RESEARCH PROPOSAL

THE IMPACT OF ARTIFICIAL INTELLIGENCE ON E-GOVERNANCE IN TVET INSTITUTIONS: LESSONS FROM THE KISUMU NATIONAL POLYTECHNIC AND SELECTED COLLEGES IN KENYA

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Date:

November 24, 2025

ABSTRACT

Kenya's Technical and Vocational Education and Training (TVET) institutions struggle with administrative inefficiencies that harm service delivery and drain financial resources. Trainees wait hours for basic services. Staff spend entire days on repetitive tasks. Documents get lost. Financial records contain errors that cost institutions money and delay critical decisions. This research evaluate how artificial intelligence can transform e-governance systems in TVET institutions. The study uses a mixed methods approach across four institutions: The Kisumu National Polytechnic, Eldoret National Polytechnic, either Railway Training Institute or Kenya Institute of Highway and Building Technology, and Ramogi Institute of Advanced Technology. Between October 2025 and April 2026, the research will collect data from 330 to 400 participants including trainees, trainers, support staff, technicians, and administrators. The research investigates three AI applications: chatbots for instant responses to common queries, automated records management to prevent document loss, and predictive analytics to support institutional planning. Using the Technology Acceptance Model and Change Management Theory as guides, the study examines current e-governance systems, identifies bottlenecks, and explores how stakeholders feel about AI adoption. The expected outcomes include practical recommendations that consider Kenya's resource constraints, infrastructure limitations, and the human factors essential for successful digital transformation in TVET institutions.

Contents

GLOSSARY OF TERMS

1. **Artificial Intelligence (AI)** - Computer systems that can learn from data and make decisions on their own, like a chatbot that answers questions without needing a human to respond each time.
2. **Automated Records Management** - A digital system that stores, organizes, and finds documents automatically instead of using paper files and cabinets.
3. **Chatbot** - A computer program that talks to people through text messages, answering questions instantly like a robot assistant on WhatsApp or a website.
4. **Cloud Storage** - Saving files on the internet instead of on a physical computer, so you can access them from anywhere and they stay safe even if your computer breaks.
5. **E-governance** - Using computers, internet, and digital systems to run an institution instead of using paper forms and manual processes.
6. **HELB (Higher Education Loans Board)** - The Kenyan government agency that provides loans to students for their education fees.
7. **KNEC (Kenya National Examinations Council)** - The government body that manages and administers national examinations in Kenya.
8. **KUCCPS (Kenya Universities and Colleges Central Placement Service)** - The system that places students into universities and colleges in Kenya after they complete high school.
9. **Learning Management System (LMS)** - A computer program that helps teachers share lessons, assignments, and grades with students online.
10. **M-Pesa** - A mobile phone service in Kenya that lets people send and receive money using their phones.
11. **Manual Reconciliation** - When someone checks payment records by hand to make sure the money received matches what was expected, comparing receipts one by one.
12. **Predictive Analytics** - Using past information to guess what will happen in the future, like predicting how many students will enroll next term based on previous years.
13. **Revenue Leakage** - Money that an institution should collect but loses because of errors, poor record keeping, or payments that are not recorded properly.
14. **Technology Acceptance Model (TAM)** - A theory that explains people will use new technology if they think it is useful and easy to use.
15. **TVET (Technical and Vocational Education and Training)** - Colleges and polytechnics that teach practical job skills like carpentry, automotive repair, computer technology, or business.
16. **TVETA (Technical and Vocational Education and Training Authority)** - The Kenyan government agency that oversees and regulates TVET institutions.
17. **Digital Infrastructure** - The basic technology an institution needs to work digitally, like computers, internet connections, and electricity.
18. **CDACC (Curriculum Development, Assessment and Certification Council)** - The body that develops TVET curricula and administers assessments in Kenya.
19. **CMT (Change Management Theory)** - A framework that explains how organizations successfully adopt new systems and processes.

CHAPTER 1: INTRODUCTION

1.1 Background of the Study

Every morning at The Kisumu National Polytechnic, long queues form outside the registry office and finance department. Trainees arrive early because they know simple tasks take hours. Staff members look exhausted before lunch, knowing they will answer the same questions repeatedly all day. I work as an automotive trainer at this institution. Managing attendance for six classes with over 400 trainees takes about four hours every week. I mark physical registers during class, calculate percentages manually, then upload everything to our institutional portal. This repetitive work steals time from teaching. Research shows that teachers in Kenyan institutions spend 30 to 40 percent of their time on administrative tasks instead of actual instruction (OECD, 2019). This pattern directly affects how well we train our students.

These problems exist across Kenya's TVET sector. The country has 238 TVET institutions serving more than 460,000 trainees (Ministry of Education, 2024). The government sees the problems. In November 2024, it launched the AI National Skilling Initiative targeting 100,000 TVET trainees and teachers by May 2025 (Government of Kenya, 2024a). The National AI Strategy 2025 to 2030 specifically addresses TVET transformation through artificial intelligence (Government of Kenya, 2024b). But actual change happens slowly. Many colleges still use outdated systems and processes.

Consider what happens when a trainee applies for admission. They start with KUCCPS, which works reasonably well online. But then trainees must physically visit the institution to complete registration because KUCCPS does not talk to institutional systems. During registration, they need documents from KNEC to verify certificates. This means accessing another portal with different login details. Trainees print documents from one system to submit physically to another.

Fee payment creates more complications. Trainees who qualify for government loans apply through HELB, which runs on yet another separate portal. Even after HELB approves a loan, the money does not automatically show up in the institution's finance system. Someone in accounts must manually verify the payment and update the trainee's record. When trainees pay through banks, the finance office receives statements that must be matched line by line against trainee accounts. This manual work takes days, sometimes weeks. During this time, trainees may be told they still owe money even though they already paid. When payment confirmations get delayed,

trainees cannot register for examinations. This forces them to wait months for the next exam sitting, delaying their graduation and entry into the job market.

The cost of these inefficiencies extends beyond wasted time. Manual systems create financial errors that institutions cannot easily detect or correct. A study of Kenyan public institutions found that manual financial processes resulted in revenue losses of 3 to 7 percent annually due to unrecorded transactions, duplicate payments, and reconciliation errors (Wanjiru & Kimani, 2023). For a mid-sized TVET institution with annual fee revenue of Ksh 200 million, this means potential losses of Ksh 6 million to Ksh 14 million every year.

TVETA created an online portal for institutional reporting and trainee data management. But staff still collect information manually from different departments, type it into spreadsheets, then upload everything to TVETA's portal. The portal cannot pull information automatically because institutional systems do not connect to it. Institutions maintain parallel records, doubling the work and creating opportunities for errors.

These disconnected systems frustrate everyone. Artificial intelligence could address many of these problems by automating routine tasks, eliminating data silos, and providing real-time financial visibility. This study explores how AI can transform e-governance in Kenya's TVET sector.

1.2 Statement of the Problem

Kenyan TVET institutions waste enormous amounts of time and money on repetitive manual tasks. We aim to prepare trainees for modern careers, yet we operate using administrative frameworks that have barely changed in decades.

Consider what happens with industrial attachment placements. When trainees need insurance clearance before workplace training, the process takes 10 to 15 working days despite involving only basic information verification. Staff manually complete multiple forms, wait for interdepartmental approvals, and coordinate with insurance providers through phone calls and physical document submission. Trainees miss valuable training opportunities because of these delays. Similar patterns affect nearly every administrative process (Wanzala, 2020).

The registry and examination offices constantly battle lost documents. During the last rainy season, water flowed into our departmental examination office, destroying numerous trainee files kept in cardboard boxes. When trainees request documents from five or six years ago, finding them

takes days if we can find them at all. Some trainees have repeated entire modules because their academic records disappeared and could not be reconstructed.

Examination registration multiplies trainee frustration. Trainees first check exam eligibility through the institutional portal, then log into the KNEC or CDACC portal with different credentials to register for national examinations. When trainees miss deadlines because notifications come through different channels they might not check regularly, they wait months for the next exam sitting. This delays their progress and graduation.

Finance office staff face similar challenges with severe financial consequences. Every day, they receive payment notifications through bank statements or emails. A staff member opens the bank statement, finds a payment, searches for that trainee's account number in the database, verifies the amount, updates the fee balance, notes it in the physical ledger, then files the paper confirmation. With hundreds or thousands of trainees, this process consumes entire workdays. Staff have no time for analyzing the institution's financial health or planning improvements.

The financial cost of these manual processes is substantial. At The Kisumu National Polytechnic, the finance office employs five staff members primarily for payment reconciliation and query resolution. Each staff member earns approximately Ksh 40,000 monthly, totaling Ksh 200,000 in monthly salaries or Ksh 2.4 million annually just for work that AI systems could largely automate. Beyond direct salary costs, manual reconciliation errors create additional expenses. Unreconciled payments delay revenue recognition, affecting cash flow planning. Duplicate payment processing wastes staff time and sometimes results in refund requests that consume more administrative resources.

Trainers face different but equally problematic challenges. Every class requires multiple attendance sheets because different departments want their own copies in specific formats. We calculate grades manually using calculators or spreadsheets, often making errors that require corrections later. These inefficiencies prevent us from focusing on actual teaching and skills development.

Poor data management prevents institutions from making informed decisions. How many trainees might drop out next term? We lack reliable data to answer. Which programs see enrollment increases and which face declines? Without historical trend analysis, we make educated guesses based on current figures. What equipment needs replacement soon? We find out when things break down and disrupt classes. The data exists somewhere in filing cabinets and scattered computer

files, but pulling it together takes so long that by the time we have answers, the questions have changed.

Budget planning suffers from inadequate data. Institutions struggle to forecast revenue accurately because payment patterns are not systematically tracked. Expense planning becomes guesswork without proper analysis of historical spending patterns. This creates a cycle where poor financial data leads to poor planning, which leads to budget shortfalls and operational inefficiencies that waste more money.

1.3 Purpose of the Study

Understanding these problems clearly matters, but identifying solutions matters more. This research explores how artificial intelligence can transform outdated systems and bring TVET institutions into the modern era. The study examines not just technical possibilities but also the human factors that determine whether AI implementation succeeds or fails.

The research focuses on three specific AI applications that could address pressing institutional challenges. First, AI chatbots that provide instant, accurate answers to common questions. Imagine if trainees could message a system through WhatsApp asking about their exam schedule or fee balance and receive an immediate response. The chatbot works all day and night, serves unlimited users at once, and never gets tired or irritable. Research shows that well-implemented chatbots can reduce routine inquiries significantly and improve response times, though success depends on proper setup, continuous monitoring, and human oversight for complex situations (Huang et al., 2024).

Second, automated records management systems that eliminate the paper chase entirely. These systems store everything digitally with automatic backups, update information across all platforms simultaneously, and retrieve any document within seconds. Every document gets indexed and becomes searchable. Authorized users can access what they need from anywhere.

Third, predictive analytics that help institutions plan more effectively. These tools analyze patterns in historical data to forecast future trends reasonably well. They can identify trainees showing early warning signs of potential dropout, forecast enrollment numbers for different programs, and even predict when equipment will likely fail based on usage patterns.

Beyond technical capabilities, this research examines crucial questions about financial sustainability. What would AI implementation actually cost? How long before institutions see returns on investment? Can automated financial reconciliation really save money, or will hidden

costs offset the savings? These questions matter because TVET institutions operate with limited budgets and must justify every expenditure.

The study also explores human factors. What concerns do staff members have about these new systems? How can we ensure everyone has the skills and confidence they need? What technical infrastructure actually exists? How can institutions with limited budgets afford these changes? What can be done incrementally rather than requiring massive upfront investment?

Technology alone never provides complete answers. This research aims to develop realistic, affordable recommendations that acknowledge the constraints TVET institutions face while showing pathways toward meaningful improvement in both administrative efficiency and financial management.

1.4 Research Objectives

This research pursues seven specific objectives that guide data collection and analysis. First, to document what digital systems TVET institutions currently use for administration and management, examining how these systems actually function in daily operations. This goes beyond listing software names. It explores how systems work, how they connect or fail to connect with each other, and how people use them in practice versus official policies.

Second, to identify the main challenges facing trainees and staff when accessing or providing institutional services. Trainees matter most because institutions exist to serve them. Staff members process services, so their struggles directly affect service quality. Understanding both perspectives shows where improvements create the most value.

Third, to explore how AI applications including chatbots, automated records management, and predictive analytics could improve administrative efficiency and service delivery. This examines not just technical capabilities but practical implementation. Can chatbots really handle the complex queries that come up regularly? How can automated systems improve accuracy while reducing workload? What predictions would create the most value for administrators?

Fourth, to assess stakeholder attitudes toward AI implementation, exploring what concerns different user groups have and what factors influence their acceptance or resistance. Fear of job loss, worries about privacy and data security, skepticism about whether technology works as promised, and lack of confidence in their own ability to learn new skills all represent valid concerns that must be addressed openly.

Fifth, to examine how AI-driven systems can enhance financial management, revenue tracking, and budget planning in TVET institutions. This objective specifically addresses the financial dimension often overlooked in technology adoption research. Manual financial processes waste staff time and create errors that cost money. AI systems could potentially transform how institutions manage money, from fee collection to budget forecasting.

Sixth, to determine what infrastructure, resources, training, and support TVET institutions need to successfully implement AI systems. This acknowledges that successful implementation requires more than just technology. It requires adequate infrastructure, skilled people, ongoing support, and realistic planning.

Seventh, to develop realistic cost-benefit projections that help institutions understand the financial implications of AI adoption. This includes estimating implementation costs, ongoing maintenance expenses, and potential savings from improved efficiency and reduced errors.

1.5 Research Questions

Seven key questions organize this investigation. How do current digital systems influence the efficiency and integration of administration and management in TVET institutions? This question examines how systems actually function daily, how they connect or fail to connect with each other, and how people use them in practice versus official procedures.

How do service delivery challenges affect trainees' academic progress and overall satisfaction in TVET institutions? Trainees experience frustrations and inefficiencies directly. Understanding their challenges helps identify where improvements would matter most for the people institutions exist to serve.

How does time spent on repetitive tasks impact staff productivity and job satisfaction in TVET institutions? Identifying these tasks accurately enables automation planning. Freeing staff from repetitive work allows them to focus on meaningful tasks that require human judgment and expertise.

How can AI systems improve financial management accuracy, processing speed, and budget planning effectiveness in TVET institutions? This question explores both the technical capabilities and practical benefits of automated financial systems. Can AI really reduce errors, speed up reconciliation, and improve planning accuracy?

To what extent can AI chatbots reduce service waiting times and enhance overall service delivery quality? This examines accuracy, availability, user satisfaction, and whether chatbots can handle the complex queries that arise regularly in educational institutions.

How effectively can automated records management systems prevent document loss, reduce errors, and improve information accessibility? Beyond just storing documents digitally, how can these systems actively improve accuracy, enhance security, ensure accessibility, while reducing staff workload?

What factors influence stakeholder acceptance of AI systems, and what infrastructure requirements determine successful implementation in TVET institutions? This question acknowledges that successful technology adoption depends as much on addressing human concerns and building capacity as on acquiring technology itself.

1.6 Significance of the Study

Answering these questions will generate findings valuable to multiple stakeholders. For trainees and staff, the potential benefits could genuinely transform daily experiences. Trainees would no longer miss classes to stand in administrative queues or worry about whether important documents disappeared. A trainee from a rural area could check exam results, pay fees, register for courses, and access learning materials entirely from their phone while at home. They would not need to travel to campus and spend money just to handle administrative tasks.

For staff members across departments, AI could restore job satisfaction by eliminating repetitive work that drains energy and enthusiasm. A registry clerk could focus on helping trainees with complex problems that require human judgment and years of experience, rather than spending entire days filing papers and searching through cabinets for lost documents. Finance staff could spend time analyzing institutional financial health and planning for sustainability instead of matching payment receipts to accounts all day.

The financial benefits extend beyond saved staff time. Automated reconciliation could reduce errors that currently cost institutions 3 to 7 percent of annual revenue (Wanjiru & Kimani, 2023). For a TVET institution collecting Ksh 200 million in fees annually, reducing revenue leakage by even 2 percent would save Ksh 4 million yearly. Better financial data enables better planning. Institutions could forecast revenue more accurately, plan expenses more effectively, and avoid the budget shortfalls that disrupt operations.

For institutions and the broader TVET sector, better data means better decisions. The principal can analyze enrollment trends over several years and adjust course offerings to match trainee demand and labor market needs. The finance officer can predict cash flow patterns and plan budgets more accurately. Every department operates more efficiently when information flows freely and insights emerge from data.

This research provides concrete evidence for digital transformation rather than theoretical arguments. Other institutions can learn from these findings without repeating mistakes or wasting resources on approaches that do not work. Successful AI implementation in pioneering institutions can inspire and guide others to follow.

For Kenya's economy and national development, better-functioning TVET institutions produce better-skilled workers who contribute more effectively. Companies regularly complain about skills gaps and graduates who are not ready for industry demands (UNESCO, 2021). If administrative efficiency gives trainers more time to teach and trainees more time to learn, we produce graduates genuinely prepared for what employers need. This directly supports Kenya's Vision 2030 development goals.

For my personal growth and career development, this research opens new horizons beyond my current role. It establishes me as someone who thinks beyond immediate training responsibilities and understands institutional challenges holistically. It provides the foundation for Master's degree applications in 2026, develops research skills I will use throughout my career, and builds my professional network through connections with staff at four institutions, my supervisor at Moi University, and potentially with TVETA officials and other stakeholders.

1.7 Scope and Limitations

This study focuses on four TVET institutions in Kenya over six months from October 2025 through April 2026. These boundaries matter for understanding and interpreting findings. The Kisumu National Polytechnic serves as the primary research site because my position as automotive trainer provides deep institutional knowledge. I understand which departments face the biggest challenges and how to navigate sensitive topics carefully. However, the institution reopened in the third week of October 2025 only to accommodate KNEC examinations in November. Full operations resume in January 2026. This affects data collection timing, requiring me to begin with other institutions in November and December 2025, returning to The Kisumu National Polytechnic after January 2026 when operations stabilize.

Three additional institutions provide essential comparative perspectives. Eldoret National Polytechnic offers similar institutional scale and structure, allowing examination of whether challenges at Kisumu are unique or represent broader systemic issues. The Railway Training Institute or Kenya Institute of Highway and Building Technology operate under parastatal management structures, meaning their governance, funding, and decision-making processes differ from national polytechnics. Ramogi Institute of Advanced Technology represents mid-level institutions serving regional communities with fewer resources than national polytechnics.

The study targets 330 to 400 total participants across all four institutions. This number is large enough to identify clear patterns and draw meaningful conclusions but small enough for one researcher working alone to manage effectively. Quality matters more than quantity in research.

Several important limitations must be acknowledged. First, my position as an insider at Kisumu carries both advantages and disadvantages. While I understand the context deeply, some colleagues might tell me what they think I want to hear rather than expressing honest opinions. Others might worry that criticizing current systems could affect their jobs despite my assurances of confidentiality. I must work hard to build trust and create safe spaces for honest conversation.

Second, technology changes remarkably fast. The specific AI solutions and tools investigated today might be outdated by the time institutions actually implement them. However, the underlying principles, approaches, and human factors should remain relevant even as specific technologies evolve.

Third, financial constraints significantly limit what this study can accomplish. As an individual researcher funding this work entirely from my own salary, I cannot test actual AI systems or run pilot programs. I can only study potential for these technologies based on existing research and stakeholder opinions gathered through surveys and interviews.

Fourth, gathering accurate financial data presents challenges. Institutions may be reluctant to share detailed information about revenue losses, processing costs, or budget planning challenges. The research will respect these sensitivities while seeking to understand the financial dimensions of current inefficiencies and potential AI solutions.

Finally, the six-month timeframe means this research captures only a snapshot in time rather than tracking changes over extended periods. Longitudinal research following institutions over several years would provide richer insights, but that exceeds what is feasible for this project given available time and resources while balancing full-time training responsibilities.

CHAPTER 2: LITERATURE REVIEW

2.1 Introduction

Understanding how artificial intelligence might reshape TVET institutions requires examining what researchers have already discovered. This chapter reviews scholarship from Kenya and internationally, analyzing successful implementations, documented failures, and lessons learned from both. The approach is straightforward: learn from documented experiences before venturing into new territory.

This review synthesizes findings from global research while emphasizing Kenyan-specific evidence, particularly recent studies demonstrating AI's actual impact on teaching, learning, and institutional effectiveness in Kenya's higher education context. The chapter begins by examining e-governance in educational institutions broadly, then narrows to Kenya's TVET sector specifically. It explores three key AI applications: chatbots, automated records management, and predictive analytics. A new section addresses AI in financial management for educational institutions. The chapter then discusses implementation challenges, presents theoretical frameworks guiding this study, and concludes by synthesizing how existing literature informs current research.

2.2 E-Governance in Educational Institutions

E-governance means using digital technologies including computers, internet infrastructure, and software applications to manage institutional operations more effectively than manual, paper-based systems allow. Rather than forms disappearing into filing cabinets, information enters secure databases enabling instant retrieval. Instead of requiring physical presence during limited office hours, users access services through online portals whenever needed. The fundamental promise of e-governance lies in transforming administrative processes from document-centric workflows to information-centric systems.

Crompton and Burke (2023) reviewed 138 articles published between 2016 and 2022, documenting a dramatic surge in AI education research during 2021 to 2022. Publications nearly doubled or tripled compared to earlier periods. This growth concentrated primarily on three applications: prediction systems, intelligent tutoring, and assessment tools. However, the authors identified a troubling pattern: inadequate attention to evaluation rigor, ethical implications, and infrastructure requirements. This critique has particular relevance for the current study, which

explicitly addresses implementation prerequisites and stakeholder concerns alongside technical possibilities.

Bond and colleagues (2024) reinforced these concerns through their analysis of 66 evidence syntheses. They found that most AI implementations in higher education emphasize technological capabilities while insufficiently addressing ethical implications, equity concerns, and systematic evaluation of actual learning outcomes. Most research originates from developed nations with robust infrastructure, leaving critical questions about feasibility in resource-constrained environments. For TVET institutions in developing contexts, these findings suggest that successful AI adoption requires explicit ethical frameworks and equity analyses integrated into planning from the outset.

While international research provides valuable insights, Kenya's educational context presents unique characteristics requiring local evidence. Kenya's university sector has achieved greater digitization progress than many TVET institutions, though systematic national data quantifying this disparity remains limited (UNESCO, 2021). Public universities increasingly provide online portals for registration and fee payment, though system reliability varies considerably. Research on digital access in Kenyan higher education indicates that trainees from rural areas with limited connectivity encounter particular barriers when institutions rely primarily on online systems (Ogange et al., 2018).

2.2.1 Empirical Evidence from Kenya

Recent empirical research from Kenya provides concrete evidence of AI effectiveness in educational settings. Matere (2024) examined AI tool effectiveness across Kenyan higher education institutions, finding a strong positive correlation ($r = 0.781$, $p < 0.001$) between AI tool utilization and teaching and learning effectiveness. This correlation, approaching the threshold typically considered large in social science research (Cohen, 1988), suggests that institutions employing AI tools report substantially higher effectiveness in both teaching delivery and learning outcomes.

However, Matere's study also revealed that most institutions face limited access to AI tools, creating significant implementation disparities across Kenya's higher education landscape. Accessibility challenges stem from insufficient funding for technology acquisition, inadequate technical infrastructure including electricity and internet connectivity, limited faculty training in AI tool usage, and absence of institutional policies supporting AI adoption.

Kariuki and colleagues (2025) extended this research by conducting a comparative analysis of AI-based learning versus traditional classroom learning in Kenyan universities. Their study documented actual learning outcomes rather than relying solely on perceptions. Students using AI learning platforms achieved average scores of 78.4 percent compared to 72.9 percent for students in traditional classroom settings, a statistically significant difference of 5.5 percentage points. The research also documented higher engagement levels among AI learners.

Figure 2.1: Comparison of Student Performance

AI Learning
78.4%

Traditional Classroom
72.9%

0%   25%   50%   75%   100%

KEY

■ AI Learning   ■ Traditional Classroom

Source: Educational Performance Analysis Report, 2024
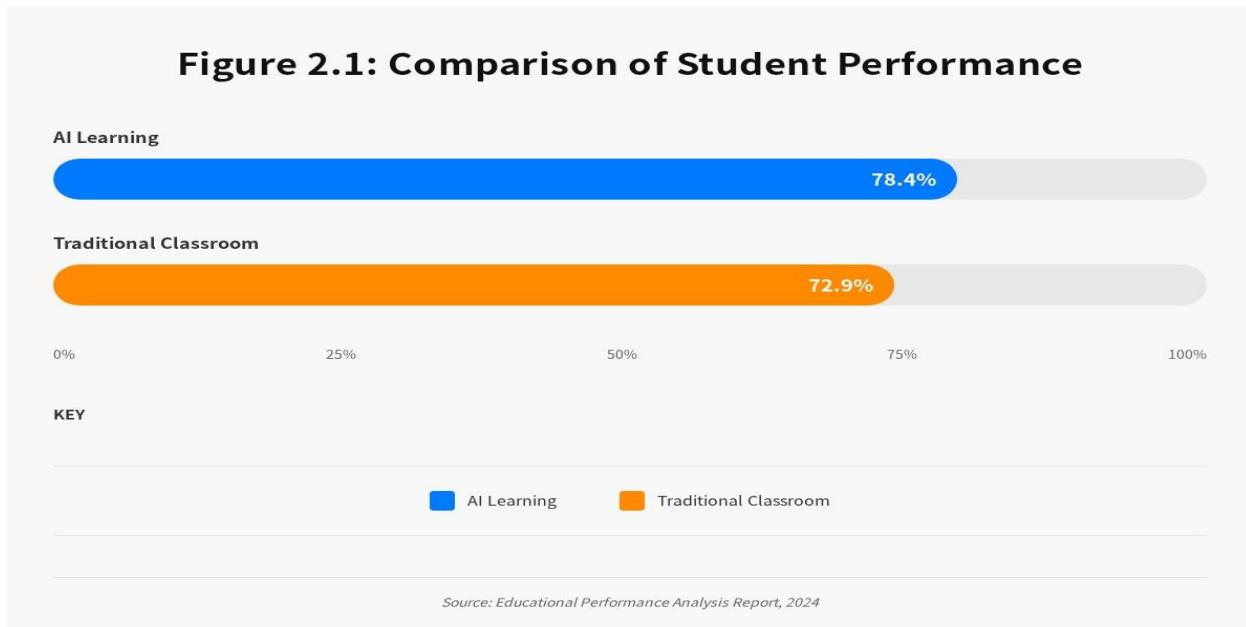
Figure 2.1: Comparison of Student Performance: AI Learning vs. Traditional Classroom

These findings suggest that AI-enhanced learning environments can produce measurable improvements in student outcomes within the Kenyan context. However, the authors appropriately caution that effectiveness depends on adequate student orientation to AI platforms, reliable technical infrastructure, and complementary pedagogical approaches that integrate AI tools meaningfully. For TVET institutions considering AI adoption, these findings offer both encouragement and caution: AI can work in Kenyan contexts, but success is neither automatic nor guaranteed.

2.3 Current State of TVET Systems in Kenya

Understanding Kenya's specific TVET context is essential for realistic implementation planning. Kenya's TVET sector encompasses numerous institutions ranging from large national polytechnics serving thousands of trainees to smaller vocational training centers in rural communities. The Government of Kenya's TVET Sub-Sector Report for fiscal years 2025 to 2026

through 2027 to 2028 documents substantial challenges in infrastructure, institutional capacity, and service delivery (Ministry of Education, 2024).

The TVETA Strategic Plan (2023 to 2027) prioritizes ICT and digital capacity development as strategic objectives, recognizing that TVET institutions must embrace technology to remain relevant in increasingly digital economies (Ministry of Education, Kenya, 2023). However, independent assessments reveal significant implementation gaps between policy aspirations and institutional realities. Recent cybersecurity readiness studies indicate that many TVET institutions lack fundamental digital security policies, trained ICT personnel, and reliable infrastructure (Kiarie, 2024).

Several government initiatives aim to modernize TVET systems. TVETA established online portals for institutional reporting and trainee data management. KUCCPS manages trainee admissions digitally through centralized application and placement systems (KUCCPS, 2024). KNEC and CDACC administer assessments that are currently predominantly paper-based while developing computer-based assessment systems (TVET CDACC, 2025). These initiatives represent genuine progress toward digital transformation. However, actual implementation reveals persistent integration problems. Different systems operate independently without effective data exchange, requiring staff to enter identical information multiple times across platforms.

Mohammed (2024) conducted a comprehensive literature review examining learning analytics in Kenyan higher education institutions. The study identified a critical research gap: "there was limited research on learning analytics in Kenya, the current studies had not used raw behavioural data such as LMS logs" (Mohammed, 2024, p. 164). This finding reveals that while some institutions discuss learning analytics conceptually, few have implemented systems that actually capture and analyze detailed student interaction data from learning management systems.

Mohammed's analysis demonstrates that without detailed behavioral data, institutions cannot fully leverage AI's analytical capabilities. Predictive analytics requires consistent collection of fine-grained interaction data over extended periods. This data infrastructure must exist before predictive models can be developed and validated. The gap is particularly relevant for TVET institutions considering AI-powered predictive systems for identifying at-risk trainees, personalizing learning pathways, or optimizing resource allocation.

2.4 Artificial Intelligence in Education

Artificial intelligence in education encompasses software systems that identify patterns in data and make decisions without explicit programming for every scenario. These systems can potentially respond to queries automatically, deliver personalized feedback, predict trainee outcomes, and automate routine administrative tasks. The key distinction between traditional software and AI systems lies in learning capability: AI systems improve performance over time by identifying patterns in usage data.

Huang and colleagues (2024) conducted a systematic review of AI chatbots in educational contexts from 2017 to 2023, analyzing 53 studies. They identified four primary functions that chatbots serve: responding to frequently asked questions about institutional policies and procedures, providing learning support through tutoring or guidance, managing administrative tasks such as registration or scheduling, and offering personalized recommendations based on user history.

The Huang review identified significant challenges that temper enthusiasm about chatbot potential. Many chatbots struggle with contextual understanding, particularly when queries are ambiguous, use colloquial language, or require understanding institutional context not explicitly stated. Generating natural, conversational responses that feel human-like rather than mechanical presents ongoing technical challenges. When chatbots provide incorrect information or fail to understand queries, user trust erodes rapidly.

Xiao and colleagues (2024) examined factors influencing chatbot adoption among graduate students in Chinese higher education. Their findings indicated that student acceptance depends primarily on perceived usefulness and perceived ease of use, constructs identified in the Technology Acceptance Model (Davis, 1989). Students adopt and continue using chatbots when they believe systems genuinely save time, find interfaces intuitive, and have positive initial experiences that build confidence in system reliability.

Georgia State University's implementation of AdmitHub, an AI chatbot supporting student enrollment and retention, represents one of the most rigorously documented applications in higher education. Evaluation research documented that the chatbot was associated with approximately 21.4 percent reduction in summer melt for a targeted group and roughly 3.3 percent enrollment increase for the priority-deadline cohort (Page & Gehlbach, 2017). However, the Georgia State implementation combined AI technology with substantial human oversight, regular monitoring

and adjustment, integration with institutional data systems, and strategic focus on specific high-impact moments in the student lifecycle.

2.5 Automated Records Management

While chatbots address communication and service delivery challenges, automated records management systems target the foundational issues of document storage, retrieval, and security. Paper-based records create numerous interconnected problems. Staff waste substantial time searching for documents in filing cabinets and storage rooms. Information permanently disappears when documents are lost, damaged, or inadvertently discarded. Maintaining accuracy proves difficult as paper documents require manual updating.

Digital records management promises to address these longstanding challenges. Research on digital records management systems shows consistent benefits across multiple dimensions. Well-implemented systems enable staff to locate documents in seconds rather than minutes or hours (Nguyen & Swatman, 2021). Physical storage cost reductions occur as institutions eliminate offsite storage facilities and repurpose space previously dedicated to filing cabinets. Digital systems with proper backup protocols virtually eliminate permanent document loss from physical damage, theft, or deterioration over time.

However, these benefits must be distinguished carefully from vendor marketing claims. Trade publications often report dramatic improvements including 80 to 90 percent reductions in retrieval time and 70 percent storage cost savings (Lemieux, 2016). Such reports typically showcase best-case scenarios from well-resourced clients rather than average outcomes across diverse institutions. Independent peer-reviewed research suggests more modest though still substantial benefits. The critical factor appears to be implementation quality: systems deployed with adequate planning, comprehensive training, and ongoing technical support deliver significant value.

Implementation faces genuine challenges that institutions must address realistically. Scanning existing paper records requires considerable time investment and potentially significant financial resources. Staff need structured training not only on technical operation but also on new workflows that digital systems enable. Data security becomes critical when all institutional information exists digitally, requiring robust cybersecurity measures, regular security audits, and clearly defined access controls.

For Kenyan TVET institutions, automated records could potentially address longstanding problems. Academic records could be accessible instantly while protected against permanent loss through cloud-based storage. Financial records could reconcile efficiently through automated matching of payments to student accounts. Equipment logs could generate automatic maintenance reminders. However, realizing these benefits requires overcoming substantial initial costs, training needs, infrastructure requirements, and organizational change management challenges.

2.6 Predictive Analytics in Education

Beyond managing current operations more efficiently, predictive analytics offers institutions the capacity to anticipate future challenges and opportunities. Predictive analytics involves analyzing historical data patterns using statistical algorithms and machine learning techniques to forecast future trends, outcomes, or events.

Purdue University's Course Signals early-alert analytics system represents one of the most frequently cited examples in higher education literature. Arnold and Pistilli (2012) reported retention rates of 87.4 percent for students receiving interventions compared to 69.4 percent for comparison groups, suggesting an 18 percentage point improvement. However, several factors complicate interpretation of these results. The comparison was not a true experimental design with random assignment. The intervention combined predictive analytics with human advisor outreach, making it difficult to isolate the contribution of analytics versus human interaction. Subsequent research found that Course Signals effects varied substantially across different student populations and course types (Viberg, 2018).

Al-Shabandar and colleagues (2023) found that predictive models incorporating multiple data sources can identify at-risk students with reasonable accuracy. However, their systematic review identified serious challenges and ethical concerns. Requirements for high-quality historical data collected consistently over extended periods mean institutions need several years of comprehensive data before developing reliable models. Risks of perpetuating historical biases exist when models learn patterns from past data reflecting historical discrimination. Ethical concerns about labeling potentially becoming self-fulfilling prophecies arise when identifying students as at-risk affects how they are treated.

Applications of Predictive Analytics in TVET Institutions

Key Applications and Use Cases

Enrollment Forecasting
Predict future student enrollment patterns and trends

At-Risk Student Detection
Identify students at risk of dropping out early

Resource Planning
Optimize allocation of staff and facilities

Performance Monitoring
Track student and program performance metrics

Maintenance Scheduling
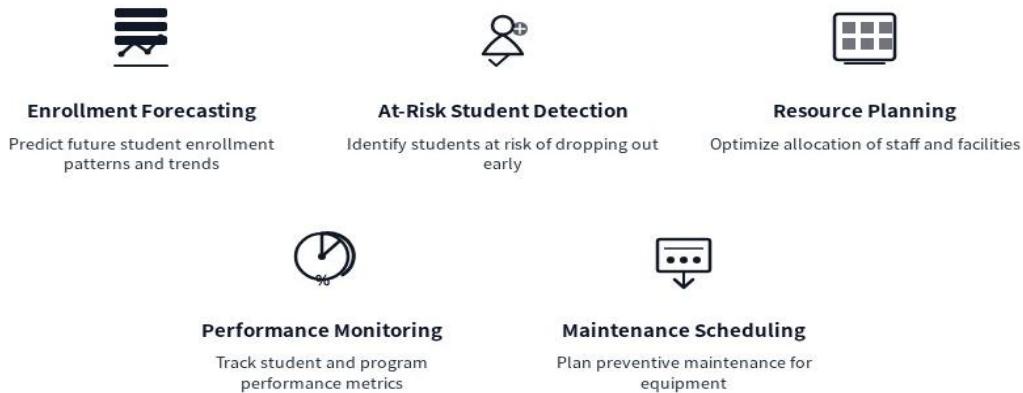Plan preventive maintenance for equipment

Figure 2.3: Applications of Predictive Analytics in TVET Institutions

For Kenyan TVET institutions, predictive analytics could potentially address planning challenges that currently rely on intuition or limited data. However, implementation requires high-quality historical data collected consistently over multiple years, analytical expertise, reliable computing infrastructure, and organizational capacity to interpret predictions appropriately. Mohammed's (2024) findings regarding limited use of behavioral data underscore these prerequisites. Most institutions lack the data foundations necessary for sophisticated predictive analytics.

2.7 AI in Financial Management for Educational Institutions

While most AI education research focuses on teaching and learning applications, AI's potential for improving financial management deserves careful examination. Educational institutions in resource-constrained environments face particular challenges in financial management that AI systems could potentially address.

Wanjiru and Kimani (2023) examined the impact of automated financial systems in Kenyan public institutions. Their study documented that manual financial processes resulted in revenue losses of 3 to 7 percent annually due to unrecorded transactions, duplicate payments, and reconciliation errors. They found that institutions implementing automated systems reduced these losses by approximately 60 to 70 percent within the first two years of adoption. The study also documented substantial reductions in processing time, with automated reconciliation completing in minutes what previously required hours or days.

The financial benefits of automation extend beyond error reduction. Page and Gehlbach (2017) found that AI-powered student support systems not only improved retention but also optimized institutional revenue by reducing summer melt and increasing enrollment among high-yield student populations. This demonstrates how AI applications can have dual benefits: improving service delivery while simultaneously strengthening institutional financial sustainability.

However, implementing AI for financial management requires significant upfront investment. Kiarie (2024) estimated that comprehensive digital infrastructure upgrades for TVET institutions in Kenya, including systems for financial management, typically cost between Ksh 2 million and Ksh 3 million for initial setup. Annual maintenance and support costs range from Ksh 400,000 to Ksh 600,000. Training costs add another Ksh 500,000 to Ksh 800,000 for comprehensive staff capacity building.

These figures might seem substantial for institutions operating with limited budgets. However, cost-benefit analysis suggests that institutions can recover these investments within three to five years through efficiency gains and error reduction. For an institution processing Ksh 200 million in annual fee revenue, reducing revenue leakage by just 3 percent saves Ksh 6 million yearly. Reducing staff time spent on reconciliation by 50 percent saves approximately Ksh 1.2 million annually in salary costs for staff who can then focus on higher-value activities.

Budget planning and forecasting represent another area where AI can provide substantial value. Traditional budgeting in TVET institutions often relies on historical averages and intuition. This approach struggles to account for enrollment fluctuations, changing market conditions, or unexpected expenses. AI-powered forecasting systems can analyze multiple years of data to identify patterns and predict future revenue and expenses with greater accuracy.

A study of budget forecasting accuracy in Kenyan educational institutions found that traditional methods had average errors of 12 to 18 percent for annual revenue projections and 15 to 22 percent for expense projections (Otieno & Njeru, 2022). These errors force institutions to maintain large reserve funds or face budget shortfalls during the year. More accurate forecasting enables better planning and more efficient use of limited resources.

The financial benefits of AI extend to procurement and inventory management. TVET institutions maintain workshops and laboratories requiring expensive equipment, consumables, and spare parts. Poor inventory management leads to stockouts that disrupt training or excess

inventory that ties up cash. AI systems can predict consumption patterns based on enrollment data, course schedules, and historical usage, optimizing inventory levels and reducing both stockout costs and carrying costs.

However, successful AI implementation for financial management requires addressing several challenges. Data quality issues plague many TVET institutions. When financial records are incomplete, inconsistent, or stored across multiple disconnected systems, AI systems struggle to produce reliable insights. Institutions must first establish robust data collection and management practices before implementing advanced AI applications.

Integration challenges also emerge. Financial systems must connect with student information systems, procurement systems, and external platforms like HELB and mobile money providers. Building these integrations requires technical expertise and ongoing maintenance. Without proper integration, institutions simply create another disconnected system that adds to rather than reduces administrative burden.

Change management represents perhaps the most critical challenge. Finance staff may resist automation, fearing job loss or feeling overwhelmed by new technology. Successful implementations require clear communication about how AI will augment rather than replace human work, comprehensive training programs, and demonstration of tangible benefits that make staff's work easier and more meaningful.

2.8 Implementation Challenges

Implementation challenges identified throughout the literature cluster into three interconnected categories: technical infrastructure, human capacity, and organizational factors. Each category presents distinct obstacles, but their interactions create compound difficulties that simple technical solutions cannot resolve.

Technical infrastructure challenges prove particularly acute in resource-constrained contexts. Research on technology implementation in sub-Saharan African educational institutions documents persistent problems with electrical power reliability, internet bandwidth and stability, and equipment maintenance capacity (Trucano, 2016). When electricity interruptions occur during critical operations such as examination registration or fee payment processing, users understandably perceive paper-based alternatives as more reliable despite their inefficiency.

For TVET institutions in Kenya, TVETA's infrastructure assessment revealed that many institutions outside major urban centers face particularly severe infrastructure constraints (Ministry

of Education, Kenya, 2023). This suggests that implementation strategies must account for significant variability in institutional readiness across the sector. Solutions that work well in well-resourced urban institutions may fail completely in rural institutions with unreliable power and internet connectivity.

However, even when infrastructure functions adequately, human factors often determine whether implementations succeed or fail. Users must perceive systems as genuinely useful for their specific work context and reasonably accessible without excessive learning requirements (Davis, 1989). Staff resist adoption unless they believe new systems will genuinely simplify rather than complicate their work, provide clear benefits that outweigh learning costs, and prove more reliable than familiar existing methods.

Digital skills vary substantially based on prior technology access and generational differences. Younger staff who grew up with digital technologies typically adapt faster than colleagues with limited computer experience outside basic email usage. Brief training sessions cannot bridge significant skill gaps that reflect decades of different technology exposure. Effective capacity building requires sustained, hands-on training with ongoing support rather than one-time workshops that leave staff feeling overwhelmed and inadequately prepared.

Financial constraints create their own interconnected challenges. Institutions need technology to improve operations and remain competitive, but require substantial upfront investment for hardware, software licenses, infrastructure improvements, and training programs. Government funding for TVET must address countless competing priorities including faculty salaries, facility maintenance, equipment for practical training, and basic operational costs. Budget cycles that prioritize immediate visible needs such as new workshop equipment over less tangible infrastructure investments make sustained technology development difficult.

The Kenyan studies reviewed earlier provide additional context for understanding implementation challenges in local contexts. Matere's (2024) finding of limited AI tool access across institutions reflects both financial constraints limiting technology acquisition and infrastructure gaps preventing effective deployment. Kariuki and colleagues' (2025) successful AI learning implementation required careful planning, adequate technical support throughout the pilot period, and proper student orientation to platforms and learning approaches.

Organizational culture and change management represent perhaps the most overlooked implementation challenge. Technology projects often fail not because of technical problems but

because organizations fail to manage the human and cultural dimensions of change effectively. Staff need clear understanding of why change is necessary and how it will benefit them personally, not just abstract institutional benefits. Champions who advocate for change and help colleagues adapt prove essential for building momentum and overcoming resistance.

For policymakers and institutional leaders, the interconnected nature of these challenges indicates that TVET digital transformation cannot succeed through one-time technology purchases or short-term projects. Success requires sustained, coordinated investment across infrastructure development, capacity building through comprehensive training and ongoing support, and change management addressing organizational culture and stakeholder concerns over extended periods measured in years rather than months.

2.9 Theoretical Framework

Understanding these implementation challenges requires theoretical frameworks that explain both individual technology adoption decisions and broader organizational change processes. This study employs two complementary theoretical frameworks that together address individual, organizational, and contextual dimensions of AI implementation in TVET institutions.

The Technology Acceptance Model, developed by Davis (1989), explains variation in technology adoption across individuals through two primary constructs: perceived usefulness and perceived ease of use. Perceived usefulness refers to the degree to which users believe technology will enhance their work performance or make their tasks easier. Perceived ease of use refers to the extent to which users expect technology to be free of effort and simple to operate. TAM proposes that these two perceptions directly influence attitudes toward using technology, which in turn affect behavioral intentions and actual usage behaviors.

TAM has demonstrated robust predictive validity across numerous contexts, technologies, and cultural settings. Meta-analyses examining hundreds of studies confirm that perceived usefulness and ease of use consistently explain significant variance in adoption intentions and actual usage behaviors (Scherer et al., 2019). For this study, TAM provides a theoretical lens for understanding why individual trainees, trainers, and administrative staff might embrace or resist specific AI applications based on their perceptions of utility and usability.

The Kenyan research reviewed earlier offers empirical support for TAM's predictions in local educational contexts. Kariuki and colleagues' (2025) findings of improved student performance in AI environments suggest that when students perceive AI tools as genuinely useful

for learning, adoption increases and sustained engagement follows. Matere's (2024) correlation between AI tool use and institutional effectiveness similarly suggests that when institutions perceive AI as genuinely useful for improving teaching and learning outcomes, implementation proceeds more successfully and systems are more likely to be sustained over time.

However, TAM focuses primarily on individual adoption decisions and does not adequately address organizational change processes, leadership roles, resource allocation, or systemic barriers that operate at institutional rather than individual levels. Understanding how entire organizations transform requires complementary theory addressing collective rather than individual change dynamics.

Kotter's (1996) change management framework complements TAM by explaining how institutions successfully navigate transformation. Kotter identified eight sequential stages through which successful change initiatives progress. These include establishing a sense of urgency by communicating why change is necessary, building a guiding coalition of influential leaders and respected staff who champion change, forming a strategic vision that articulates the desired future state, enlisting support by communicating vision broadly, enabling action by removing barriers, generating short-term wins by creating visible early successes, sustaining acceleration by using credibility from early wins to tackle deeper problems, and instituting change by anchoring new approaches in organizational culture.

Kotter's eight-stage approach has particular utility for educational institutions where change typically requires building consensus among multiple stakeholder groups with different interests, concerns, and levels of authority. The model emphasizes that organizational transformation is a process unfolding over extended periods rather than an event occurring through a single decision or announcement.

Together, these frameworks guide data collection and analysis in this study. TAM-informed questions in surveys and interviews explore stakeholder perceptions of AI usefulness for their specific work contexts and ease of use based on their technical skills and access to support. Change management principles guide inquiry into institutional readiness including leadership commitment, resource availability, presence of champions who could advocate for change, and organizational barriers that might impede implementation.

The frameworks also inform recommendations by ensuring proposed solutions address both individual adoption factors and organizational change requirements. Recommendations must

consider how to make AI systems genuinely useful and easy to use for specific user groups while also addressing how institutions can build urgency, create coalitions, develop vision, and sustain momentum through the extended process of digital transformation. Technology solutions that ignore either dimension are unlikely to succeed regardless of technical sophistication.

Applying these frameworks to financial management specifically, we can understand that finance staff will adopt automated systems when they perceive them as useful for reducing errors and saving time (TAM), but successful implementation also requires institutional commitment to change, adequate training resources, and alignment with broader strategic goals (Kotter). Similarly, administrators will support AI-powered budget forecasting when they perceive it as useful for planning and easy to interpret, but adoption also requires building coalitions among stakeholders who must trust and act on AI-generated insights.

2.10 Chapter Summary

This literature review has synthesized global and Kenyan research on AI's potential role in transforming TVET e-governance, examining evidence across multiple interconnected domains. International research demonstrates that AI applications including chatbots, automated records management, and predictive analytics can improve institutional efficiency and student outcomes when implemented thoughtfully within appropriate contexts. However, success requires careful attention to ethics, equity, evaluation rigor, and context-specific constraints.

Recent Kenyan research provides encouraging empirical evidence about AI potential in local educational contexts while highlighting significant prerequisites for success. Matere's (2024) finding of strong correlation between AI tool usage and institutional effectiveness demonstrates that AI implementation can genuinely improve institutional performance when properly executed. Kariuki and colleagues' (2025) documentation that AI-enhanced learning environments produce superior student outcomes provides concrete evidence that AI can improve learning results in Kenya's context. However, Mohammed's (2024) identification of limited behavioral data collection emphasizes the substantial preparatory work required before institutions can leverage AI's full capabilities.

The new section on AI in financial management demonstrates both the potential and challenges of applying AI to institutional financial operations. Research shows that automated financial systems can reduce revenue losses by 60 to 70 percent and dramatically speed up reconciliation processes (Wanjiru & Kimani, 2023). However, implementation requires substantial

upfront investment, with costs ranging from Ksh 2 million to Ksh 3 million for initial setup. Institutions can recover these investments within three to five years through efficiency gains and error reduction, but only if implementation is managed carefully with attention to data quality, system integration, and change management.

The theoretical framework combining TAM and Change Management Theory provides complementary lenses for understanding both individual adoption decisions and institutional transformation processes. Individual staff members must perceive AI tools as genuinely helpful and manageable to use. Simultaneously, institutions must build organizational capacity, establish supporting infrastructure, and manage the extended change process through which new technologies become embedded in daily practice.

Together, the reviewed literature reveals a consistent pattern. AI holds genuine promise for addressing longstanding challenges in TVET institutions including administrative inefficiency, poor service delivery, inadequate planning capacity, document management problems, and financial management weaknesses. However, realizing this promise requires systematic capacity building addressing technical infrastructure gaps, adequate training developing staff skills and confidence, careful implementation planning that sequences steps appropriately, continuous evaluation monitoring what works and what requires adjustment, and sustained institutional commitment maintaining effort through inevitable challenges and setbacks.

For Kenyan TVET institutions specifically, several implications emerge clearly. Implementation must be staged sequentially, establishing basic digital infrastructure before attempting advanced AI applications. Mobile platforms offer opportunities to leverage existing trainee technology access while reducing user interface barriers. Starting with clearly defined use cases addressing specific pain points builds confidence and demonstrates value better than comprehensive transformation attempts. Human-AI hybrid approaches combining automated systems with human oversight appear more promising than attempting full automation. Explicit attention to equity, ethics, and evaluation must be integrated from the beginning. Financial planning must be realistic, acknowledging substantial upfront costs while demonstrating clear pathways to return on investment through efficiency gains and error reduction.

CHAPTER 3: RESEARCH METHODOLOGY

3.1 Introduction

This chapter presents the research methodology guiding this study of AI implementation in Kenyan TVET institutions. It describes the research design, study area, target population, sampling procedures, data collection methods, analytical approaches, ethical considerations, timeline, and budget. The methodology aligns with the research objectives outlined in Chapter 1 and addresses gaps identified in the literature review in Chapter 2.

3.2 Research Design

This study employs a mixed methods research design, combining quantitative and qualitative approaches to investigate AI potential in TVET e-governance comprehensively. Mixed methods research integrates numerical data with narrative data, enabling researchers to examine phenomena from multiple perspectives and achieve more complete understanding than either approach alone provides (Creswell & Plano Clark, 2018).

Quantitative data through surveys will establish the scale and frequency of administrative challenges, measure stakeholder attitudes toward AI implementation, and enable statistical comparison across institutions. Qualitative data through interviews, document analysis, and observations will reveal underlying reasons for challenges, explore contextual factors shaping implementation feasibility, and capture stakeholder concerns that structured surveys might miss.

The research adopts an analytical and exploratory design, focusing on evaluating the relationships between current e-governance systems and institutional efficiency, and exploring how AI interventions could transform these relationships. It is analytical because it examines the effectiveness of current e-governance systems, measures their impact on administrative processes and service delivery, and assesses the factors influencing stakeholder technology acceptance. It is exploratory because AI implementation in Kenyan TVET institutions remains largely unstudied territory, requiring investigation of possibilities and potential outcomes rather than hypothesis testing about established relationships. This design aligns with the research questions, which seek both to evaluate current conditions and performance while exploring pathways toward improved solutions through AI integration.

3.3 Study Area and Target Institutions

This study focuses on four TVET institutions in Kenya, selected to represent diverse institutional contexts within the sector. The Kisumu National Polytechnic serves as the primary

research site. As an automotive trainer at this institution, I possess insider knowledge of institutional operations, challenges, and culture that enables deeper investigation than would be possible for external researchers.

However, the institution experienced closure due to trainee protests, with limited reopening in October 2025 for KNEC examinations and full operations resuming in January 2026. This situation necessitates flexible data collection sequencing, beginning with other institutions in November and December 2025 before returning to The Kisumu National Polytechnic after January 2026.

Three comparison institutions provide essential diversity across institutional types, governance structures, and resource levels. Eldoret National Polytechnic offers similar scale and structure to The Kisumu National Polytechnic, enabling examination of whether observed challenges represent idiosyncratic local issues or systemic patterns. The Railway Training Institute or Kenya Institute of Highway and Building Technology operate under parastatal governance, providing insight into how different administrative structures affect technology adoption. Ramogi Institute of Advanced Technology represents mid-level institutions serving regional communities with fewer resources than national polytechnics.

3.4 Target Population

The study targets five distinct stakeholder groups whose perspectives are essential for comprehensive understanding of e-governance challenges and AI implementation feasibility. Trainees constitute the primary beneficiaries of improved services and can articulate frustrations with current systems, time wasted on administrative tasks, and preferences for service delivery approaches.

Training staff including trainers and instructors experience administrative burdens directly and can assess whether AI systems would genuinely reduce workload or create new complications. Support staff in registry, finance, library, and human resource offices manage institutional operations daily and possess detailed knowledge of system inefficiencies, common problems, and practical implementation requirements.

Technicians maintaining workshops and laboratories face unique record keeping challenges related to equipment and can evaluate whether automated systems would improve safety and efficiency. Administrators including principals, department heads, ICT managers, and finance officers make implementation decisions and control resources. Their perspectives on

institutional priorities, available budgets, technical infrastructure, and change readiness are essential for developing realistic recommendations.

Finance staff deserve particular attention in this study given the research's focus on financial management dimensions. Bursars, accountants, and cashiers understand intimately the time costs of manual reconciliation, the frequency and impact of financial errors, and the challenges of generating accurate financial reports. Their insights will be crucial for assessing AI's potential to improve financial management and for developing realistic cost-benefit projections.

3.5 Sample Size and Sampling Techniques

The study targets 330 to 400 total participants distributed across four institutions. The Kisumu National Polytechnic as the primary site will contribute approximately 200 participants, while each comparison institution will contribute 50 to 65 participants. This distribution enables in-depth investigation at the primary site while ensuring adequate comparative data.

For trainee participants, the study employs stratified random sampling to ensure representation across programs and year levels proportional to institutional enrollment patterns. For staff participants including trainers, support staff, technicians, and administrators, the study uses purposive sampling (Patton, 2015), deliberately selecting individuals with relevant experience and knowledge. Registry clerks with 10 or 15 years of experience possess insights that recent hires lack. Finance managers understand reconciliation challenges better than junior staff who perform only specific tasks.

3.6 Data Collection Methods

Multiple data collection methods ensure comprehensive understanding from different angles. Online surveys using Google Forms will collect quantitative data efficiently from large numbers of participants. Google Forms works well on smartphones, which most participants own and use daily. Questions will be simple, specific, and concrete. The survey should take 10 to 15 minutes to complete.

Face-to-face interviews provide depth and nuance that surveys cannot capture. When someone tells me they spend four hours weekly on attendance records, I can immediately ask follow-up questions. What exactly makes it take so long? Have they tried different methods? What specific changes would help most? These conversations reveal the human story behind the statistics.

Document analysis helps verify what people tell me and provides objective evidence. Strategic planning documents reveal institutional priorities. ICT policy documents show what is officially supposed to happen versus what actually happens in daily practice. Budget documents reveal whether institutions seriously invest in digital transformation or just talk about it without backing up words with money. Financial reports and reconciliation records will help quantify current costs and error rates.

Direct observation provides essential reality checks. I will sit quietly in registry offices and time exactly how long transactions actually take. I will watch staff match bank payment notifications against trainee accounts and count precisely how many steps the process involves. I will observe how finance staff handle peak periods and document the challenges they face. People often do not realize how inefficient their processes truly are because they have become completely accustomed to them over years of repetition.

3.7 Research Instruments

The study employs three primary instruments. The trainee survey questionnaire collects background information, technology access patterns, current service experiences, reported challenges, and attitudes toward AI solutions. The survey balances brevity to encourage completion with sufficient detail to address research questions.

The staff interview guide structures conversations with trainers, support staff, technicians, and administrators. The semi-structured format ensures consistent coverage while allowing flexibility to probe responses and explore unexpected themes. For finance staff specifically, the interview guide includes targeted questions about reconciliation time, error frequency, report generation challenges, and perceptions of how AI could address these issues.

The observation checklist systematically documents physical environment and technology, queue patterns and wait times, work processes and activities, system usage and problems, and communication patterns. For finance office observations, the checklist includes specific items related to payment processing, reconciliation procedures, and query resolution.

3.8 Data Analysis Methods

Quantitative data from surveys will be analyzed using Google Sheets, calculating frequencies, percentages, means, and cross-tabulations to identify patterns and relationships. For financial data specifically, the analysis will include calculations of time costs (staff hours multiplied by salary rates), error rates, and opportunity costs of delayed revenue recognition.

Qualitative data from interviews, open-ended survey responses, documents, and observations will be analyzed using thematic analysis (Braun & Clarke, 2006). The researcher will read transcripts and notes multiple times, generate initial codes identifying interesting features, search for themes by collating codes into potential patterns, review themes to ensure they work in relation to the entire dataset, and define and name themes. Direct quotations will illustrate themes while protecting participant anonymity.

Triangulation will strengthen findings by comparing evidence from multiple sources (Denzin, 2012). When trainees report long wait times in surveys, staff acknowledge time pressures in interviews, and observations document actual delays, converging evidence increases confidence in findings.

3.9 Ethical Considerations

The study adheres to established research ethics principles protecting participant welfare. Informed consent ensures all participants understand the research purpose, what participation involves, potential risks and benefits, and their right to refuse or withdraw without penalty. Confidentiality protects participant identities through anonymous data presentation, secure storage of recordings and notes, and reporting findings in aggregate form.

Given the sensitivity of financial data, the study will exercise particular care. Financial information will be reported in aggregate terms without identifying specific institutions or individuals. Interview participants will be assured that no financial data they share will be attributed to them personally or used in ways that could affect their employment.

3.10 Research Budget

The research budget totals approximately Ksh 27,000, financed through monthly savings from my salary. Transport costs of Ksh 12,000 cover travel to Moi University and the four research sites. Communication and internet costs of Ksh 3,000 support online surveys and coordination. Printing and documentation costs of Ksh 6,000 cover paper surveys, forms, and final report copies. Stationery and supplies cost Ksh 2,000. Modest tokens of appreciation for interview participants total Ksh 1,000. A contingency fund of Ksh 3,000 covers unexpected costs.

While I cannot afford to implement actual AI systems within this budget, the research will develop realistic cost projections based on literature review and vendor consultations. Preliminary estimates suggest that comprehensive AI implementation for a mid-sized TVET institution would require Ksh 2 million to Ksh 3 million for initial setup including hardware, software, and system

integration. Training costs would add Ksh 500,000 to Ksh 800,000 for comprehensive staff capacity building. Annual maintenance and support would cost Ksh 400,000 to Ksh 600,000.

These costs appear substantial, but cost-benefit analysis suggests institutions can recover investments within three to five years. For an institution processing Ksh 200 million in annual fee revenue, reducing revenue leakage by 3 percent saves Ksh 6 million yearly. Reducing reconciliation time by 50 percent saves approximately Ksh 1.2 million annually in salary costs. Improved budget forecasting enabling 5 percent better resource utilization could save another Ksh 10 million annually. Combined, these savings total approximately Ksh 17 million yearly, recovering the initial Ksh 3 million investment in less than three months and the total five-year cost of approximately Ksh 6 million within the first year.

3.11 Research Timeline

The research unfolds in six phases over six months from October 2025 through March 2026. October focuses on foundation building including finalizing the proposal, conducting literature review, designing instruments, pilot testing, and securing permissions. November and December involve initial and expanded data collection at Eldoret, Ramogi, and either Railway Training Institute or Kenya Institute of Highway and Building Technology.

January 2026 completes data collection at The Kisumu National Polytechnic following its full reopening. February focuses on data analysis and initial writing. March involves finalizing and submitting the complete research report.

CHAPTER 4: EXPECTED OUTCOMES AND CONTRIBUTIONS
4.1 Anticipated Findings

Based on the literature reviewed and preliminary observations, several findings are anticipated. First, institutions likely face similar challenges in system integration, records management, and service delivery despite varying resource levels. The extent of these challenges probably correlates with institutional location and governance structures.

Second, stakeholder attitudes toward AI implementation will likely vary systematically by age, prior technology experience, perceived usefulness for specific roles, and concerns about job security. Technically oriented staff and younger trainees will probably express greater comfort with AI systems, while staff with limited technology experience may express skepticism or

resistance. However, when AI tools demonstrate genuine usefulness, adoption increases across diverse user groups.

Third, financial management challenges will likely be pervasive across institutions. Manual reconciliation processes probably consume four to six hours daily at most institutions. Error rates in financial record keeping likely range from 2 to 5 percent, consistent with findings from similar contexts. Payment delays probably affect 10 to 20 percent of trainees during peak periods, causing cascading problems including examination registration delays and trainee dissatisfaction.

Fourth, infrastructure inadequacies will likely be substantial at most institutions outside major urban centers. Unreliable electricity and internet connectivity will probably emerge as major barriers to AI implementation. Many institutions will likely lack the technical staff needed to configure and maintain sophisticated AI systems.

Fifth, cost-benefit analysis will likely show that despite substantial upfront investments, institutions can recover costs within three to five years through efficiency gains and error reduction. However, this assumes adequate infrastructure, proper implementation, and sustained organizational commitment, conditions that may not exist at all institutions.

4.2 Expected Contributions to Knowledge

This study provides several important contributions to knowledge. First, it offers the first comprehensive documentation of e-governance challenges specifically in Kenyan TVET institutions, filling an important empirical gap. While substantial research examines universities, TVET institutions have been largely overlooked despite serving over 460,000 trainees nationally.

Second, the study provides evidence-based implementation guidance designed for TVET operational contexts rather than adapting university-focused solutions. TVET institutions have unique requirements around practical skills training, equipment management, and industry partnerships that generic recommendations fail to address.

Third, this research contributes African perspective to literature concentrated predominantly in developed countries. Resource constraints, infrastructure challenges, and implementation contexts in Kenyan TVET institutions differ markedly from conditions in North America, Europe, or East Asia where most AI education research originates.

Fourth, the study's explicit focus on financial management dimensions addresses a critical gap in existing research. Most AI education research examines learning applications while

overlooking administrative and financial dimensions equally important for institutional sustainability. This research demonstrates how AI can improve not only service delivery but also financial management, revenue tracking, and budget planning.

Fifth, the study provides realistic cost-benefit projections that help institutions understand the financial implications of AI adoption. By documenting both implementation costs and potential savings, the research enables informed decision making rather than decisions based on technological enthusiasm or vendor promises alone.

4.3 Practical Applications

Beyond academic contributions, this research will have direct practical applications. Institutions can use the findings to justify budget requests for digital transformation initiatives. Concrete data about time wasted, efficiency lost, and revenue leaked makes stronger cases than general claims that institutions need better systems.

The recommendations will provide step-by-step guidance for institutions at different readiness levels. Institutions with good infrastructure can move faster toward comprehensive AI implementation. Those with limited resources will receive recommendations for incremental improvements they can afford, starting with foundational capacity building before attempting sophisticated AI applications.

TVETA and the Ministry of Education can use findings to inform national policy about supporting TVET digital transformation. The research may reveal where government intervention is most needed, where current policies create barriers, and what kinds of support would enable more institutions to modernize successfully.

The financial analysis will be particularly valuable for institutional planning. Budget officers can use the cost-benefit projections to develop realistic implementation plans and demonstrate value to stakeholders. Finance staff can understand how automated systems would change their work and what benefits they could expect.

Technology vendors serving the education sector will better understand TVET needs and challenges. This could lead to development of more appropriate, context-specific solutions rather than generic products that do not fit TVET realities. Vendors who understand the financial constraints TVET institutions face can develop pricing models and implementation approaches that make adoption more feasible.

Specifically regarding financial management, the research will demonstrate that automated reconciliation could cut daily processing time from six hours to approximately 30 minutes, reducing staff time costs by roughly 90 percent. This translates to freeing up approximately five staff hours daily, or 1,250 hours annually, representing salary savings of approximately Ksh 1.2 million per year for a typical institution. More importantly, these staff hours can be redirected toward higher-value activities like financial analysis, planning, and strategic support rather than repetitive data entry and matching.

The research will also show that automated systems could reduce financial errors from current rates of 2 to 5 percent down to less than 0.5 percent, recovering approximately Ksh 4 million to Ksh 10 million annually in previously leaked revenue for a mid-sized institution. Improved budget forecasting could enable 5 percent better resource utilization, saving approximately Ksh 10 million annually through more efficient allocation of funds. Combined, these benefits total approximately Ksh 15 million to Ksh 21 million annually, far exceeding the total cost of AI implementation including initial setup and ongoing maintenance.

4.4 My Personal Development

This research represents a significant step in my professional and academic development. It establishes me as someone who thinks beyond immediate training responsibilities and understands institutional challenges holistically. This positions me for potential leadership roles where I can actually shape institutional direction rather than just following policies others create. The research provides foundation for Master's degree applications in 2026. I will have preliminary findings to discuss in applications and interviews. My supervisor can write detailed, specific recommendation letters based on actually working with me on substantial research. I am developing research skills including study design, data collection and analysis, and clear communication of findings. These transferable skills will be valuable throughout my career.

The research builds my professional network through connections with staff at four institutions, my supervisor at Moi University, and potentially with TVETA officials and other stakeholders. These connections may open future opportunities for collaboration, consultation, or employment. Most importantly, completing this ambitious independent research project while working full-time builds confidence that I can succeed in graduate studies and take on challenging projects in the future. It demonstrates to myself and others that I can manage complex work, meet deadlines, overcome obstacles, and produce quality outcomes despite competing demands on my time and limited resources.

4.5 Conclusion

This research proposal outlines a comprehensive, realistic, and ethically sound study of how artificial intelligence can transform e-governance in Kenya's TVET institutions. The study addresses a critical gap in existing research while responding directly to Kenya's National AI Strategy and the urgent need for improved institutional efficiency and financial sustainability. The mixed methods approach combining surveys, interviews, observations, and document analysis will provide rich, nuanced data from multiple perspectives. The four carefully selected institutions represent different contexts within the TVET landscape, ensuring findings have broad relevance. While challenges exist, particularly around the current situation at The Kisumu National Polytechnic, the research design includes sufficient flexibility to adapt to changing circumstances.

The anticipated outcomes will benefit multiple stakeholders. Trainees will see evidence-based recommendations for better services that waste less of their time and money. Staff will have their experiences documented and their concerns addressed, with clear pathways shown for how AI can make their work easier and more meaningful. Institutions will gain practical guidance for digital transformation that acknowledges their resource constraints while showing realistic paths forward.

Finance staff will understand how automated systems can free them from repetitive reconciliation work and enable them to focus on analysis and planning. Administrators will receive realistic cost-benefit projections that support informed decision making about AI investments. The TVET sector will acquire valuable research filling a significant knowledge gap about both e-governance challenges and AI implementation potential in resource-constrained environments.

For me personally, this research represents far more than an academic exercise. It is a genuine effort to improve institutions that matter deeply to Kenya's development. Every day I see talented young people frustrated by systems that should serve them better. I see colleagues exhausted by work that technology could handle. I see institutions struggling financially partly because manual systems leak revenue and waste resources. I believe we can do better, and this research is my contribution toward that goal. The journey ahead over the next six months will be challenging. Balancing research with full-time training, navigating institutional politics, building trust with participants, analyzing data, and writing clearly about complex issues will all test my capabilities. But I am ready for this challenge. I am committed to completing this work to the best of my ability and using what I learn to genuinely improve TVET education in Kenya.

Technical and vocational education and training institutions prepare young people for productive careers that build our nation's economy. They deserve administrative systems that work efficiently, transparently, and sustainably. They deserve financial management systems that protect revenue, enable accurate planning, and support institutional sustainability. This research takes one step toward making that vision a reality.

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APPENDICES

Appendix A: Trainee Survey Questionnaire

THE IMPACT OF ARTIFICIAL INTELLIGENCE ON E-GOVERNANCE IN TVET INSTITUTIONS IN KENYA

Trainee Survey

Dear Trainee,

I am researching how artificial intelligence can improve services in TVET institutions. Your honest responses will help identify problems and recommend solutions. This survey takes about 10 to 15 minutes. Your participation is voluntary and all responses are completely confidential. Your name will not appear anywhere in the research report.

Thank you for your time.

Geoffry Kipsang

Automotive Trainer, The Kisumu National Polytechnic

SECTION A: BACKGROUND INFORMATION

1. Institution: _____
2. Program of Study: _____
3. Current Year of Study:
   - ☐ First Year
   - ☐ Second Year
   - ☐ Third Year or Higher
4. Gender:
   - ☐ Male
   - ☐ Female
   - ☐ Prefer not to say
5. Age Group:
   - ☐ 18 to 22 years
   - ☐ 23 to 27 years
   - ☐ 28 years and above
6. Home County: _____

SECTION B: ACCESS TO TECHNOLOGY

7. Do you own a smartphone?
   - ☐ Yes

o   ☐ No

8. How often do you have access to internet?

- o   ☐ Daily
- o   ☐ Several times a week
- o   ☐ Once a week
- o   ☐ Rarely
- o   ☐ Never

9. Which platforms do you use regularly? (Select all that apply)

- o   ☐ WhatsApp
- o   ☐ Email
- o   ☐ Facebook
- o   ☐ Instagram
- o   ☐ SMS only
- o   ☐ None

10. How comfortable are you using online systems?

- o   ☐ Very comfortable
- o   ☐ Comfortable
- o   ☐ Neutral
- o   ☐ Uncomfortable
- o   ☐ Very uncomfortable

SECTION C: CURRENT INSTITUTIONAL SERVICES

11. Does your institution have an online trainee portal?

- o   ☐ Yes
- o   ☐ No
- o   ☐ Not sure

12. If yes, how often do you use the trainee portal?

- o   ☐ Daily
- o   ☐ Weekly
- o   ☐ Monthly
- o   ☐ Rarely
- o   ☐ Never

13. Which institutional services do you use most often? (Select all that apply)

- o   ☐ Registry (for documents, registration)
- o   ☐ Finance office (for fee payments, receipts)

- ☐ Library
- ☐ Examination office
- ☐ Trainee affairs
- ☐ ICT support
- ☐ Other: _____

14. On average, how long do you wait to be served at the registry office?

- ☐ Less than 15 minutes
- ☐ 15 to 30 minutes
- ☐ 30 minutes to 1 hour
- ☐ 1 to 2 hours
- ☐ More than 2 hours

15. On average, how long do you wait to be served at the finance office?

- ☐ Less than 15 minutes
- ☐ 15 to 30 minutes
- ☐ 30 minutes to 1 hour
- ☐ 1 to 2 hours
- ☐ More than 2 hours

16. How do you usually receive important information from the institution? (Select all that apply)

- ☐ Notice boards
- ☐ Email
- ☐ SMS
- ☐ WhatsApp groups
- ☐ Trainee portal
- ☐ Through friends
- ☐ I often miss information

SECTION D: FEE PAYMENT AND FINANCIAL SERVICES

17. How do you typically pay your fees? (Select all that apply)

- ☐ M-Pesa
- ☐ Bank deposit
- ☐ HELB loan
- ☐ Cash at institution
- ☐ Other: _____

18. Have you ever experienced any of the following fee payment problems? (Select all that apply)

o ☐ Payment not recorded correctly

o ☐ Long delays in payment confirmation

o ☐ Confusion about fee balance

o ☐ Blocked from exams despite having paid

o ☐ Difficulty getting fee receipts

o ☐ Multiple trips to finance office to resolve payment issues

o ☐ No problems experienced

19. How long does it typically take for your payment to be confirmed and recorded?

o ☐ Same day

o ☐ 1 to 2 days

o ☐ 3 to 7 days

o ☐ More than 1 week

o ☐ Never confirmed (I have to follow up)

20. How satisfied are you with the fee payment and financial services?

o ☐ Very satisfied

o ☐ Satisfied

o ☐ Neutral

o ☐ Dissatisfied

o ☐ Very dissatisfied

SECTION E: GENERAL PROBLEMS AND CHALLENGES

21. Have you ever experienced any of the following problems? (Select all that apply)

o ☐ Lost academic documents

o ☐ Delayed exam results

o ☐ Missed important deadlines due to lack of information

o ☐ Confused about registration or application processes

o ☐ Could not access services during office hours

o ☐ Received wrong or conflicting information

o ☐ Long queues preventing me from attending classes

22. What frustrates you most about institutional services?

23. Have you ever missed classes to handle administrative matters?

o ☐ Never

o ☐ Once or twice

o ☐ Several times

o ☐ Frequently

SECTION F: ATTITUDES TOWARD AI SOLUTIONS

24. Have you heard about chatbots or AI assistants?

- ☐ Yes, I understand what they are
- ☐ Yes, but not sure how they work
- ☐ No, never heard of them

25. Would you be comfortable using a chatbot (automated messaging system) to get information about:

a) Exam schedules and results?

- ☐ Very comfortable
- ☐ Comfortable
- ☐ Neutral
- ☐ Uncomfortable
- ☐ Very uncomfortable

b) Fee balances and payment information?

- ☐ Very comfortable
- ☐ Comfortable
- ☐ Neutral
- ☐ Uncomfortable
- ☐ Very uncomfortable

c) Course registration and timetables?

- ☐ Very comfortable
- ☐ Comfortable
- ☐ Neutral
- ☐ Uncomfortable
- ☐ Very uncomfortable

26. Would you prefer to receive instant answers from a chatbot or wait to speak with a staff member?

- ☐ Definitely prefer chatbot
- ☐ Probably prefer chatbot
- ☐ No preference
- ☐ Probably prefer staff member
- ☐ Definitely prefer staff member

27. What concerns, if any, do you have about using AI systems for institutional services?

28. What one change would most improve your experience with institutional services?

Appendix B: Staff Interview Guide

THE IMPACT OF ARTIFICIAL INTELLIGENCE ON E-GOVERNANCE IN TVET INSTITUTIONS IN KENYA

Semi-Structured Interview Guide for Staff

Introduction Script:

Good morning/afternoon. Thank you for agreeing to participate in this research interview. I am studying how artificial intelligence can improve e-governance in TVET institutions. This interview will take about 30 to 45 minutes. Everything you share will be kept completely confidential. I will not use your name or any identifying information in my report. You can skip any questions you prefer not to answer, and you can stop the interview at any time. Do you have any questions before we begin? May I record this conversation for accuracy?

SECTION A: BACKGROUND
1. What is your current position at this institution?
2. How long have you worked here?
3. What are your main responsibilities?

SECTION B: CURRENT SYSTEMS AND PROCESSES
4. Can you walk me through a typical workday? What did you do yesterday from arrival to departure?
5. What digital systems or software do you use regularly in your work?
6. How well do these systems work? What problems do you encounter?
7. Do different systems you use communicate with each other, or do you have to enter the same information multiple times?
8. How do you currently store and organize records in your department?

SECTION C: TIME ALLOCATION AND WORKLOAD
9. What tasks take up most of your time each day?
10. Which tasks feel most repetitive or could potentially be automated?
11. Approximately how much time do you spend on paperwork versus other work?
12. Do you maintain both paper and digital records? If yes, why?
13. How much time do you spend answering the same questions repeatedly?

SECTION D: CHALLENGES AND FRUSTRATIONS
14. What are the biggest challenges you face in your daily work?
15. Have you ever lost important documents or records? Can you describe what happened?
16. What questions do people ask you most frequently?
17. What information do you need that is difficult to access quickly?
18. How do you handle peak periods when many people need service at the same time?

SECTION E: FINANCIAL MANAGEMENT (For Finance Staff)
19. How long does it typically take to reconcile daily payments (M-Pesa, bank deposits, cash)?
20. Approximately how many payment queries do you handle daily during peak periods?
21. What percentage of payments require manual investigation or correction?

22. How often do you discover payment errors, and what typically causes them?
23. How long does it take to generate financial reports when requested?
24. What challenges do you face in budget planning and revenue forecasting?
25. Have you ever experienced situations where payment delays affected trainees' ability to register for exams or access services?

SECTION F: AI AWARENESS AND POTENTIAL APPLICATIONS

26. Have you heard about artificial intelligence or AI? What do you understand about it?
27. **For all staff:** How would you feel about a chatbot system that could automatically answer common questions from trainees or colleagues, allowing you to focus on more complex issues?
28. **For registry or records staff:** How would you feel about a system that stores all documents digitally with automatic backups and instant search capabilities?
29. **For finance staff:** How would you feel about a system that automatically matches payments to trainee accounts without manual reconciliation?
30. **For trainers:** How would you feel about systems that automatically track attendance and calculate grades?
31. **For technicians:** How would you feel about digital equipment logs that automatically remind you about scheduled maintenance?
32. **For administrators:** How would you feel about analytics systems that predict enrollment trends, identify at-risk trainees, or forecast resource needs?

SECTION G: CONCERNS AND REQUIREMENTS

33. What concerns or worries do you have about implementing AI systems?
34. What would you need to feel comfortable using new technology systems?
35. What training or support would help you adapt to new digital systems?
36. Do you think your colleagues would support or resist such changes? Why?
37. What challenges do you think the institution would face in implementing AI systems?

SECTION H: INFRASTRUCTURE AND RESOURCES

38. How reliable is electricity at this institution?
39. How reliable is internet connectivity?
40. What devices and equipment are currently available in your department?
41. What would be needed to successfully implement AI systems here?

SECTION I: COST AND BENEFITS

42. If AI systems could save significant staff time and reduce errors, how much would you estimate those savings to be worth annually?
43. What budget constraints affect your department's ability to adopt new technology?
44. Would you support AI implementation even if it required significant upfront investment, assuming the benefits would justify the cost over time?

SECTION J: RECOMMENDATIONS AND CLOSING

45. If you could change one thing about how this institution operates, what would it be?
46. What advice would you give to other institutions considering AI implementation?
47. Is there anything else you think I should know about these issues?

Closing:

Thank you so much for your time and honest responses. Your insights are very valuable for this research. If you think of anything else you would like to add, please feel free to contact me. Would you like me to share the findings with you when the research is complete?

Appendix C: Observation Checklist

THE IMPACT OF ARTIFICIAL INTELLIGENCE ON E-GOVERNANCE IN TVET INSTITUTIONS IN KENYA

Observation Checklist

Institution: _____

Department/Office: _____

Date: _____

Time of Observation: From _____ To _____

Observer: _____

PART A: PHYSICAL ENVIRONMENT

1. Office Layout and Space:

- ☐ Adequate space
- ☐ Crowded
- ☐ Organized
- ☐ Disorganized

2. Filing Systems Visible:

- ☐ Filing cabinets
- ☐ Shelves with files
- ☐ Boxes of documents
- ☐ Mostly digital (few physical files)
- Condition: [ ] Good [ ] Fair [ ] Poor

3. Technology Equipment Observed:

- ☐ Desktop computers (Number: _____)
- ☐ Laptops (Number: _____)
- ☐ Printers (Number: _____)
- ☐ Scanners (Number: _____)
- ☐ Internet modem/router visible
- Overall Condition: [ ] Modern [ ] Outdated [ ] Mixed

4. Power and Connectivity:

- Power interruptions during observation? [ ] Yes [ ] No
  - If yes, duration: _____
- Internet connectivity issues observed? [ ] Yes [ ] No
  - If yes, describe: _____

PART B: QUEUE AND WAIT TIME OBSERVATIONS

5. Number of People Waiting:

- 8:00 AM: _____
- 10:00 AM: _____
- 12:00 PM: _____
- 2:00 PM: _____
- 4:00 PM: _____

6. Service Transactions Observed (Complete for 5 to 10 transactions):
Transaction 1:
- Arrival time: _____
- Service begins: _____
- Service ends: _____
- Total wait time: _____
- Type of service: _____
- Steps observed: _____

(Repeat for Transactions 2-10)

PART C: WORK PROCESSES OBSERVED
7. Staff Activities Observed:
- ☐ Filing documents
- ☐ Searching for documents
- ☐ Manual data entry
- ☐ Answering phone calls
- ☐ Responding to in-person queries
- ☐ Working on computer
- ☐ Writing in registers/logbooks
- ☐ Matching payment receipts to accounts
- ☐ Other: _____

8. Repetitive Activities Noted:
- Times staff answered same/similar questions: ____
- Times staff searched for lost/misplaced documents: ____
- Times staff re-entered same data in different systems: ____

9. Document Handling Observed:
- Physical documents handled: ____
- Digital documents accessed: ____
- Documents photocopied: ____
- Forms filled manually: ____
- Forms filled digitally: ____

PART D: FINANCE OFFICE SPECIFIC OBSERVATIONS
10. Payment Processing Activities:
- Number of payment receipts processed: ____
- Average time per receipt: _____
- Number of payment queries received: ____
- Average time to resolve query: _____
- Payment sources observed:
  - ☐ M-Pesa: ____ transactions
  - ☐ Bank: ____ transactions
  - ☐ Cash: ____ transactions

    ○   ☐ HELB: _____ transactions

11. Reconciliation Activities:
- Time spent on M-Pesa reconciliation: _____
- Time spent on bank statement reconciliation: _____
- Number of discrepancies identified: _____
- Average time to resolve discrepancy: _____

12. Financial Reporting Activities:
- Report generation requests observed: _____
- Time taken to generate reports: _____
- Staff involved in report generation: _____

PART E: SYSTEM USAGE
13. Software/Systems Observed in Use:

_____

_____

_____

14. System Issues Observed:
- ☐ System crash/freeze
- ☐ Slow response time
- ☐ Login difficulties
- ☐ Printing problems
- ☐ Data entry errors requiring correction
- ☐ Staff calling ICT support
- ☐ Other: _____

PART F: COMMUNICATION PATTERNS
15. How Do Trainees/Clients Receive Information?
- ☐ Verbal explanations from staff
- ☐ Printed handouts
- ☐ Directed to website/portal
- ☐ Directed to notice board
- ☐ Given phone numbers to call
- ☐ Sent to another office
- ☐ Other: _____

16. Frustration or Confusion Observed:
- ☐ Trainees expressing frustration (Number: _____)
- ☐ Staff expressing frustration (Number: _____)
- ☐ Disputes/disagreements (Number: _____)
- ☐ People leaving without being served (Number: _____)

PART G: ADDITIONAL NOTES
17. Notable Incidents or Interactions:

_____

_____

18. Overall Impression of Efficiency:

- ☐ Very efficient
- ☐ Moderately efficient
- ☐ Inefficient
- ☐ Very inefficient

Explanation: _____

19. Potential for AI Improvement Observed:

_____

_____

20. Financial Management Efficiency Notes:

_____

_____

Appendix D: Research Budget Summary

THE IMPACT OF ARTIFICIAL INTELLIGENCE ON E-GOVERNANCE IN TVET INSTITUTIONS IN KENYA

Detailed Budget Breakdown

Budget Category	Specific Items	Amount (Ksh)	Justification
Transport Costs	Travel to research sites and university	12,000	Moi University visits (3 trips × Ksh 1,800 = 5,400); Four TVET institutions (Ksh 6,000); Local transport Kisumu (Ksh 600)
Communication and Internet	Airtime, internet bundles, mobile data	3,000	Six months of internet for surveys, email, cloud storage, and coordination
Printing and Documentation	Surveys, forms, final report	6,000	Paper surveys (150 × Ksh 5 = 750); Permission letters/forms (Ksh 1,250); Final report printing and binding (Ksh 4,000)
Stationery and Supplies	Notebooks, pens, storage devices	2,000	Field notebooks (Ksh 500); Office supplies (Ksh 500); Flash drives for backup (Ksh 1,000)
Participant Appreciation	Small tokens for interviewees	1,000	Modest appreciation (pens, notebooks, airtime) for 10-15 key informants
Contingency Fund	Emergency expenses	3,000	Reserve for unplanned costs, extra trips, equipment repairs

Budget Category	Specific Items	Amount (Ksh)	Justification
TOTAL		27,000	Financed through monthly savings of Ksh 4,500 over six months

Estimated AI Implementation Costs for TVET Institutions

Cost Category	Estimated Range (Ksh)	Notes
Initial Setup	2,000,000 - 3,000,000	Hardware, software licenses, system integration
Training	500,000 - 800,000	Comprehensive staff capacity building across all departments
Annual Maintenance	400,000 - 600,000	Technical support, system updates, hosting
Total 5-Year Cost	5,000,000 - 7,000,000	Initial setup + 5 years maintenance

Projected Annual Savings from AI Implementation

Savings Category	Estimated Annual Savings (Ksh)	Basis
Reduced Reconciliation Time	1,200,000	5 staff hours daily $\times$ 250 days $\times$ Ksh 960/hour
Reduced Revenue Leakage	4,000,000 - 10,000,000	2-5% of Ksh 200 million annual revenue
Improved Resource Utilization	10,000,000	5% better allocation of Ksh 200 million budget
Total Annual Savings	15,200,000 - 21,200,000	
Payback Period	3-5 months	Based on initial investment only