (2019) argue that taxpayer education enhances voluntary compliance by improving taxpayer knowledge and reducing filing and reporting errors. Similarly, Iddrisu (2023) found that digital taxpayer education significantly improved taxpayer adoption of electronic tax systems through increased digital literacy and awareness. In the Kenyan context, Tanui et al. (2025) established that continuous taxpayer sensitization under the iTax platform improved filing accuracy, taxpayer engagement, and compliance behavior.

4.6.2 Generalize Least Square Model Statistics

This section presents the overall model statistics for the Generalized Least Squares (GLS) estimation used in the study. Model statistics are important in assessing the overall performance, explanatory power and goodness-of-fit of the estimated regression model. These statistics provide insights into how well the independent variables jointly explain variations in revenue collection efficiency. Table 4.9 presents the GLS model statistics, including key indicators used to evaluate the adequacy and reliability of the estimated model.

Table 4.9: Generalize Least Square Model Statistics

Statistic	Value
R-squared	0.779
Adj. R-squared	0.727
F-statistic	15.196
Prob(F-statistic)	0.000
AIC	1335.101
BIC	1422.41

Source (Author, 2026)

The results presented in Table 4.9 indicate that the Generalized Least Squares (GLS) model possesses strong explanatory power in examining the effect of digitization of tax services on revenue collection efficiency in Kenya. The R-squared value of 0.779 implies that approximately 77.9 percent of the variation in revenue collection efficiency is explained by the explanatory variables included in the model, namely electronic tax filing, digital payment platforms, digital invoice management systems, and digital taxpayer education. This relatively high coefficient of determination suggests that the digitization variables collectively account for a substantial proportion of the observed changes in revenue collection efficiency during the study period. The findings are consistent with empirical literature which emphasizes the importance of digital technologies in improving tax administration performance. Martínez et al. (2022) found that digital tax administration systems significantly enhance revenue mobilization by improving compliance monitoring, reducing administrative inefficiencies, and strengthening transaction transparency. Similarly, Okunogbe and Santoro (2023) argue that the adoption of digital technologies within tax administration improves information flows between taxpayers and revenue authorities, thereby increasing compliance efficiency and revenue performance.

The adjusted R-squared value of 0.727 further confirms the robustness and reliability of the estimated model. Unlike the ordinary R-squared statistic, the adjusted R-squared accounts for the number of explanatory variables included in the regression model and adjusts the goodness-of-fit measure accordingly. The adjusted value indicates that after controlling for the number of predictors in the model, approximately 72.7 percent of the variation in revenue collection efficiency remains explained by the explanatory variables. The relatively small difference between the R-squared and adjusted R-squared values suggests that the explanatory variables included in the model contribute meaningfully to explaining changes in revenue collection efficiency and that the model does not suffer from substantial overfitting. This finding indicates that the model specification is appropriate and statistically reliable for explaining the relationship between tax digitization initiatives and revenue collection efficiency. The F-statistic of 15.196, with a corresponding probability value of 0.000, further demonstrates that the overall regression model is statistically significant. The statistically significant F-statistic indicates that the explanatory

variables jointly have a significant effect on revenue collection efficiency. This finding provides strong empirical support for the argument that digitization of tax administration significantly influences the performance of revenue collection systems. The result is consistent with previous empirical studies which establish that integrated digital tax administration systems improve compliance management, strengthen transparency, and enhance revenue mobilization outcomes (Muceke, 2021; Martínez et al., 2022).

The Akaike Information Criterion (AIC) and Bayesian Information Criterion (BIC) provide additional measures for evaluating the quality and efficiency of the estimated GLS model. These information criteria are commonly used in econometric analysis to assess the balance between model fit and model complexity. Generally, lower AIC and BIC values indicate better-fitting and more parsimonious models relative to alternative specifications. In this study, the GLS model records an AIC value of 1335.101 and a BIC value of 1422.410. These relatively moderate values suggest that the estimated model achieves an acceptable balance between explanatory power and model simplicity. The relatively close relationship between the AIC and BIC values further suggests that the model does not suffer from excessive complexity arising from unnecessary predictors or over-parameterization. Instead, the model appears to capture the essential dynamics linking tax digitization initiatives to revenue collection efficiency while maintaining statistical parsimony. This finding aligns with empirical literature which emphasizes the importance of parsimonious econometric models in fiscal and public finance studies. Martínez et al. (2022) and Okunogbe and Santoro (2023) similarly argue that well-specified digital tax administration models should balance explanatory strength with model simplicity to ensure reliable inference and policy relevance.

4.7 Chapter Summary

This chapter presented the empirical analysis and findings on the effect of digitization of tax services on revenue collection efficiency in Kenya using monthly data covering the period 2013–2025. The analysis utilized 156 observations for each variable with no missing values reported. Descriptive statistics were used to summarize the distributional characteristics and variability of the study variables, revealing considerable fluctuations in revenue collection efficiency and the digitization indicators over time. Correlation analysis

indicated positive relationships between revenue collection efficiency and all digitization variables, particularly digital invoice management systems and digital payment platforms. Diagnostic tests for multicollinearity, stationarity, heteroskedasticity, autocorrelation, and normality were conducted to assess the reliability of the regression model. The results revealed violations of some classical regression assumptions, including heteroskedasticity, non-normality, and serial correlation. Consequently, the study adopted the Generalized Least Squares (GLS) estimation technique to obtain efficient and robust estimates. The GLS regression results demonstrated that electronic tax filing, digital payment platforms, digital invoice management systems, and digital taxpayer education all have positive and statistically significant effects on revenue collection efficiency in Kenya. Among these variables, digital payment platforms exhibited the strongest positive influence. Overall, the findings confirmed that digitization initiatives play a significant role in improving the efficiency and effectiveness of tax administration in Kenya.

VT OMNES VNVM SINT

Chapter Five: Discussion, Conclusion and Recommendation

5.1 Introduction

The begins with a summary of the major findings in relation to the study objectives, followed by a discussion of the results in the context of existing empirical literature. The chapter then presents the conclusions and policy recommendations. Finally, the chapter outlines the limitations of the study and provides suggestions for future research.

5.2 Summary of Findings

The study examined the effect of digitization of tax services on revenue collection efficiency in Kenya using monthly time-series data covering the period 2013–2025. Specifically, the study focused on four dimensions of tax digitization: electronic tax filing, digital payment platforms, digital invoice management systems, and digital taxpayer education. The study utilized descriptive statistics, correlation analysis, diagnostic tests, and Generalized Least Squares (GLS) regression analysis to establish the relationship between tax digitization initiatives and revenue collection efficiency. The findings generated from the empirical analysis are summarized according to the specific objectives of the study.

The first objective of the study was to determine the effect of electronic tax filing on revenue collection efficiency in Kenya. The descriptive statistics indicated substantial growth and variability in electronically filed returns over the study period, suggesting increasing adoption of electronic filing systems among taxpayers. Correlation analysis further revealed a moderately strong positive relationship between electronic tax filing and revenue collection efficiency, implying that increased electronic filing activity was associated with improvements in tax administration efficiency. The GLS regression results confirmed that electronic tax filing has a positive and statistically significant effect on revenue collection efficiency. Specifically, the findings indicated that increased electronic filing significantly enhances efficiency in tax administration by simplifying filing procedures, reducing administrative delays, minimizing filing errors, and strengthening taxpayer compliance. These findings suggest that electronic tax filing systems contribute significantly to improving operational efficiency within tax administration. The results are

consistent with empirical studies by Martínez et al. (2022), Njeru (2022), and Tanui et al. (2025), which established that electronic filing systems improve compliance management, reduce processing costs, and enhance administrative efficiency within tax systems.

The second objective of the study was to examine the effect of digital payment platforms on revenue collection efficiency in Kenya. The descriptive results showed substantial growth in the value of taxes paid electronically over the study period, indicating increased adoption of electronic payment systems within Kenya's tax administration framework. Correlation analysis demonstrated a strong positive association between digital payment platforms and revenue collection efficiency. The GLS regression results further revealed that digital payment platforms have the strongest positive and statistically significant effect on revenue collection efficiency among all the digitization variables examined in the study. The findings imply that increased use of electronic payment systems significantly improves revenue collection efficiency through faster payment processing, increased transparency, enhanced transaction traceability, reduced administrative costs, and minimization of revenue leakages. These results demonstrate that digital payment systems represent a critical component of modern tax administration reforms. The findings are consistent with previous empirical studies by Muceke (2021), Grichawat (2022), Martínez et al. (2022), and Okunogbe and Santoro (2023), which found that digital payment systems strengthen compliance, improve accountability, and enhance revenue mobilization by simplifying tax payment procedures and reducing opportunities for corruption and inefficiency.

The third objective of the study was to assess the effect of digital invoice management systems on revenue collection efficiency in Kenya. The descriptive statistics showed that electronic invoice reporting recorded high average transaction values with relatively stable reporting patterns over time. Correlation analysis further established a strong positive relationship between digital invoice management systems and revenue collection efficiency. The GLS regression results revealed that digital invoice management systems have a positive and statistically significant effect on revenue collection efficiency. The findings suggest that electronic invoice systems improve tax administration efficiency by strengthening transaction monitoring, enhancing transparency in business reporting, improving verification of taxable transactions, and reducing opportunities for

underreporting and tax evasion. The results therefore demonstrate that digital invoice management systems play a significant role in strengthening tax compliance and improving tax administration performance. These findings are consistent with empirical literature reviewed in the study. The European Commission (2021), Kagarama (2019), Waiswa and Ngoma (2021), and Okunogbe and Santoro (2023) similarly found that electronic invoicing systems improve transaction traceability, strengthen compliance monitoring, and enhance the efficiency of tax administration systems.

The fourth objective of the study was to evaluate the effect of digital taxpayer education on revenue collection efficiency in Kenya. The descriptive statistics revealed relatively stable online taxpayer education activities over the study period, indicating continuous taxpayer sensitization efforts by the Kenya Revenue Authority. Correlation analysis established a positive but relatively weaker relationship between digital taxpayer education and revenue collection efficiency compared to other digitization variables. Nevertheless, the GLS regression results demonstrated that digital taxpayer education has a positive and statistically significant effect on revenue collection efficiency. The findings suggest that online taxpayer education programs improve taxpayer awareness, strengthen voluntary compliance, and enhance taxpayers' understanding of digital tax systems and tax obligations. Consequently, taxpayer education initiatives facilitate improved utilization of electronic filing systems, digital payment platforms, and electronic invoicing technologies, thereby contributing positively to overall tax administration efficiency. These findings are consistent with empirical studies by Olaoye et al. (2019), Iddrisu (2023), Njeru (2022), and Tanui et al. (2025), which established that taxpayer education enhances compliance behavior, improves filing accuracy, and increases adoption of digital tax administration systems.

In addition to evaluating the specific objectives, the study conducted several diagnostic tests to assess the reliability and validity of the econometric model. The multicollinearity test results indicated that all explanatory variables had acceptable Variance Inflation Factor (VIF) values below the critical threshold, implying the absence of severe multicollinearity among the regressors. The Augmented Dickey–Fuller (ADF) stationarity tests revealed mixed stationarity properties among the variables, with some variables becoming

stationary after first differencing while others remained non-stationary. The Breusch–Pagan heteroskedasticity test results confirmed the presence of heteroskedasticity, while the Durbin–Watson statistic indicated mild positive serial correlation in the residuals. The Shapiro–Wilk test further revealed that the residuals were not normally distributed. Due to these violations of classical regression assumptions, the study adopted the Generalized Least Squares (GLS) estimation technique to obtain efficient and robust parameter estimates.

5.3 Discussion

This section discusses the findings of the study in relation to the research objectives and existing empirical literature on tax digitization and revenue administration.

5.3.1 Effect of Electronic Tax Filing on Revenue Collection Efficiency

The first objective of the study sought to determine the effect of electronic tax filing on revenue collection efficiency in Kenya. The findings revealed that electronic tax filing has a positive and statistically significant effect on revenue collection efficiency. This implies that increased adoption and utilization of electronic filing systems contribute significantly to improvements in the efficiency of tax administration in Kenya. The positive effect suggests that electronic filing systems simplify tax return submission processes, reduce paperwork, minimize filing errors, improve record management, and enhance administrative transparency within tax administration systems. Consequently, electronic filing systems improve operational efficiency and strengthen compliance management. The findings support the propositions of E-Governance Theory, which argues that digital technologies improve efficiency, transparency, and service delivery within public sector institutions. The results further support the Technology Acceptance Model (TAM), which posits that adoption of technological systems improves institutional performance when users perceive digital systems as useful and easy to use. In the context of Kenya's tax administration system, the adoption of electronic filing systems through the iTax platform appears to have improved taxpayer interaction with the Kenya Revenue Authority by simplifying compliance procedures and reducing administrative inefficiencies.

The findings are consistent with previous empirical studies reviewed in the literature. Martínez et al. (2022) found that electronic filing systems improve tax administration efficiency by reducing compliance costs, simplifying filing procedures, and improving processing speed within tax authorities. Similarly, Njeru (2022) observed that electronic filing systems improve filing accuracy and enhance taxpayer compliance behavior by reducing reporting errors and improving accessibility to tax services. In the Kenyan context, Tanui et al. (2025) established that the iTax platform significantly enhanced filing efficiency, reduced processing delays, and improved taxpayer compliance through automated filing systems. Likewise, Olaoye et al. (2019) argue that electronic tax systems improve accountability and transparency by minimizing human intervention and strengthening digital audit trails within tax administration systems.

5.3.2 Effect of Digital Payment Platforms on Revenue Collection Efficiency

The second objective of the study was to examine the effect of digital payment platforms on revenue collection efficiency in Kenya. The findings revealed that digital payment platforms have the strongest positive and statistically significant effect on revenue collection efficiency among all the digitization variables examined in the study. This implies that increased use of electronic tax payment systems significantly improves efficiency in tax revenue collection. The findings suggest that digital payment systems strengthen tax administration by facilitating faster, more transparent, traceable, and accountable tax payment processes. Electronic payment systems reduce dependence on manual payment methods, minimize opportunities for corruption and revenue leakages, improve payment timeliness, and lower administrative costs associated with payment processing. The strong influence of digital payment systems observed in the study demonstrates the critical role of payment automation in modern revenue administration systems. The findings strongly support E-Governance Theory, which emphasizes that digital systems improve efficiency, accountability, and transparency within public administration.

The findings also align with the Technology Acceptance Model because taxpayers are more likely to comply with tax obligations when payment systems are simple, accessible, efficient, and convenient to use. The ease and convenience associated with electronic

payment systems therefore encourage compliance and improve overall tax administration performance. The findings are consistent with previous empirical studies reviewed in the literature. Muceke (2021) found that electronic payment systems significantly improved revenue mobilization in Sub-Saharan Africa by reducing transaction costs and strengthening payment compliance. Similarly, Grichawat (2022) reported that digital payment gateways improve tax collection efficiency by simplifying payment procedures and enhancing financial transparency within tax administration systems. Martínez et al. (2022) further established that digital payment technologies improve transaction traceability and strengthen accountability within tax systems, thereby reducing opportunities for tax evasion and revenue leakage. Likewise, Okunogbe and Santoro (2023) argue that digital payment systems strengthen information flows between taxpayers and tax authorities, thereby improving compliance monitoring and revenue administration outcomes.

5.3.3 Effect of Digital Invoice Management Systems on Revenue Collection Efficiency

The third objective of the study sought to assess the effect of digital invoice management systems on revenue collection efficiency in Kenya. The findings revealed that digital invoice management systems have a positive and statistically significant effect on revenue collection efficiency. This suggests that electronic invoice reporting systems contribute significantly to improvements in tax administration efficiency through enhanced transaction monitoring, increased transparency, and improved verification of taxable business transactions. The positive relationship implies that electronic invoicing systems strengthen compliance monitoring by creating verifiable electronic records of business transactions. Such systems improve the ability of tax authorities to detect underreporting, strengthen VAT monitoring, and reduce opportunities for tax evasion. The findings therefore demonstrate that digital invoice systems are an important mechanism for improving transparency and strengthening accountability within tax administration systems. The findings support E-Governance Theory by demonstrating that technology-driven transaction monitoring systems improve administrative efficiency and public sector accountability.

The findings are consistent with the broader logic of the Technology Acceptance Model, which suggests that adoption of user-friendly and efficient digital systems improves institutional performance and compliance outcomes. The findings are also consistent with empirical studies reviewed in the literature. The European Commission (2021) reports that electronic invoicing systems improve tax transparency and strengthen transaction monitoring by standardizing invoice-reporting processes. Similarly, Kagarama (2019) found that electronic billing systems in Rwanda significantly improved transaction reporting accuracy and reduced inefficiencies associated with tax audits. Waiswa and Ngoma (2021) also established that automated invoice-reporting technologies strengthened VAT compliance and improved tax monitoring capacity in East African tax systems. Furthermore, Okunogbe and Santoro (2023) argue that digital transaction reporting systems improve traceability and facilitate real-time monitoring of taxpayer activities, thereby enhancing tax administration efficiency.

5.3.4 Effect of Digital Taxpayer Education on Revenue Collection Efficiency

The fourth objective of the study was to evaluate the effect of digital taxpayer education on revenue collection efficiency in Kenya. The findings revealed that digital taxpayer education has a positive and statistically significant effect on revenue collection efficiency. This suggests that online taxpayer education and sensitization initiatives contribute positively to improving compliance behavior, taxpayer awareness, and overall efficiency within tax administration systems. The findings imply that digital taxpayer education improves taxpayers' understanding of tax obligations and digital tax systems, thereby encouraging voluntary compliance and improving adoption of electronic tax services. Online taxpayer education programs also reduce filing errors, improve filing accuracy, and facilitate smoother interaction between taxpayers and tax authorities. Consequently, taxpayer education supports the effectiveness of other digital tax administration systems such as electronic filing, electronic payment systems, and electronic invoicing platforms. The findings strongly support the Technology Acceptance Model, which emphasizes that awareness, understanding, and perceived usefulness influence acceptance and utilization of technological systems. Taxpayer education therefore improves taxpayer confidence and willingness to adopt digital tax administration platforms.

The findings align with E-Governance Theory, which emphasizes the importance of citizen engagement and digital awareness in enhancing the effectiveness of public sector digital reforms. The findings are also consistent with empirical literature reviewed in the study. Olaoye et al. (2019) found that taxpayer education significantly improves voluntary compliance by increasing taxpayer awareness and reducing reporting errors. Similarly, Iddrisu (2023) reported that digital taxpayer education programs improve adoption of electronic tax systems through enhanced digital literacy and taxpayer awareness. Njeru (2022) also observed that taxpayer sensitization programs strengthen compliance behavior by improving understanding of tax obligations and electronic filing procedures. In the Kenyan context, Tanui et al. (2025) established that continuous taxpayer education under the iTax framework improved taxpayer engagement, filing accuracy, and compliance with digital tax systems.

5.4 Conclusion

This study examined the effect of digitization of tax services on revenue collection efficiency in Kenya using monthly data covering the period 2013–2025. The study focused on four major dimensions of tax digitization, namely electronic tax filing, digital payment platforms, digital invoice management systems, and digital taxpayer education. Using time-series econometric techniques and the Generalized Least Squares (GLS) estimation approach, the study sought to establish the extent to which digital tax administration reforms influence the efficiency and effectiveness of revenue collection in Kenya. The findings of the study demonstrate that digitization of tax services significantly improves revenue collection efficiency in Kenya. The results revealed that all the digitization variables examined in the study have positive and statistically significant effects on revenue collection efficiency. This implies that digital transformation within tax administration contributes substantially to improving compliance management, enhancing transparency, reducing administrative inefficiencies, and strengthening revenue mobilization. The findings therefore confirm that adoption of digital technologies within tax administration systems represents an effective strategy for improving the performance of modern revenue authorities.

The study established that electronic tax filing significantly improves revenue collection efficiency by simplifying filing procedures, reducing paperwork, minimizing filing errors, and enhancing administrative efficiency within tax administration systems. Electronic filing systems also strengthen compliance management and improve accessibility of tax services to taxpayers. The findings therefore suggest that the continued expansion and improvement of electronic filing systems are essential for strengthening operational efficiency within Kenya's tax administration framework. The study further established that digital payment platforms exert the strongest positive influence on revenue collection efficiency among all the digitization variables examined. The findings demonstrate that electronic tax payment systems significantly improve revenue administration through faster payment processing, increased transaction transparency, enhanced traceability of tax payments, reduced administrative costs, and minimization of revenue leakages. The study therefore concludes that digital payment systems are a critical pillar of efficient and accountable tax administration and constitute one of the most effective mechanisms for improving revenue mobilization in Kenya.

The findings also revealed that digital invoice management systems significantly improve revenue collection efficiency by strengthening transaction monitoring, enhancing transparency in business reporting, and improving verification of taxable transactions. Electronic invoice systems reduce opportunities for tax evasion and underreporting by creating verifiable electronic transaction records that support compliance monitoring and enforcement activities. Consequently, the study concludes that digital invoice management systems play a critical role in strengthening accountability and transparency within Kenya's tax administration system. In addition, the study established that digital taxpayer education has a positive and statistically significant effect on revenue collection efficiency. The findings suggest that online taxpayer education and sensitization initiatives improve taxpayer awareness, strengthen voluntary compliance, enhance understanding of tax obligations, and facilitate adoption of digital tax administration systems. The study therefore concludes that taxpayer education programs are an important supporting mechanism for successful implementation of digital tax reforms because they improve taxpayer engagement and increase effective utilization of electronic tax systems.

5.5 Recommendations

Based on the empirical findings of the study, several recommendations are proposed to enhance the effectiveness of digitization initiatives in improving revenue collection efficiency in Kenya. These recommendations are directed to policymakers, tax administrators and other relevant stakeholders involved in tax administration reforms.

5.5.1 Policy Recommendations

Given that digital payment platforms exerted the strongest positive influence on revenue collection efficiency, the Government of Kenya and the National Treasury should prioritize investment in digital tax payment infrastructure. Specifically, KRA should allocate at least KSh 500 million annually over the next five years toward upgrading digital payment integration, server capacity, and transaction-processing infrastructure. The Authority should target increasing the proportion of taxes paid electronically from the current levels to at least 95% of all tax payments by 2030. In addition, interoperability between iTax, commercial banks, mobile money platforms, and eTIMS should be fully automated to ensure real-time payment confirmation and reconciliation. Policymakers should also strengthen regulatory requirements mandating electronic invoicing and digital record-keeping for all VAT-registered businesses to improve transaction transparency and compliance monitoring.

5.5.2 Institutional and Administrative Recommendations

The study established that electronic tax filing significantly improves revenue collection efficiency. Therefore, KRA should modernize the iTax platform by upgrading server capacity and system architecture to achieve system availability of at least 99.9% annually and reduce average filing response time to less than five seconds during peak filing periods. The Authority should also strengthen implementation of TIMS and eTIMS by reducing invoice validation and processing time from the current average of approximately 24 hours to less than two hours. Furthermore, compliance with eTIMS should be increased to at least 90% of eligible businesses by 2030 through enhanced monitoring, automated compliance alerts, and targeted enforcement initiatives. Integration between iTax, TIMS/eTIMS, and digital payment platforms should be strengthened to enable real-time sharing of taxpayer information and automated compliance verification. The findings also revealed that digital

taxpayer education significantly improves revenue collection efficiency. KRA should therefore expand digital taxpayer education programmes from an average of 14 online sessions per year to at least 24 sessions annually. In addition, the Authority should target reaching at least 500,000 taxpayers annually through webinars, online tutorials, social media campaigns, and virtual taxpayer clinics, with particular emphasis on SMEs, informal sector operators, and first-time taxpayers.

5.5.3 Technological and Operational Recommendations

To sustain gains from tax digitization, KRA should invest in advanced analytics and artificial intelligence systems capable of supporting risk-based compliance management. Specifically, the Authority should establish a centralized tax analytics unit and deploy machine-learning tools capable of screening at least 90% of electronic tax returns and invoices for anomalies and compliance risks. Such systems should be used to reduce audit selection errors and increase detection of suspicious transactions. The Authority should also strengthen cybersecurity by allocating a minimum of KSh 300 million annually toward cybersecurity infrastructure, system audits, penetration testing, and taxpayer data protection. Furthermore, KRA should introduce a dedicated 24-hour digital support centre and reduce average taxpayer issue-resolution time from several days to less than 24 hours. These interventions will improve user experience, strengthen taxpayer confidence, and encourage greater utilization of digital tax platforms.

5.5.4 Capacity Building and Stakeholder Engagement Recommendations

KRA should implement annual digital skills training programmes for all officers involved in tax administration, with a target of training at least 80% of staff in data analytics, cybersecurity, digital auditing, and electronic compliance monitoring by 2030. In addition, the Authority should institutionalize quarterly stakeholder forums involving taxpayers, financial institutions, technology providers, professional bodies, and business associations to identify operational challenges and improve digital tax services. Partnerships with universities and technology firms should also be strengthened to support innovation, research, and continuous improvement of digital tax administration systems. These measures will enhance taxpayer acceptance, strengthen voluntary compliance, and improve the long-term sustainability of tax digitization reforms in Kenya.

5.6 Limitations of the Study

Despite the important insights generated by this study, several limitations should be acknowledged. Recognizing these limitations is important in interpreting the findings and understanding the scope within which the conclusions of the study can be generalized. First, the study relied exclusively on secondary data obtained from the Kenya Revenue Authority (KRA). Although secondary data provides reliable and objective information for empirical analysis, the researcher had limited control over the manner in which the data was originally collected, processed and recorded. Any inaccuracies, measurement errors, or inconsistencies present in the administrative records could potentially influence the results of the analysis. Nevertheless, the use of official administrative data from KRA ensured that the study utilized credible and authoritative information on tax administration activities.

Second, the study focused on selected indicators of tax digitization, namely electronic tax filing, digital payment platforms, digital invoice management systems, and digital taxpayer education. While these variables capture key aspects of digital tax administration, other important factors that may influence revenue collection efficiency were not included in the model. For instance, factors such as tax policy reforms, economic growth, institutional capacity, enforcement mechanisms, and taxpayer compliance behavior may also influence revenue collection performance. The exclusion of these variables may limit the ability of the model to fully capture all determinants of revenue collection efficiency. Third, the study utilized monthly time-series data covering the period 2013–2025. Although this period provides a relatively large number of observations for statistical analysis, the findings may still be influenced by structural changes in the economy, policy reforms, or technological upgrades that occurred during the study period. For example, major reforms in tax administration systems, the introduction of new digital platforms, or macroeconomic shocks may have affected revenue collection efficiency in ways that are difficult to fully isolate in an econometric model.

Fourth, the study primarily employed quantitative econometric techniques to examine the relationship between digitization of tax services and revenue collection efficiency. While quantitative analysis is useful for identifying statistical relationships among variables, it

may not fully capture institutional, behavioral, and organizational factors that influence the effectiveness of digital tax administration systems. Qualitative insights from tax administrators, policymakers, and taxpayers could provide additional understanding of how digital tax reforms influence compliance behavior and administrative performance. Fifth, although the study employed Generalized Least Squares (GLS) estimation to address econometric challenges such as heteroskedasticity and autocorrelation, time-series analysis is inherently sensitive to issues such as structural breaks, policy changes, and dynamic adjustments in the tax system. These factors may influence the stability of the estimated relationships over time. Despite these limitations, the study provides valuable empirical evidence on the relationship between tax digitization and revenue collection efficiency in Kenya. The findings contribute to the growing body of literature on digital tax administration and provide useful insights for policymakers seeking to improve the effectiveness and efficiency of tax systems through digital transformation.

The last limitation relates to the stationarity properties of the study variables. The Augmented Dickey–Fuller (ADF) tests revealed that while revenue collection efficiency, electronic tax filing, and digital taxpayer education became stationary after first differencing, the digital payment platforms (DPP) and digital invoice management systems (DIMS) variables remained non-stationary. The persistence of unit roots in these variables may introduce challenges in estimating long-run relationships and raises the possibility of biased or inefficient parameter estimates. Although the study mitigated this limitation through the use of the Generalized Least Squares (GLS) estimation technique, which is more robust to violations of certain classical regression assumptions, the presence of non-stationary variables may still affect the precision of the estimated relationships. Consequently, the findings relating to DPP and DIMS should be interpreted with caution. Future studies should consider applying cointegration techniques, error correction models, or alternative time-series approaches to further examine the long-run dynamics between tax digitization initiatives and revenue collection efficiency.

5.7 Recommendations for Future Research

While this study provides important insights into the relationship between digitization of tax services and revenue collection efficiency in Kenya, further research is necessary to

deepen understanding in this area. Future studies could incorporate additional variables such as tax enforcement mechanisms, macroeconomic conditions, taxpayer compliance behavior, and institutional capacity to provide a more comprehensive assessment of the determinants of revenue collection efficiency. Researchers may also consider employing mixed-method approaches that combine quantitative analysis with qualitative insights from tax administrators and taxpayers to better understand the behavioral and institutional dynamics of digital tax systems. Additionally, comparative studies across different countries or tax jurisdictions could provide broader insights into how digital tax administration reforms influence revenue performance in different economic and institutional contexts.

5.8 Chapter Summary

This chapter presented the summary of findings, discussion, conclusions, recommendations, limitations of the study, and recommendations for future research. The chapter began by summarizing the key empirical findings derived from the econometric analysis conducted in Chapter Four. The findings established that digitization of tax services significantly improves revenue collection efficiency in Kenya. Specifically, electronic tax filing, digital payment platforms, digital invoice management systems and digital taxpayer education were all found to have positive and statistically significant effects on revenue collection efficiency. Among the variables examined, digital payment platforms exhibited the strongest positive influence, highlighting the critical role of electronic payment systems in improving transparency, accountability, compliance, and efficiency within tax administration. The chapter further discussed the findings in relation to E-Governance Theory, the Technology Acceptance Model, and existing empirical literature on digital tax administration. Based on the conclusions of the study, several policies, institutional, technological, and stakeholder engagement recommendations were proposed to strengthen the effectiveness of tax digitization initiatives in Kenya. The chapter also outlined the limitations of the study, particularly those relating to data scope and methodological constraints. Finally, recommendations for future research were provided to guide further studies on digital tax administration, technological innovation, and revenue mobilization in developing economies.

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Appendix I: Ethical Approval Letter

Strathmore UNIVERSITY

8th April 2026

Ms Kituli Beatrice,
beatrice.kituli@strathmore.edu

Dear Ms Kituli,

RE: Effect of Digitization of Tax Services on Revenue Collection Efficiency in Kenya

This is to inform you that SU-ISERC has reviewed and **approved** your above **SU-masters** research proposal. Your application reference number is **SU-ISERC3446/26.** The approval period is from **8th April 2026 to 7th April 2027.**

This approval is subject to compliance with the following requirements:

i. Only approved documents including (informed consents, study instruments, and MTA) will be used
ii. All changes including (amendments, deviations, and violations) are submitted for review and approval by SU-ISERC.
iii. Death and life-threatening problems and serious adverse events or unexpected adverse events whether related or unrelated to the study must be reported to SU-ISERC within 72 hours of notification
iv. Any changes, anticipated or otherwise, that may increase the risks or affect the safety or welfare of study participants and others or affect the integrity of the research must be reported to SU-ISERC within 72 hours
v. Clearance for the export of biological specimens must be obtained from relevant institutions.
vi. Submission of a request for renewal of approval at least 60 days prior to the expiry of the approval period. Attach a comprehensive progress report to support the renewal.
vii. Submission of an executive summary report within 90 days of completion of the study to SU-ISERC.

Before commencing your study, you will be expected to obtain a research license from National Commission for Science, Technology, and Innovation (NACOSTI) https://research-portal.nacosti.go.ke/ and obtain other clearances needed.

Yours sincerely,

Mr Ambrose Rachier,
Chairperson; SU-ISERC

Ole Sangale Rd, Madaraka Estate. PO Box 59857-00200, Nairobi, Kenya. Tel +254 (0)703 034000
Email admissions@strathmore.edu www.strathmore.edu

Appendix II: Introductory Letter from the University

Ole Sangale Rd, Madaraka Estate
P. O Box 59857 - 00200, Nairobi, Kenya
Cell: +254 703 034 414/6/7
X/Twitter/Tiktok: @SBSKenya
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Strathmore UNIVERSITY
BUSINESS SCHOOL

Wednesday, 8th April 2026

To Whom It May Concern.

Dear Sir/Madam,

RE: FACILITATION OF RESEARCH – BEATRICE KITULI

This is to introduce Beatrice Kituli, who is a Master of Science in Development Finance student at Strathmore University Business School, admission number MDF/078382/23. As part of our MDF programme, Beatrice is expected to do applied research and undertake a project. This is in partial fulfilment of the requirements of the MDF course. To this effect, she would like to request appropriate data from your organisation.

Beatrice is undertaking a research paper on "***Effect of Digitisation of Tax Services on Revenue Collection Efficiency in Kenya".*** The information obtained from your organisation shall be treated confidentially and shall be used for academic purposes only.

Our MDF seeks to establish links with industry, and one of these ways is by directing our research to areas that would be of direct use to industry. We would be glad to share our findings with you after the research, and we trust that you will find them of great interest and of practical value to your organisation.

We appreciate your support and shall be willing to provide any further information if required.

Yours sincerely,



Alois Njenga,
Manager – Graduate Programmes,
Strathmore University Business School.

Strathmore University Business School is a Proud member of:
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Appendix III: Research Permit from NACOSTI

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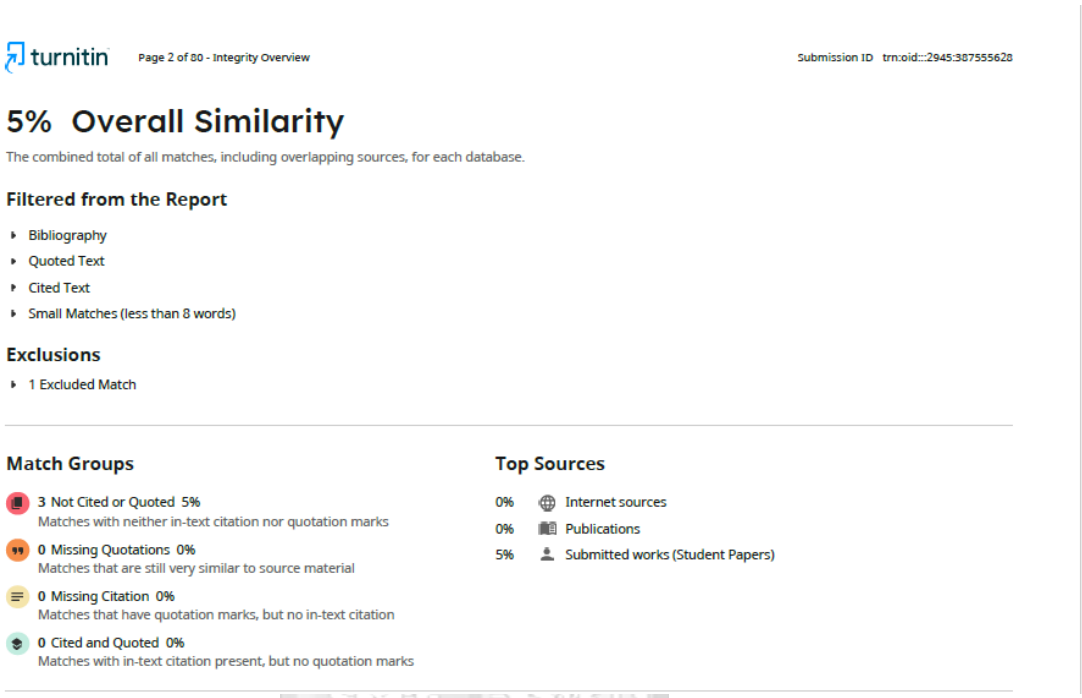
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